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THE EFFECT OF A COMBINATION OF TOPICAL COLD PAIN RELIEVER GEL AND PROGRESSIVE RESISTANCE EXERCISE ON REDUCING KNEE PAIN IN THE ELDERLY

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ABSTRACT

Elderly individuals are those who have reached the age of over 60 years. Knee pain is a condition that occurs in the knee and can reduce independence and health in the elderly. Topical Cold Pain Reliever Gel is a selective activator of the transient receptor potential melastatin-8 (TRPM8) channel and also a vasoactive compound. Progressive Resistance Exercise is a gradual form of exercise where the load increases slowly with each session. This study aims to determine the effect of combining Topical Cold Pain Reliever Gel and Progressive Resistance Exercise on reducing knee pain in the elderly at the Raflesia Posyandu, Puhun Pintu Kabun, Bukittinggi in 2024. This study is a quantitative study using a quasi-experimental design with a one-group pre-test and post-test method. The sampling technique used purposive sampling. The population consisted of 80 individuals, with a sample of 10 individuals who met the inclusion criteria. The results of the study showed a P-Value of 0.004. With a value of 0.005 < α (0.05), this means that Ho is rejected, leading to the conclusion that there is an effect of combining Topical Cold Pain Reliever Gel and Progressive Resistance Exercise on knee pain reduction in the elderly.
Keywords: Elderly; Knee; Pain; Gel; Exercise.

BACKGROUND

The elderly population is a group that continues to increase in number each year. Aging is a process in which tissues gradually become less capable of repairing or replacing themselves, maintaining normal functions, fighting infections, and healing damage. If you are over 60 years old, you may be considered an "elderly person." The term "elderly" refers to individuals whose functional abilities are impaired due to changes caused by aging and associated risk factors (Kiik et al., 2018).

The United Nations (UN) has responded positively to the growing elderly population (aged > 60 years) since 2000 and has considered the importance of elderly welfare. Based on population projections, the number and proportion of elderly individuals have been rapidly increasing since 2000 and are expected to continue to rise into the 2050s. The global elderly population is expected to double by 2050, increasing from 6.9% in 2019 to 16.4% by 2050. This means that by then, one in five people in the world will be elderly (Widiyastomo, 2020).

According to the World Health Organization (WHO), elderly individuals are classified as: a) ages 45-60, referred to as middle age; b) ages 60-75, referred to as elderly; c) ages 75-90, referred to as old; and d) over 90, referred to as very old. The WHO estimates that Indonesia's elderly population will increase by 41.4% in 2025, representing the highest growth rate in the world. Furthermore, the UN estimates that Indonesia's elderly population will reach 60 million by 2050, placing Indonesia 41st globally in terms of elderly population growth (Akbar et al., 2021).

Knee osteoarthritis is the most commonly diagnosed type of arthritis, and its prevalence will continue to rise as life expectancy and obesity rates increase. Depending on the source, about 13% of women and 10% of men aged 60 and older experience symptoms of knee osteoarthritis. Among those over 70, the prevalence increases to 40%. The prevalence of knee osteoarthritis is lower in men than in women. Interestingly, not everyone who shows radiographic signs of knee osteoarthritis will have symptoms. A study found that only 15% of patients with radiographic signs of knee osteoarthritis reported symptoms. Regardless of age, the incidence of symptomatic knee osteoarthritis is about 240 cases per 100,000 people annually (Jannah et al., 2023).

Topical cold gels are commonly used to alleviate acute pain or injuries, but there is limited research exploring their effectiveness in chronic conditions such as knee osteoarthritis (OA). Investigating this is crucial to determine whether these products offer significant clinical benefits for individuals with knee OA compared to other treatments.

Pain management in knee OA often relies on oral medications, such as NSAIDs, which carry the risk of long-term side effects. Topical gels could serve as a safer alternative, particularly for patients with comorbidities.

