JPPIPA 9(11) (2023)

Jurnal Penelitian Pendidikan IPA

Journal of Research in Science Education

http://jppipa.unram.ac.id/index.php/jppipa/index

Vetiver Root Oil Therapy's Effectiveness in Reducing Pain in Elderly Patients with Rheumatoid Arthritis?

Rudy Alfiyansah[1], Hasbi Taobah Ramdani[1*], Tri Sutrisno[2]

[1] Nursing Science Program, STIKes Karsa Husada Garut, Garut, Indonesia.
[2] Griya Lansia Garut, Garut, Indonesia.

Received: September 3, 2023
Revised: October 6, 2023
Accepted: November 25, 2023
Published: November 30, 2023

Corresponding Author:
Hasbi Taobah Ramdani
hasbiners@gmail.com

DOI: 10.29303/jppipa.v9i11.5183

Abstract: Rheumatoid arthritis is an autoimmune joint inflammation. This illness mainly affects those over 55. Many studies have examined the therapeutic advantages of perfume root oil, a processed product, for pain relief. Ginger compresses and warm water have been studied as treatments. This study evaluated the pain reported by Lansia Garut Griya Service Unit residents before and after scented root oil therapy and its effectiveness in treating pain. The study included 13 RA patients, 10 of whom met the inclusion criteria. The study found that 60% (n=6) of men and 40% (n=4) of women had rheumatoid arthritis. (RA). Before the intervention, 70% (n=7) had moderate pain and 30% (n=3) had severe pain. H0's Wilcoxon test result can be rejected because the p-value is 0.005, below the 0.05 standard of significance. It can be concluded that pre- and post-test pain scale measurements differ. These data imply that aromatic root oil therapy reduces pain in elderly rheumatoid arthritis patients.

Keywords: Elderly; Pain; Rheumatoid arthritis; Vetiver root oil

Introduction

Rheumatoid arthritis is classified as one of the diffuse connective tissue disorders that are immune system-mediated, characterized by joint bone abnormalities, form alterations, and significant ankylosis (Ngatwadi et al., 2018). Rheumatoid arthritis (RA) affects a substantial population of around 335 million individuals, representing a prevalence rate of 1 in 6 persons. This disease exhibits a widespread occurrence in both industrialized and developing nations. The prevalence of this disease in Indonesia is estimated to affect approximately 360,000 individuals (Arisandy et al., 2023). Rheumatoid arthritis has the potential to induce discomfort as a result of restricted physical movement. Additionally, it has the potential to result in impairment, paralysis, and challenges in doing routine tasks. Furthermore, the systemic consequences remain ambiguous; nonetheless, they have the potential to result in organ dysfunction and mortality, as well as many complications including but not limited to pain, exhaustion, alterations in self-perception, and susceptibility to harm (Yusefa et al., 2023).

Pain is a subjective and aversive perception accompanied by emotional and psychological components, which can exert a more profound influence than mere physical injury. Pain, particularly in the joints, has the potential to disrupt joint mobility and exert an influence on the surrounding muscles and tissues as a result of muscular spasm (Fitriana et al., 2021). The prevalence of rheumatoid arthritis pain among senior individuals is expected to be influenced by their level of independence in activities of daily living (ADL) (Yusefa et al., 2023).

According to the data obtained from the Griya Lansia Service Unit, the prevalence of pain complaints among the elderly population amounts to 17.33%, ranking second only to hypertension. In the case of elderly individuals with hypertension, regular administration of pharmacological treatment is prescribed on a daily basis. Conversely, for individuals with rheumatoid arthritis, treatment is administered only when the elderly individuals express discomfort

How to Cite:
Alfiyansah, R., Ramdani, H. T., & Sutrisno, T. (2023). Vetiver Root Oil Therapy's Effectiveness in Reducing Pain in Elderly Patients with Rheumatoid Arthritis?. *Jurnal Penelitian Pendidikan IPA*, *9*(11), 9142–9148. https://doi.org/10.29303/jppipa.v9i11.5183

that hampers their ability to carry out their daily activities, requiring assistance from personnel in the care facility and fellow elderly residents (Griya Lansia, 2023).

