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Comparison of Contract-Relax Stretching Durations on Gastrocnemius Pain in Online Drivers: A Quasi-Experimental Study

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Abstract

Introduction: Prolonged driving can lead to muscle tension, particularly in the gastrocnemius muscle, which plays a crucial role in ankle stabilization during pedal operation. Contract-Relax Stretching (CRS) is known to be effective in reducing muscle tension through isometric contraction mechanisms. This study aimed to compare the effectiveness of two CRS durations in reducing gastrocnemius muscle pain.

Methods: This quasi-experimental study employed a pre-test and post-test design. A total of 34 male four-wheeled online drivers in Jombang were non-randomly assigned into two groups. Group I received CRS intervention for 20 seconds, while Group II received it for 30 seconds. The intervention was administered three times per week for one week. Muscle pain was assessed using the Visual Analog Scale (VAS) before and after the intervention. Data were analyzed using the Wilcoxon test for within-group comparisons and the Mann–Whitney U test for between-group comparisons.

Results: Both groups demonstrated a reduction in VAS scores; however, the changes were not statistically significant. In Group I (20-second CRS), the median VAS score changed from 2 to 3 (P = 0.863), and in Group II (30-second CRS), from 3 to 3 (P = 0.257). The between-group comparison also showed no significant difference (P = 0.427). The majority of participants were aged 36–40 years, and all were male.

Conclusion: The difference in CRS duration (20 vs. 30 seconds) did not result in a statistically significant reduction in gastrocnemius muscle pain. External factors such as prolonged sitting duration and traffic conditions may have influenced the outcomes.

Keywords: Contract-relax, Driver, Gastrocnemius, Isometric, Muscle pain

Introduction

Driving, although seemingly passive due to the seated position, actually requires high levels of concentration and can lead to muscle tension from prolonged static posture.[1] Prolonged four-wheeled driving can cause muscle tension due to the sustained sitting position, particularly affecting the gastrocnemius muscle in the posterior lower leg. The gastrocnemius plays a vital role in foot movements while driving, such as pressing the accelerator and brake pedals. Prolonged muscle tension in this area may trigger pain and negatively impact comfort and work performance among online drivers. Muscle pain is often caused by sustained, intense, and repetitive static muscle tension.[2]

Myalgia commonly arises from static contractions or repetitive and intensive use of muscles, leading to lactic acid accumulation.[3] This condition is prevalent in occupations involving prolonged static positions, such as long-duration driving.[4] Pain itself is defined as an unpleasant sensory and emotional experience associated with actual or potential tissue damage.[5] When tissue damage occurs, nociceptors transmit signals to the brain, resulting in the sudden onset of discomfort.

According to World Health Organization (WHO) data in 2018, approximately 50–62% of the global population experience myalgia complaints.[4] An occupational health analysis by the Indonesian Ministry of Health reported that around 40.5% of work-related illnesses are associated with musculoskeletal disorders. A study involving 9,482 workers across 12 regions in Indonesia found that the most reported complaints were musculoskeletal disorders (16%), cardiovascular diseases (8%), neurological disorders (6%), followed by respiratory diseases (3%) and ENT disorders (1.5%).[6] However, no studies have specifically compared the effectiveness of 20-second versus 30-second Contract-Relax Stretching (CRS) in online driver populations, who exhibit a unique activity pattern characterized by prolonged static sitting.

A study on employees of a department store in Bogor found that 20 individuals reported severe pain, 43 reported moderate pain, and 21 experienced pain in the gastrocnemius muscle. Although not specific to drivers, this finding supports the notion that occupations involving sustained static positions may lead to tension in this muscle. Other studies have identified gastrocnemius pain among tea leaf pickers working on uneven terrain, and individuals who wear high heels for prolonged periods without adequate muscle relaxation.[7] However, these findings may not fully reflect the

experience of online drivers, whose primary strain arises from prolonged seated posture. Therefore, the main focus should be on prolonged static sitting as a key contributor to gastrocnemius muscle tension in drivers.