Topical Cold Pain Reliever Gel is a selective activator of the transient receptor potential melastatin-8 (TRPM8) channel and a vasoactive compound. As a topical agent, it provides a cooling effect and anti-irritant action by initially stimulating nociceptors and then reducing their sensitivity. Menthol applied externally also activates central analgesic pathways. However, high concentrations of menthol can lead to cold allodynia (Pergolizzi et al., 2018).

Progressive Resistance Exercise is a dynamic isotonic strengthening exercise with a gradually increasing load. This method of exercise is effective in maintaining and improving muscle function, reducing joint pain, and enhancing the function of patients with knee osteoarthritis (Nugraha & Kambayana, 2018). This exercise can be performed using resistance bands.

Gel is a semi-solid topical preparation that is comfortable to use, as it creates a cool, moist environment with good skin absorption and can be easily washed off with water (Rosida et al., 2018). Progressive Resistance Exercise is a dynamic isotonic strengthening exercise with a gradually increasing load. This method of strength training is more effective in maintaining and improving muscle function, reducing joint pain, and enhancing knee osteoarthritis patients' function (Nugraha & Kambayana, 2018). This exercise can be performed using resistance bands.

This study aims to investigate the effect of combining Topical Cold Pain Reliever Gel and Progressive Resistance Exercise on reducing knee pain in the elderly.

METHOD

This study was conducted at the Raflesia Posyandu in Puhun Pintu Kabun, Bukittinggi, from January to February 2024. A quasi-experimental research method was employed to determine the effect of combining Topical Cold Pain Reliever Gel and Progressive Resistance Exercise on knee pain in the elderly. The research design used was a one-group pretest and posttest.

The sampling technique used was purposive sampling, where samples were selected based on criteria set by the researchers. The inclusion criteria for this study are as follows: Respondents experiencing knee pain at the Rafflesia Posyandu, Puhun Pintu Kabun, Respondents aged 60-74 years, Respondents with moderate pain levels (scores of 4-6), Respondents willing to participate in the exercise program from start to finish. Data analysis was performed using the Dependent T-Test. The measurement tool used was the Visual Analog Scale (VAS). The respondents were elderly individuals experiencing knee pain, with a sample size of 10 participants who met the inclusion criteria.

RESULTS AND DISCUSSION

1. The Average Knee Pain in Elderly Individuals Before Intervention

The average (mean) knee pain score before the administration of Topical Cold Pain Reliever Gel and Progressive Resistance Exercise was 5.30, with a standard deviation of 0.675, a minimum score of 4, and a maximum score of 6 (moderate pain)

These findings are also consistent with a study by (Topp et al., 2013), which investigated the effects of topical menthol or placebo on knee function and pain in patients with knee osteoarthritis. The pain levels before the intervention ranged from 1-3 (mild pain) as measured by the VAS. The study can demonstrate that cold pain relief gels have significant short-term effectiveness in reducing pain in knee osteoarthritis (OA) patients compared to placebos or other methods. Another key finding might include evidence that these gels provide pain relief without systemic side effects often associated with oral medications (e.g., NSAIDs). The cooling effect of the gel can help patients perform activities without pain.

Novelty Gained from This Research: A New Approach to Non-Invasive Therapy. This research provides new insights into the benefits of topical cooling as a non-invasive and non-pharmacological approach for managing chronic knee OA pain. It may offer clearer evidence of the mechanisms underlying local cooling (via TRPM8 receptors) in reducing pain sensitivity in knee OA. Another novelty could be evidence that these gels are safe and effective for patients with comorbidities such as hypertension or gastrointestinal disorders, which are often contraindications for oral NSAIDs.

Impact of This Research on Scientific Development: Enhancing Clinical Understanding. Enriching Clinical Literature: This study can contribute to the clinical body of knowledge on local therapies for knee OA, offering a safer alternative to oral or injectable treatments. Advancing Personalized Medicine: The findings could lay the groundwork

for personalized OA therapies tailored to patient needs based on pain levels, age, or comorbidities. This could inspire innovations in topical gel formulations, such as more targeted active ingredients or a combination of cooling and anti-inflammatory effects. Supporting Non-Pharmacological Rehabilitation: The research emphasizes the importance of non-invasive pain management in facilitating patient mobility, strengthening the role of physical therapy-based rehabilitation.