Hence, it is imperative to establish non-pharmacological interventions that can be employed among the aged population to mitigate the persistence of their pain. Similarly, Aini's investigation into the water compresses of lemongrass leaf decoction yielded a reduction in pain intensity among individuals with rheumatoid arthritis (RA) (Aini et al., 2023). Hence, the inclusion of non-pharmacological interventions for the elderly becomes imperative in order to potentially mitigate the persistence of pain. While prior investigations, such as Purnama's study on the efficacy of warm water compresses infused with grated ginger, have demonstrated a reduction in pain intensity (Purnama Dewi et al., 2023). The practicality of elderly individuals having to independently procure a grater and ginger for compresses presents potential safety hazards.

Furthermore, it should be noted that the process of preparing a lemongrass leaf decoction carries a similar potential for inflicting harm to individuals of advanced age. Hence, there exist non-pharmacological interventions that can be directly employed by older individuals to effectively address and alleviate their pain. One of the potential remedies is Vetiver Root Oil, a refined substance originating from Garut Regency, which has undergone rigorous testing to assess its efficacy.

Method

The measures are taken twice, i.e., before and after the intervention is delivered, in this sort of experimental quantitative research employing a quasi-experimental design (Nursalam, 2019). 75 old adults who resided in the Garut Griya Lansia Service Unit and up to 13 people with rheumatoid arthritis comprised the study's population. Total sampling was used in this study, meaning that all samples from the population were taken while keeping in mind the restrictions of the criteria the researcher had established. A total of 10 respondents who will participate in the study's activities from beginning to end are senior adults with rheumatoid arthritis who are willing to participate as respondents.

The Numeric Rating Scale (NRS) instrument with assessment markers was used in this study to measure the pain scale both before and after vetiver oil therapy: 0 indicates no discomfort, 1-3 minor discomfort, 4-6 mild discomfort, 7-9 very bad pain, 10 equals unbearable discomfort (Krebs, 2007). The respondents filled out an informed consent form for those who could read and write, while the researcher assisted those who could not, and then the researchers collected sample data from the elderly who met the inclusion criteria. The respondents were then given an explanation of the purpose, objectives, benefits, and methods of the research, as well as any potential risks that might occur.

Following a pain scale assessment of the respondent, vetiver root oil therapy is administered. This involves applying the oil twice daily for five days to the area that is in discomfort. Pure vetiver oil combined with virgin coconut oil carrier oil is utilized for this therapy.

Figure 1. The process of making vetiver oil for therapy

The nurses at the Garut Griya Lansia Service Unit participated in this study with the researchers to guarantee that the therapy was administered by respondents. The Numeric Rating Scale (NRS) was used to assess the respondent's pain response on the fifth day following the vetiver root oil therapy. This allowed researchers to see whether the respondent's pain scale had changed or not.

However, the paired sample t-test was used for analysis. As a parametric statistic, this test requires a normal data distribution. Therefore, a one-sample Kolmogorov-Smirnov normality test was performed before the data analysis. The results indicate that the data distribution is normal if the Kolmogorov-Smirnov Z-value is greater than the critical value or the p-value is greater than 0.05. In such cases, the paired sample t-test can be used to analyses the data. The Wilcoxon test is used in cases where the distribution of the research data is not normal. The criteria used for the test are as follows (Lei et al., 2018).

Result and Discussion

Based on the data presented in Table 1, it is evident that the majority of respondents are female, comprising 6 individuals, whilst the remaining 4 individuals are male. The characteristics of the respondents were analyzed based on the duration of their pain, as presented in Table 2. It was observed that out of the total respondents, 5 individuals reported experiencing pain for a duration exceeding 4 years, while another 5 individuals reported experiencing pain for a duration shorter than 4 years.