Contract-Relax Stretching (CRS) is a technique derived from Proprioceptive Neuromuscular Facilitation (PNF), involving isometric muscle contraction followed by relaxation and passive stretching.[8] This method aims to stretch soft tissues such as muscles, fascia, tendons, and ligaments that experience spasm or shortening, thereby helping to reduce muscle pain due to tension.[9] In practice, CRS can be administered in varying durations. Studies report that low-dose CRS may last 7 seconds, while high-dose interventions can extend up to 30 seconds.[10]

Research by Jannah et al. demonstrated that both the Contract-Relax and Hold-Relax methods significantly reduced gastrocnemius muscle pain.[7] Banjar et al. (2018) found that a combination of both techniques was more effective than CRS combined with isotonic quadriceps exercises in improving hamstring flexibility. Rachel Poon recommended 6–8 seconds of isometric contraction before proceeding to the stretching phase. Meanwhile, Schrier and Harrison suggested stretching durations ranging from 10 to 30 seconds to achieve optimal relaxation effects.[11]

Although various CRS durations have been studied in general populations, there is no consensus on the optimal duration for individuals engaged in static work patterns, such as online drivers. Therefore, this study aims to evaluate and compare the effectiveness of two CRS intervention durations—20 seconds and 30 seconds—in reducing gastrocnemius muscle pain among online car drivers. This approach is expected to provide insights into the optimal CRS duration for occupations involving prolonged static sitting.

This study hypothesizes that there is a significant difference between the effects of 20-second and 30-second CRS interventions in reducing gastrocnemius muscle pain among online car drivers. In other words, the duration of the intervention is presumed to differentially influence its effectiveness in pain reduction.

Methods

This study employed a quasi-experimental design with a parallel group format and a 1:1 allocation ratio, comparing two intervention groups receiving Contract Relax Stretching (CRS) with durations of 20 seconds and 30 seconds, respectively. It was classified as a non-randomized controlled trial, with group allocation performed non-randomly based on the order of participant registration. No changes were made to the study design or methods after the trial commenced.

Participants were selected based on specific inclusion criteria: active members of the Persatuan Driver Reguler Jombang (PDRJ) community; experiencing mild to moderate gastrocnemius muscle pain as assessed using the Visual Analog Scale (VAS); classified as “tutup poin 16” (minimum daily order target required to receive app bonuses); users of manual transmission cars; and willing to complete the full intervention protocol. Exclusion criteria included: current use of analgesic medications or topical muscle balms within the past week; history of musculoskeletal injuries or disorders of the lower limbs; and any medical or neurological conditions that could influence pain perception or interfere with the intervention outcomes.

The study was conducted in September 2024 at the headquarters of the PDRJ community (MABES PDRJ) in Jombang City. Recruitment was carried out by the principal investigator using purposive sampling. Participants were alternately assigned to intervention groups based on registration order: the first participant was assigned to Group I, the second to Group II, and so on in alternating fashion. Due to design and field constraints, blinding procedures were not implemented.

Each group underwent CRS intervention administered by a trained physiotherapist. Group I received CRS targeting the gastrocnemius muscle, involving 6 seconds of isometric contraction followed by 20 seconds of passive stretching. This was repeated three times per session, once daily for three consecutive days. Group II followed the same procedure, except with 30 seconds of passive stretching. Interventions were conducted with participants in a supine position and applied exclusively to the right leg. Prior to the intervention, all participants received a standardized explanation and demonstration of the CRS technique. Both groups received identical procedures, with the only variation being the duration of the passive stretching phase, to ensure consistency of treatment.

The primary outcome was the intensity of gastrocnemius muscle pain, measured using the Visual Analog Scale (VAS). The scale was explained to participants before use, with scores interpreted as follows: 0 indicating no pain; 1–3 for mild pain; 4–6 for moderate pain; 7–9 for severe pain; and 10 for extreme pain. Sample size was calculated using the Lemeshow formula, with $\alpha = 0.05$, power of 80%, an estimated mean difference in VAS scores of 1.5, and a standard deviation of 1.2. This resulted in a minimum requirement of 17 participants per group, for a total of 34 respondents. Statistical significance was set at $p < 0.05$.