Economic and Social Impacts: Affordable and Accessible Alternatives. By providing a more affordable and user-friendly therapy option, the findings could alleviate the financial burden of OA treatment, particularly in populations with limited access to healthcare services. This makes the intervention both economically and socially impactful, promoting wider adoption of safe and effective OA management strategies. The knee is one of the largest and most complex joints in the body, and it is also the most vulnerable because it bears heavy loads and pressure while providing flexible movement. Knee osteoarthritis (OA) is a multifactorial disease caused by various risk factors such as aging, obesity, joint trauma, genetic abnormalities in joint cartilage, and excessive stress on the joints from physical activities or sports (Tika & Aryana, 2018).

The most common symptoms experienced by OA patients are joint pain and stiffness. Joint pain typically occurs when physical activities are excessive, while stiffness often develops after periods of inactivity, such as in the morning after waking up or following a midday rest. The affected joint may also become red, warm, and tender, leading to stiffness, immobility, and deformity. If osteophytes form in the joints of the hands or feet, swelling or deformity may occur, limiting the patient's range of motion and negatively impacting their physical well-being. Additionally, if left untreated, OA can profoundly affect various aspects of a person's life and may lead to disability (Ignatavicius & Workman, 2016).

The findings of this study align with the research conducted by (Wahyuni & Zakaria, 2021), which aimed to investigate the effect of strengthening exercises using elastic bands on improving the functional abilities of knee osteoarthritis patients at Condong Catur Hospital, Sleman. The study used a quasi-experimental design with a one-group pretest-posttest method. Respondents were randomly divided into two groups: a treatment group that received elastic band strengthening exercises and a control group that received standard care provided by the hospital. The intervention was given twice a week for four weeks. Functional ability was measured using the WOMAC score. In the treatment group, the average pain score before the intervention was 26.80.

2. The Average Knee Pain in Elderly Individuals After Intervention.

The average knee pain score after the administration of Topical Cold Pain Reliever Gel and Progressive Resistance Exercise was 2.30, with a standard deviation of 0.483, a minimum score of 2, and a maximum score of 3 (mild pain). In the study by (Katsukawa et al., 2010), we evaluated lemongrass essential oil using assays developed for COX-2 and PPAR activity. The results showed that COX-2 promoter activity was suppressed by lemongrass oil in cell-based transfection assays, and citral was identified as the main component responsible for suppressing COX-2 expression as well as acting as an activator of PPARα and PPARγ. PPARγ-dependent suppression of COX-2 promoter activity was also observed following citral treatment.

Topical Cold Pain Reliever Gel is a form of medical aromatherapy, defined as the use of natural products containing at least one active or co-active volatile organic compound, administered through topical application, oral ingestion, or inhalation, with the aim of achieving health benefits (Sadgrove et al., 2021). The leaves of *Cymbopogon citratus* (lemongrass) contain a high composition of essential oils. The main constituents of this essential oil include citral (a mixture of terpenoids and geranial), myrcene, genariol, citronellol (cymbopogonol and cymbopogone), and α-oxobisabolene. These contents vary depending on the plant species and geographic location. For example, West Indian lemongrass contains 12–15% essential oil, while East Indian lemongrass has 10–13%. Citral is a key component responsible for the characteristic aroma of this plant (Oladeji et al., 2019).

Qualitative and quantitative phytochemical screening of *Cymbopogon citratus* reveals the presence of significant bioactive compounds associated with the plant's therapeutic potential. These bioactive compounds include ketones, alcohols, phenols, terpenes, flavonoids, saponins, steroids, tannins, alkaloids, geranial, terpenoids, polyphenols, esters, aldehydes, and fatty acids. According to literature, the most important compounds in *C. citratus* are its essential oils and flavonoids, which play a major role in the plant's therapeutic and pharmacological activities (Oladeji et al., 2019). The benefits of using Topical Cold Pain Reliever Gel include easy application, a cooling sensation, good absorption, no residue, and ease of use (Agustiani et al., 2022).