Table 1. Characteristics of Respondents Based on Gend

Gender	f	%
Male	4	40
Female	6	60
N	10	100

Table 2. Characteristics of Respondents Based on Duration of Pain

Duration of Pain	f	%
< 4 years	5	50
≥ 4 years	5	50
N	10	100

Table 3. Pain Scale before Intervention

Pain Scale	f	%
Mild	0	0
Moderate	7	70
Severe Controlled	3	30
N	10	100

Table 4. Pain Scale after Intervention

Pain Scale	f	%
Mild	6	60
Moderate	4	40
Severe Controlled	0	0
N	10	100

According to the data presented in Table 3, it is evident that prior to the administration of vetiver oil, the majority of respondents reported experiencing pain at a moderate level, with a total of 7 individuals (70%). Conversely, 3 individuals (30%) reported experiencing pain at a severe level. The data presented here corroborate the findings of Anggraeni et al. (2023) that indicate moderate pain as the most prevalent category of pain experienced by elderly individuals with RA. This pain is a type of painful and subjective sensory and emotional experience that occurs as a result of tissue damage, particularly in the joints of older individuals with rheumatoid arthritis. Additionally, following the administration of the intervention, the pain scale exhibited a shift over a period of 5 days. Table 4 illustrates that the majority of individuals (60%) reported experiencing mild pain, but a significant proportion (40%) reported moderate pain.

The one-sample Kolmogorov-Smirnov Test was employed to assess the normality of the Pre-test and Post-test data in this investigation. This test determines the appropriate statistical method to employ in further analyses using paired data research, namely the correlated sample t-test. The correlated sample t-test is suitable for data that follows a normal distribution, but the Wilcoxon test is better suitable for data that does not exhibit a normal distribution. The subsequent data normality test output presents the findings of the Pre-test and Post-test.

Table 5. Pre-test Normality Test

	Kolmogorov-Smirnov[a]		
	Statistic	df	Sig.
Pre_Test	0.433	10	0.000
a. Lilliefors Significance Correction			

According to the results of the Pre-test normality test table, the p-value is less than the significance level of 0.05 ($p < 0.05$). This indicates that the null hypothesis (H0) is rejected, leading to the conclusion that the distribution of the Pre-test data is not in accordance with a normal distribution.

Table 6. Post-test Normality Test

	Kolmogorov-Smirnov[a]		
	Statistic	df	Sig.
Post_Test	0.245	10	0.091
a. Lilliefors Significance Correction			

In the Post-test normality test table, the p-value of 0.091 is greater than the significance level of 0.05. This suggests that the null hypothesis (H_0) is accepted, indicating that the distribution of the Post-test data can be considered as normally distributed. Due to the presence of non-normally distributed data results, the utilization of the correlated sample t test is deemed inappropriate in this investigation. In the subsequent examination, the Wilcoxon test was employed to ascertain the presence of a disparity between the pain scale measurements in the Pre-test and Post-test.

The Wilcoxon test, alternatively referred to as the Wilcoxon signed-rank test, is a nonparametric statistical test employed to assess the disparity between Pre-test and Post-test measurements. The exam generates a tabular representation of rankings. The table presented herein displays the hierarchical arrangement of the disparities seen between pairs of data, specifically pertaining to the contrast between pretest and posttest data. The ranks are organized in ascending or descending order, depending on the polarity of the differences.

The results of the Wilcoxon test indicate that the null hypothesis (H_0) can be rejected, as the p-value of 0.005 is less than the predetermined significance level of 0.05. Therefore, it may be inferred that there exists a disparity in the pain scale measurements between the pre-test and post-test assessments. The findings suggest that the use of vetiver oil therapy is efficacious in diminishing the level of pain experienced by elderly individuals afflicted with rheumatoid arthritis.

Table 7. Wilcoxon test

Test Statistics[a]	
	Post_Test - Pre_Test
Z	-2.831[b]
Asymp. Sig. (2-tailed)	0.005
a. Wilcoxon Signed Ranks Test	
b. Based on positive ranks.	