Statistical analysis included the Shapiro–Wilk test to assess data normality. If data were not normally distributed, the Wilcoxon signed-rank test was used to compare pre- and post-intervention VAS scores within each group, and the Mann–Whitney U test was used to compare the changes in VAS scores between the two groups. Additionally, univariate analysis was conducted to describe participants’ demographic characteristics, including age, sex, work duration, and "tutup poin" classification. The study did not perform subgroup analysis or adjust for potential confounding variables.

Results

The demographic characteristics of the respondents provide an overview of the equal distribution of participants across both intervention groups, which is essential for understanding the context of the study population. These characteristics include variables such as age, sex, years of experience as an online car driver, and point closure category, which reflects the drivers’ daily workload. Detailed information regarding the distribution of respondents in each intervention group is presented in Table 1.

Table 1. Respondent Characteristics by Intervention Group

Characteristic	20-second Group (n = 15)	30-second Group (n = 16)	Total (n = 31) (%)
Age			
30–35 years	4	5	9 (29.0%)
36–40 years	6	5	11 (35.5%)
41–50 years	4	4	8 (25.8%)
56–65 years	1	2	3 (9.7%)
Sex			
Male	15	16	31 (100%)
Years of Experience			
2 years	3	5	8 (25.8%)
3 years	2	1	3 (9.7%)
4 years	1	1	2 (6.5%)
5 years	7	7	14 (45.2%)
6 years	2	2	4 (12.9%)
Point Closure Category			
10 points	6	5	11 (35.5%)
18 points	8	9	17 (58.1%)
24 points	1	1	2 (6.5%)

Note: The point closure category refers to the target number of jobs a driver must complete to earn a bonus. Higher targets may increase the risk of muscle pain due to greater workload.

The majority of respondents were in the 36–40 years age group (35.5%), and all participants were male. Most had five years of work experience (45.2%), and the 18-point target category was the most common, accounting for 58.1% of participants. A comparison of pain scores before and after the intervention for each group is shown in Table 2, while the between-group comparison of pain score changes is presented in Table 3.

Table 2. Comparison of Pain Scores Before and After Intervention (Wilcoxon Test)

Group	n	Median (Pre)	IQR	Median (Post)	IQR	p-value
20 seconds	8	2	1.75	3	1.25	0.863
30 seconds	9	3	0	3	3	0.257

Table 3. Comparison of Pain Score Changes Between Groups (Mann–Whitney U Test)

Group	N	Median Change	IQR	α	p-value
20 seconds	8	3.0	1	0.05	0.427
30 seconds	9	3.0	1	0.05	0.427

Based on the Wilcoxon test results, no statistically significant differences were observed in gastrocnemius muscle pain scores before and after the intervention within either group. The p-value for the 20-second group was 0.863, and for the 30-second group, 0.257—both exceeding the 0.05 threshold. These results suggest that neither the 20-second nor the 30-second intervention produced a statistically significant reduction in gastrocnemius muscle pain among online car drivers. Detailed results are shown in Table 2. To compare the difference between the two intervention groups, a Mann–Whitney U test was conducted. The resulting p-value of 0.427 was greater than 0.05, indicating no statistically significant difference between the two intervention durations in reducing gastrocnemius muscle pain. These results are presented in Table 3.

Based on the statistical analyses, it can be concluded that the two different intervention durations (20 seconds and 30 seconds) did not result in a statistically significant difference in reducing gastrocnemius muscle pain among online car drivers. Participant flow in this study began with 34 individuals randomly assigned to the two intervention groups—17 participants in each group. However, during the intervention period, 3 participants were unable to complete the intervention due to overlapping work commitments. As a result, only 31 participants (15 in the 20-second group and 16 in the 30-second group) were included in the final analysis using a per-protocol approach. A total of 17 participants met the inclusion criteria. The study was conducted in September 2024 and proceeded according to the planned schedule, with no early termination during the intervention period. No additional or subgroup analyses were performed due to the relatively small sample size, which could have compromised the statistical validity of such analyses.