One of the exercises provided by physiotherapists to reduce knee pain is Progressive Resistance Exercise combined with Topical Cold Pain Reliever Gel. This exercise focuses on dynamic isotonic strengthening, where the load is gradually increased. It is effective for maintaining and improving muscle function, reducing joint pain, and enhancing the functionality of knee osteoarthritis (OA) patients. Topical menthol application also activates central analgesic pathways, and in high concentrations, menthol can cause cold allodynia (Pergolizzi et al., 2018).

Progressive Resistance Exercise has been proven to be highly effective in reducing musculoskeletal complaints and perceived physical effort. Training protocols described in the literature involve strength, endurance, or light resistance exercises, all of which have demonstrated benefits in maintaining strength. Progressive Resistance Exercise is an effective intervention for improving physical function in older adults, including enhancing strength and performance in both simple and complex activities. However, caution is needed when adapting these exercises for use in clinical populations, as side effects have not been adequately reported (Christie, 2011). The results of this study are consistent with the research conducted by (Topp et al., 2013), which aimed to evaluate the effect of topical menthol or a placebo on knee function and pain in patients with knee osteoarthritis (OA). The reduction in pain during functional tasks was clinically significant, with an average decrease of 37% following the application of menthol treatment.

According to the researcher's assumptions, after applying the Topical Cold Pain Reliever Gel and Progressive Resistance Exercise to 10 respondents, their knee pain levels ranged from 2 to 3 on the Visual Analog Scale (VAS), indicating mild pain. The strengthening exercise method improved muscle function, reduced joint pain, and increased the functionality of knee OA patients. Strong muscle contractions facilitated fluid circulation, allowing better metabolism and local circulation through vasodilation and relaxation following maximal muscle contractions. This enhanced the removal of metabolic waste products from the inflammatory process, thereby reducing pain. Additionally, the sensation of menthol provides a central analgesic effect. High concentrations of menthol, however, can cause cold allodynia. The gel offers several advantages, such as easy application, a cooling sensation, good absorption, no residue, and convenience of use.

3. The Effect of Intervention on Reducing Knee Pain in Elderly Individuals.

Table 1 The Effect of Combining Topical Cold Pain Reliever Gel and Progressive Resistance Exercise on Reducing Knee Pain in the Elderly

Variable	N	Mean Positif Rank	Mean Negatif Rank	Z	P Value
Topical Cold Pain Reliver Gel dan *Progressive Resistance*	10	0.00	5.50	- 2.873[b]	0.004

Based on Table 1, the results indicate a difference between the two variables, with a value of -2.873[b]. The Positive Rank Mean (average increase) is 0.00, while the Negative Rank Mean (average decrease) is 5.50. The resulting p-value is 0.004, which is less than the significance level α (0.05), leading to the rejection of the null hypothesis (Ho). This implies that there is a significant effect of administering Topical Cold Pain Reliever Gel and Progressive Resistance Exercise on knee pain in the elderly at the Posyandu Puhun Pintu Kabun in 2024.

Several topical agents have proven effective in treating patients with chronic pain. Topical capsaicin and diclofenac have shown effectiveness in managing chronic soft tissue pain. For patients with osteoarthritis of the hands and knees, the American College of Rheumatology generally recommends oral medications (acetaminophen, nonsteroidal anti-inflammatory drugs [NSAIDs], tramadol, and intra-articular corticosteroids) and topical NSAIDs equally, favoring topical agents for patients with a previous gastrointestinal risk or those over 75 years of age (Stanos & Galluzzi, 2013).

Progressive Resistance Exercise has been shown to be the most effective for reducing musculoskeletal complaints and perceived physical exertion. Training protocols described in literature utilizing strength, endurance, or light resistance exercises have all demonstrated benefits in maintaining strength. The application of resisted or progressive resistance can stimulate a number of motor units to contract. Muscle strength is determined by the number of motor units that are active and is not influenced by muscle mass. The more motor units that are recruited, the greater the potential increase in muscle strength (Swandari et al., 2022).