Rheumatoid arthritis (RA) results in intense discomfort that can impede daily functioning. Rheumatoid arthritis (RA) is a prevalent and persistent condition that affects individuals worldwide, particularly older women. Rheumatoid arthritis (RA) is characterized by elevated levels of uric acid in the bloodstream, joint calcification, and metabolic syndrome (Aprihatin et al., 2023). Rheumatoid arthritis (RA) is a chronic autoimmune disorder that involves multiple joints bilaterally (Bhandari et al., 2020). Chronic pain, which ranks among the prevailing chronic illnesses in the United States, has been found to be linked with diminished quality of life, escalated healthcare expenses, and substantial economic burdens. The prevalence rates of chronic pain exhibit significant variability (Yong et al., 2022). According to Treede et al. (2015), pain is classified as chronic when it persists or recurs for a duration beyond 3 to 6 months.

Rheumatoid arthritis is classified as a type of systemic autoimmune disorder that affects the connective tissues, specifically characterized by the immune system's involvement leading to destruction in the ankylosis, joint bones, and alterations in their morphology (Ngatwadi et al., 2018). The occurrence of rheumatoid arthritis is significantly elevated in both developed and emerging nations, affecting a substantial population of over 335 million individuals. This statistic indicates that approximately one in every six individuals has the symptoms of rheumatoid arthritis. The prevalence of this disease in Indonesia is predominantly observed among the older population, with an estimated count of 360,000 individuals (Arisandy et al., 2023). If rheumatoid arthritis is not well treated, it can progressively result in the erosion of cartilage and ultimately lead to joint deformity. This can cause significant discomfort for patients and have a severe impact on their overall quality of life. Therefore, rheumatoid arthritis (RA) has emerged as a significant health concern, impacting individuals' well-being (Li et al., 2023).

Vetiver Essential Oil exhibits potential efficacy in the realm of health and medicinal interventions. Vetiver Essential Oil possesses versatile applications across several product formulations, including but not limited to ointments, balms, creams, shampoos, soaps, and aromatherapy blends. Indonesia is currently ranked as the third largest global producer. However, there is a need for improvement in terms of ensuring high quality standards, particularly in addressing issues such as smokey burn smell and pesticide contamination. Vetiver Essential Oil exhibits potential benefits across several age groups, ranging from children to the elderly. The development of Vetiver Essential Oil has potential applications in both topical and oral formulations (Suyono et al., 2019). David et al. (2023) vetiver essential oil and extracts exhibit many functional qualities, such as antioxidant, antibacterial, antifungal, and anticancer effects. Vetiver essential oil possesses biological qualities that render it advantageous in the field of aromatherapy, primarily for alleviating symptoms of anxiety, sadness, and sleeplessness.

Traditional medicine in South Asia, particularly in India, has historically employed various forms of plant material, such as dried roots, infused roots, and stems/leaves, which are then boiled in water. These preparations have been utilised for the treatment of various ailments, including but not limited to headaches, fevers, diarrhoea, dysentery, malaria, epilepsy, snake bites, and burns.

The vetiver root exhibits therapeutic properties characterized by its ability to induce a cooling and relaxing impact on patients. VEO exhibits several pharmacological actions, such as antioxidant, anti-inflammatory, antifungal, antiparasitic, antibacterial, hepatoprotective, antidepressant, anxiolytic, and antihyperglycemic properties (Zahoor et al., 2018). The plant species Chrysopogon zizanioides, often known as vetiver, had significant antibacterial properties, as seen by its mean minimum inhibitory concentration of 0.14 mg/mL against Cutibacterium acnes, Staphylococcus aureus, Staphylococcus epidermidis, and Streptococcus pyogenes (Kurrimboccus et al., 2022). The study conducted by Han et al. (2017) demonstrates the initial evidence of the biological effects of vetiver (Vetiveria zizanioides) essential oil on human dermal fibroblasts. While definite findings are still uncertain, the data indicate that VEO holds promise as a therapeutic option for cosmetic and metabolic healthcare goods. It is advisable to conduct additional study on the biological and pharmacological mechanisms of action of VEO. The results of this study

support the ethnobotanical significance of V. zizanioides and indicate that VREX contains bioactive compounds that can prevent MRSA and its clinical isolates from forming biofilms (Kannappan et al., 2017). Ali et al. (2021) suggests that in the future, it may be possible to evaluate the potential anticancer, anti-inflammatory, antifungal, and antibacterial properties of silver nanoparticles derived from Vetiveria zizanioides.