Regarding adverse events, no unwanted effects or side effects were reported during or after the intervention among all participants. The statistical analysis indicated no significant difference in pain reduction resulting from the 20-second or 30-second gastrocnemius stretching interventions. One possible reason for the lack of significant effect is that the intervention duration may have been too short to produce a meaningful reduction in pain. Additionally, other factors—such as varying levels of occupational fatigue, driving frequency, and individual rest patterns—could have influenced the pain intensity experienced by participants. These findings suggest that future research should consider longer or more intensive interventions and possibly integrate other approaches such as strength training or ergonomic modifications to achieve more optimal therapeutic outcomes.

Discussion

Respondent Identification Based on Age

The study's data indicate that the majority of online drivers within the PDRJ community are aged between 36 and 40 years, categorizing them within the productive working age group.[12] Despite being in this productive phase, prolonged static work and extended load durations contribute to musculoskeletal complaints.[13] Natural degenerative processes occurring at this age further elevate the risk of muscle pain. Nur Sabrina (2021) elucidated that individual aged 41–56 years may experience pain influenced by tissue regeneration processes. Additionally, repetitive movements over extended periods exacerbate pain complaints due to excessive workload.[14]

The primary cause of muscle pain is repetitive movements, leading to muscle tension and subsequent oxygen deficiency. This hypoxic state triggers anaerobic oxidation processes, resulting in lactic acid accumulation within the muscles. The buildup of lactic acid is responsible for muscle stiffness and pain.[15]

Respondent Identification Based on Work Tenure

Data reveal that 41% of drivers have been working for five years. Muscle pain complaints can stem from excessive muscle contractions due to prolonged workload over the years.[16] The act of pressing the gas pedal involves plantar flexion movements, which, when sustained, can lead to pain. Furthermore, the inversion and eversion movements required to switch between the gas and brake pedals contribute to pain levels due to their repetitive nature.[17] Limited driving space also affects foot movement flexibility.[18]

Work tenure is a risk factor for gastrocnemius muscle pain complaints. Extended driving exposure increases muscle tension accumulation, leading to tissue hypoxia, anaerobic metabolic processes, and lactic acid buildup, culminating in pain.[19]

Respondent Identification Based on Point Closure Category

The study indicates that 58.8% of drivers fall into the 18-point closure category.[16] This intensive work system mandates drivers to achieve predetermined point targets. Drivers are scheduled by the application to work for 14 hours, from 06:00 to 21:00. Beyond this, drivers may work additional hours independently, not accounted for by the application. Meeting these targets results in bonuses.[20]

Physically demanding work impacts muscle function and other bodily systems. Extended driving durations without rest can cause muscle pain (Gampu et al., 2017). According to the Government Regulation of the Republic of Indonesia No. 44 of 1993 and Law No. 22 of 2009, the working hours for public vehicle drivers are set at 8 hours per day. Drivers must be given a minimum of a half-hour rest after driving continuously for 4 hours.[21]

Respondent Identification Based on Gender

The study's data show that 100% of drivers are male. This finding is limited to the male online driver community within PDRJ, necessitating caution when generalizing to broader populations, such as female drivers or other occupational groups. Males often engage in heavier workloads.[16] Physiologically, male muscles are stronger than female muscles.[19] Research indicates that muscle strength peaks earlier in women than in men. For women, muscle strength peaks in late adolescence or around 44 years, while in men, it peaks at 30 years. Muscle tone capacity declines by approximately 15–20% per decade in men but can increase up to 30% per decade in women. For individuals with active lifestyles, muscle tone loss can be significantly slowed (0.3% per year).[19]

Comparison of Contract-Relax Stretching Dosages

The study's Wilcoxon and Mann–Whitney tests indicate no significant differences between the 20-second and 30-second durations, likely due to the minimal difference between these durations. Potential contributing factors include limited intervention frequency, muscles already adapted to pain, and individual variability among respondents. Additionally, varying wait times for orders among drivers and less congested traffic in Jombang City may influence stretching effectiveness.