The results of this study are in line with the research conducted by (Risqi et al., 2021) on the "effect of combining Progressive Resistance Exercise and Isometric Exercise to reduce knee pain in cases of osteoarthritis." The aim of

their study was to determine the effect of combining Progressive Resistance Exercise and Isometric Exercise on reducing pain levels in osteoarthritis cases. The subjects were 19 residents of RW 02, Triwung Lor Village, Probolinggo City, who experienced knee pain due to osteoarthritis. The research design used a pre-experimental approach with a one-group pretest-posttest design. Pain was measured using the Numeric Rating Scale (NRS). The results demonstrated a significant difference in pain levels before and after the combination of Progressive Resistance Exercise and Isometric Exercise, with a p-value of 0.000 ($p < 0.005$). This study is also consistent with research conducted by (Stanos & Galluzzi, 2013).

Several types of topical agents have been shown to be beneficial in treating patients with chronic pain. Capsaicin and topical diclofenac have proven effective in treating patients with chronic soft tissue pain. In patients with osteoarthritis of the hands and knees, Topical Cold Pain Reliever Gel has been shown to reduce knee pain due to its mint content, which creates a cooling sensation upon application. The menthol contained in Topical Cold Pain Reliever Gel can produce a relaxing effect on the muscles, while its other ingredients may help reduce muscle spasms and decrease inflammation at the application site.

According to the researchers' assumption, there is an effect from the combination of Topical Cold Pain Reliever Gel and Progressive Resistance Exercise. After 12 treatments with Topical Cold Pain Reliever Gel and Progressive Resistance Exercise, changes were observed in the reduction of knee pain among elderly participants. Out of 10 respondents, the average knee pain score before treatment was 5.30, which decreased to an average score of 2.30 after the treatment. The mechanism of Topical Cold Pain Reliever Gel acts as a vasorelaxant, with menthol producing significant vasodilation of the skin's blood vessels. This vasodilation increases in a dose-dependent manner. The topical menthol sensation significantly increases 5 to 60 minutes after application compared to baseline. This menthol sensation can relax the muscles due to vasodilation, thereby reducing pain in the area where the Topical Cold Pain Reliever Gel is applied.

Progressive Resistance Exercise using Theraband can effectively reduce pain. During knee flexion movements, eccentric contractions occur in the hamstring, gracilis, sartorius, popliteus, and gastrocnemius muscles. When performing hip abduction with the Theraband at the knee, contractions take place in the gluteus, hamstring, and iliotibial band muscles. When these exercises are performed repeatedly according to the prescribed dosage, a process of pain reduction is initiated.

Implementing Progressive Resistance Exercise in patients with osteoarthritis can significantly increase muscle strength, enhance striated muscle fibers, and increase the number of motor units. This improvement in muscle strength is expected to stabilize the joint in the correct position and prevent pressure that could lead to pain. Regular and repeated movements can enhance blood flow, thereby increasing metabolism and reducing fluid diffusion through the bone matrix. Strong muscle contractions facilitate the pumping action mechanism, which circulates fluids, ensuring effective local metabolism and circulation due to vasodilation and relaxation following maximal muscle contraction.

Therefore, the transportation of metabolic waste and byproducts produced through inflammatory processes can occur smoothly, leading to a reduction in pain. The combined effect of Progressive Resistance Exercise and Topical Cold Pain Reliever Gel can significantly decrease knee pain. The Progressive Resistance Exercise progressively increases load-bearing activities to maintain and enhance muscle function, reduce joint pain, and improve functional activity in patients experiencing knee pain. Both interventions positively impact knee pain reduction, and their combination provides significant benefits.

CONCLUSION AND SUGGESTION

Based on the results of this study, it can be concluded that there is a significant effect of the combination of Topical Cold Pain Reliever Gel and Progressive Resistance Exercise on reducing knee pain in the elderly. The decrease in average knee pain from 5.30 before the intervention to 2.30 after the intervention indicates that this combination is effective in alleviating pain. These findings support the use of Topical Cold Pain Reliever Gel and Progressive Resistance Exercise as therapeutic strategies that can enhance the quality of life for elderly individuals experiencing knee pain.

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