The plant accumulates its essential oil (EO) in the roots, which function as the primary source of the crucial natural ingredient for the expanding cosmeceutical, pharmaceutical, and perfumery sectors. The roots demonstrate a dual advantage by establishing an interconnected network that supports the ecosystem and generating valuable essential oil, renowned for its aromatic and biological characteristics. Additionally, the plant appears to be optimally adapted to the current unfavorable environmental conditions due to its morphological adaptations. The leaves possess adaptations that enable them to withstand various stresses, including drought-desiccation, salinity, temperature fluctuations, heavy metal exposure, herbicides, pesticides, and other similar factors. On the other hand, the roots exhibit a dense, elongated, and intricate structure that intertwines to form a substantial curtain-like arrangement underground. This network is highly effective for purposes such as soil and water conservation, land rehabilitation, gully control, slope stabilization, disaster mitigation, enhancement of water-structure interfaces, water quality improvement, remediation of polluted sites, agricultural utilization, and other unrelated applications. The various applications of vetiver contribute to its remarkable characteristics. Both the underground and aboveground components of plants have been found to provide advantages to nearly all sectors of the human population. The presence of a particular rich balsamic tonality in vetiver oil suggests that the essential oil mostly consists of volatile sesquiterpenes and their derivatives, which are known for their great complexity (Shabbir et al., 2019). Additionally, 30 combinations showed synergy, and thankfully, there was no antagonistic effects from the essential oils' antibacterial activity when they were diluted with the carrier oils. P. americana carrier oils (ten combinations) and A. vera carrier oils (nine combinations) showed the most promising synergy (Orchard et al., 2019).

The application of the plant extract induces the activation of the network of antioxidant enzymes, leading to a decrease in oxidative stress levels. This process establishes equilibrium between the oxidant and antioxidant systems. Additionally, the antibacterial properties of the substance will inhibit the biological mechanisms that contribute to harm, while the central nervous system depressant impact would alleviate the pain associated with inflammation (Grover et al., 2021). Vetiver, a herb renowned for its exceptional medical properties, holds significant recognition in India. The primary application of this substance is in the field of aromatherapy, as well as its utilization in the production of cosmetic goods. Moreover, numerous studies conducted on AUYSH have shown its potential therapeutic applications in treating various ailments such as heat strokes, headaches, muscular aches, and regulating body temperature in excessively hot climates. The distinctive medical properties of this herb were a compelling factor in our decision to select vetiver as the filler material for the therapeutic cushion (Jeyanthi et al., 2020). The roots of C. zizanioides modulated multiple biological signaling pathways, thereby reducing the generation of inflammatory cytokines. These results validate the long-standing application of vetiver leaves as a treatment for RA and imply that using entire plants may have benefits by acting on many inflammatory pathways in concert (Arafat et al., 2023), Vetiver oil has demonstrated suitability as an anti-cancer agent on Triple Negative Breast Cancer cells (Hanifa et al., 2022), and furthermore, the use of V. zizanioides aqueous root extract as a dietary supplement shows potential in addressing the oxidative damage caused by free radicals in renal illness (Amarasiri et al., 2021).

In a study conducted by Fadhillah et al. (2022), the research focused on investigating the impact of Vetiveria zizanioides on the cytotoxicity of human epithelial cervical cancer cells. The findings revealed that Vetiveria zizanioides exhibited a concentration-dependent cytotoxic effect against HeLa cells for a duration of 24 hours. The vetiver oil with the highest concentration (0.02%) exhibited the most significant suppression of cell growth (96.304%). Furthermore, there are morphological alterations, such as reduction in cytoplasmic volume. The findings indicate that V. zizanioides may have effective anti-cancer effects, particularly against human cervical cancer.