This aligns with research by Syam et al. (2018), which found no difference in the impact of contraction magnitudes (25%, 50%, and 75% of maximal contraction) in the contract-relax technique on hamstring flexibility. Minimal contractions yielded similar results to maximal contractions, reducing the risk of injury from excessive muscle contractions and conserving energy.[22]

Asri et al. (2016) reported that contract-relax stretching with a 7-second duration achieved maximal effects by the 12th week, while a 20-second duration reached maximal effects by the 10th week. A 30-second duration achieved maximal effects by the 6th and 7th weeks.[10]

Contract-Relax Stretching (CRS) activates the Golgi Tendon Organ (GTO), which responds to excessive stretching. GTO activation sends afferent impulses to the spinal cord, engaging inhibitory motor neurons that halt efferent impulses causing contraction, resulting in a noticeable and sudden decrease in muscle tone. Maximal isometric contractions followed by relaxation and deep breathing enhance muscle relaxation and reduce adhesions in tense tissues. Strong muscle contractions facilitate vasodilation and relaxation, promoting local metabolism and circulation, aiding in the removal of metabolic waste produced during inflammation, and reducing pain.[23] To strengthen the argument, additional support from recent international literature on the effectiveness of CRS duration in managing muscle pain, especially among field workers like drivers, is necessary.

Limitations and Recommendations

This study is limited by its all-male respondent pool from the PDRJ community, restricting generalizability to female populations or other occupational groups. A small and uneven sample size (8 vs. 9) may affect the statistical power of the analysis. The intervention durations (20 seconds and 30 seconds) may be too brief to demonstrate significant effects. Limited intervention frequency and the absence of subgroup analyses also constrain the study.

The 20-second and 30-second durations were selected based on expert opinion. Jane Harrison recommends stretching durations between 20 and 30 seconds. However, the effectiveness of these durations can vary depending on muscle condition and training frequency.

Recommendations

Future research should consider combining contract-relax stretching dosages with other physiotherapy techniques to alleviate muscle pain. Expanding dosage variations and increasing training frequency are also advised. Including control groups and considering ergonomic factors will enhance the validity of research findings. This study underscores the importance of a holistic approach to managing muscle pain in drivers, which encompasses stretching duration, workload, ergonomics, and integrated physiotherapy interventions.

Conclusion

Based on statistical analysis using the Wilcoxon and Mann–Whitney tests, no significant difference was found in the reduction of gastrocnemius muscle pain between the intervention groups receiving contract-relax stretching for 20 seconds and 30 seconds ($p > 0.05$). These findings suggest that the variation in stretching duration within this time range does not produce a meaningful difference in alleviating muscle pain symptoms.

Several uncontrolled external factors, such as variations in order waiting time, smooth traffic conditions, and relatively short travel distances, may have influenced the results of this study. Therefore, the external and internal validity of these findings should be interpreted with caution, and generalization to populations with different characteristics may be limited.

Future research is recommended to consider additional variables, such as a more structured frequency and duration of stretching sessions, standardized working conditions, and the inclusion of a control group for comparison. Furthermore, stratification based on baseline muscle conditions—such as stiffness levels and previous physical activity—may provide deeper insight. Expanding the sample size is also essential to increase statistical power and enhance the generalizability of the results.

Author Contribution

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This study was not registered in any clinical trial registry, as it does not fall within the scope of registered clinical trials requiring a registration number. Although the study does not possess a formal ethics approval number, it was conducted in accordance with prevailing ethical standards and procedural guidelines. The study protocol is available upon request from the corresponding author. Furthermore, the research did not receive any external funding from sponsors. All research-related expenses were borne independently by the authors, with no involvement from third parties in the design, implementation, data analysis, or dissemination of the study results.

Conflict of Interest Statement

The authors declare that there are no conflicts of interest related to this study.

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Ethics Statement

This study was conducted in accordance with the ethical principles of the Declaration of Helsinki. Ethical approval was not required as the study involved only non-invasive procedures (blood pressure measurement and questionnaire surveys) and posed minimal risk to participants. Informed consent was obtained from all participants prior to their inclusion in the study, and confidentiality was strictly maintained.

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