In Li's (2023) study titled "Network Pharmacology Analysis and Clinical Verification of Jishe Qushi Capsules in the Treatment of Rheumatoid Arthritis," the author conducted research utilizing the composition of Chinese herbal medicine. The findings demonstrate that this treatment modality exhibits a significant improvement in clinical symptoms and quality of life, as well as a delay in the progression of rheumatoid arthritis. A greater understanding of symptoms in patients at risk of RA can assist influence public health campaigns, highlighting relevant signs that should prompt presentation to primary care givers (Jutley et al., 2017).

Conclusion

The results indicated a predominance of male participants. Prior to the implementation of the intervention, the pain levels were predominantly characterized as moderate. However, following the intervention, the majority of participants reported pain levels falling within the mild range. The Wilcoxon test yielded significant findings, indicating that the null hypothesis may be rejected. Consequently, it can be inferred that there exists a disparity in pain scale readings between the pre-test and post-test evaluations. The results of this study indicate that the application of vetiver oil therapy is effective in decreasing pain levels among elderly patients diagnosed with rheumatoid arthritis.

Author Contributions

The roles of the authors in this research are divided into executor and advisor in this research.

Funding

This research was funded by the Directorate of Research, Technology and Community Service of the Ministry of Education, Culture, Research and Technology and the Higher Education Service Institution Region IV and Karsa Husada College of Health Sciences Garut and Griya Lansia Garut Regency.

Conflicts of Interest

The authors declare no conflict of interest.

References

Aini, L., Noviyanti, D., & Yurika, T. (2023). Pengaruh Pemberian Kompres Hangat Air Rebusan Serai (Cymbopogon Citratus) terhadap Penurunan Nyeri Arthritis Gout di Puskesmas Merdeka Palembang. *Malahayati Nursing Journal*, *5*(3), 633–646. https://doi.org/10.33024/mnj.v5i3.7969

Ali, S., Arthanari, A., & Shanmugam, R. (2021). Antioxidant Activity of Silver Nanoparticles Synthesized Using Vetiveria zizanioides-In Vitro Study. *J. Res. Med. Dent. Sci*, *9*(10), 199–203. Retrieved from https://www.jrmds.in/articles/antioxidant-activity-of-silver-nanoparticles-synthesized-using-vetiveria-zizanioidesin-vitro-study.pdf

Amarasiri, S. S., Attanayake, A. P., Arawwawala, L. D. A. M., Jayatilaka, K. A. P. W., & Mudduwa, L. K. B. (2021). Nephroprotective activity of Vetiveria zizanioides (L.) Nash supplement in doxorubicin-induced nephrotoxicity model of Wistar rats. *Journal of Food Biochemistry*, *45*(9). https://doi.org/10.1111/jfbc.13901

Anggraeni, R., Villayatina, V., Jati, R. P., Aeni, Q., & Nurwijayanti, A. M. (2023). Description of the Characteristics of Barriers to Pain Comfort: Sleep Quality in Elderly with Rheumatoid Arthritis in Kendal Regency. *Proceedings of the International Conference on Nursing and Health Sciences*, *4*(1), 113–118. https://doi.org/10.37287/picnhs.v4i1.1715

Aprihatin, Y., Andriani, L., & Yanti, E. (2023). Intervention of Slow-Stroke Back Massage Cutaneous Stimulus Techniques in Patients with Rheumatoid Arthritis. *Jurnal Penelitian Pendidikan IPA*, *9*(7), 5710–5715. https://doi.org/10.29303/jppipa.v9i7.4449

Arafat, M. A. M., Khalil, M. N. A., Mohamed, O. G., Abd El-Ghafar, O. A. M., Tripathi, A., Mahrous, E. A., Abd El-kader, E. M., & El-Hawary, S. (2023). Vetiver aerial parts and roots ameliorate rheumatoid arthritis in complete Freund's adjuvant rat model, a phytochemical profiling and mechanistic study. *Journal of Ethnopharmacology*, *317*, 116764. https://doi.org/10.1016/j.jep.2023.116764

Arisandy, W., & Suherwin, S. (2023). Application of Warm Compress with Red Ginger in Rheumatoid Arthritis Against Chronic Pain. *Jurnal'Aisyiyah Medika*, *8*(1), 230–239. https://doi.org/10.36729/jam.v8i1.1007

Bhandari, B., Basyal, B., Sarao, M. S., Nookala, V., & Thein, Y. (2020). Prevalence of Cancer in Rheumatoid Arthritis: Epidemiological Study Based on the National Health and Nutrition Examination Survey (NHANES). *Cureus*, *12*(4), 7870. https://doi.org/10.7759/cureus.7870

David, A., Fărcaş, A., & Socaci, S. A. (2023). An overview of the chemical composition and bioactivities of Vetiveria zizanioides (L.) Nash essential oil. *Trends in Food Science & Technology*, *140*, 104153. https://doi.org/10.1016/j.tifs.2023.104153

Fadhillah, S. S., Aini, A. Q., Mualifah, Saifudin, & Bowolaksono, A. (2022). Effects of Vetiveria zizanioides on Cytotoxicity of Human Epithelial Cervical Cancer Cells. *Journal of Hunan University Natural Sciences*, *49*(2). Retrieved from http://jonuns.com/index.php/journal/article/view/1065

Fitriana, V., Pujiati, E., & Sari, I. (2021). Penerapan Kompres Hangat Jahe Merah Pada Penderita Rheumatoid Arthritis: Studi Literatur. *Jurnal Profesi Keperawatan (JPK)*, *8*(2), 179–191. Retrieved from https://jurnal.stikes-aisyiyah-palembang.ac.id/index.php/JAM/article/view/1007

Grover, M., Behl, T., Bungau, S., & Aleya, L. (2021). Potential therapeutic effect of Chrysopogon zizanioides (Vetiver) as an anti-inflammatory

agent. *Environmental Science and Pollution Research*, *28*(13), 15597–15606. https://doi.org/10.1007/s11356-021-12652-z

Han, X., & Parker, T. L. (2017). Biological activity of vetiver (Vetiveria zizanioides) essential oil in human dermal fibroblasts. *Cogent Medicine*, *4*(1), 1298176. https://doi.org/10.1080/2331205X.2017.1298176

Hanifa, M., Wulandari, R., Zulfin, U., Nugroho, E., Haryanti, S., & Meiyanto, E. (2022). Different Cytotoxic Effects of Vetiver Oil on Three Types of Cancer Cells, Mainly Targeting CNR2 on TNBC. *Asian Pacific Journal of Cancer Prevention*, *23*(1), 241–251. https://doi.org/10.31557/APJCP.2022.23.1.241

Jeyanthi, B., Chinnammal S, K., & R, K. (2020). Development of Therapeutic Cushion Using Chrysopogon Zizanioides (Vetiver) and Bamboo Fabric. *Research Journal of Textile and Leather*, 23–27. https://doi.org/10.46590/rjtl.2020.010104

Jutley, G. S., Latif, Z. P., & Raza, K. (2017). Symptoms in individuals at risk of rheumatoid arthritis. *Best Practice & Research Clinical Rheumatology*, *31*(1), 59–70. https://doi.org/10.1016/j.berh.2017.09.016

Kannappan, A., Gowrishankar, S., Srinivasan, R., Pandian, S. K., & Ravi, A. V. (2017). Antibiofilm activity of Vetiveria zizanioides root extract against methicillin-resistant Staphylococcus aureus. *Microbial Pathogenesis*, *110*, 313–324. https://doi.org/10.1016/j.micpath.2017.07.016

Kurrimboccus, F., Orchard, A., Danckwerts, M. P., & van Vuuren, S. (2022). Antimicrobial Formulation of Chrysopogon zizanioides Essential Oil in an Emulsified Lotion for Acne. *Planta Medica*, *88*(13), 1256–1262. https://doi.org/10.1055/a-1699-3284

Lei, S. D. T., & Zhu, X. (2018). *Pretest–Posttest Designs* (B. B. Frey (ed.)). SAGE Publications, Inc.

Li, Y., Zhang, N., Peng, X., Ma, W., Qin, Y., Yao, X., Huang, C., & Zhang, X. (2023). Network pharmacology analysis and clinical verification of Jishe Qushi capsules in rheumatoid arthritis treatment. *Medicine*, *102*(34), e34883. https://doi.org/10.1097/MD.0000000000034883

Ngatwadi, M., & Mulyadi. (2018). Differences in Effectiveness of Hypnotherapy and Deep Breath Relaxation Techniques on Joint Pain in Patients with Rheumatoid Arthritis. *Jurnal Ilmu Keperawatan*. Retrieved from https://jurnal.usk.ac.id/JIK/article/view/12268

Nursalam, N. (2019). *Konsep dan Penerapan Metodologi Penelitian Ilmu Keperawatan (87)*. Stikes Perintis Padang.

Orchard, A., Kamatou, G., Viljoen, A. M., Patel, N., Mawela, P., & Vuuren, S. F. van. (2019). The Influence of Carrier Oils on the Antimicrobial Activity and Cytotoxicity of Essential Oils. *Evidence-Based Complementary and Alternative Medicine*, 1–24. https://doi.org/10.1155/2019/6981305

Purnama Dewi, B., & Aprilia Utami, I. (2023). Pengaruh Kompres Air Hangat Parutan Jahe terhadap Penurunan Nyeri Arthritis Rheumatoid pada Wanita Menopause. *Jurnal Kesehatan Saelmakers PERDANA SS (JKSP)*, *6*(1), 133–139. https://doi.org/10.32524/jksp.v6i1.818

Shabbir, A., Khan, M. M. A., Ahmad, B., Sadiq, Y., Jaleel, H., & Uddin, M. (2019). Vetiveria zizanioides (L.) Nash: A Magic Bullet to Attenuate the Prevailing Health Hazards. In M. Ozturk & K. Hakeem (Eds.), *Plant and Human Health, Volume 2* (Vol. 2, pp. 99–120). Springer International Publishing. https://doi.org/10.1007/978-3-030-03344-6_3

Suyono, H., & Susanti, D. (2019). The Medical Benefits of Vetiver Essential Oil. *Proceedings of the 2nd International Conference of Essential Oils*, 9–12. https://doi.org/10.5220/0009954400090012

Treede, R.-D., Rief, W., Barke, A., Aziz, Q., Bennett, M. I., Benoliel, R., Cohen, M., Evers, S., Finnerup, N. B., First, M. B., Giamberardino, M. A., Kaasa, S., Kosek, E., Lavand'homme, P., Nicholas, M., Perrot, S., Scholz, J., Schug, S., Smith, B. H., … Wang, S.-J. (2015). A classification of chronic pain for ICD-11. *Pain*, *156*(6), 1003–1007. https://doi.org/10.1097/j.pain.0000000000000160

Yong, R. J., Mullins, P. M., & Bhattacharyya, N. (2022). Prevalence of chronic pain among adults in the United States. *Pain*, *163*(2), e328–e332. https://doi.org/10.1097/j.pain.0000000000002291

Yusefa, M., Wijayanto, W. P., & Sutrisno, S. (2023). Hubungan Nyeri Rheumatoid Arthritis dengan Kemandirian ADL pada Lansia. *Jurnal Ilmu Medis Indonesia*, *2*(2), 61–67. https://doi.org/10.35912/jimi.v2i2.1511

Zahoor, S., Shahid, S., & Urooj Fatima. (2018). Review of Pharmacological Activities of Vetiveria zizanoide (Linn) Nash. *Journal of Basic & Applied Sciences*, *14*, 235–238. https://doi.org/10.6000/1927-5129.2018.14.36