JSRMBS Journal of Scientific Research in Medical and Biological Sciences
ISSN 2709-0159(print) and ISSN 2709-1511 (online)
Volume 5, Issue 4 Article 8
DOI: https://doi.org/10.47631/jsrmbs.v5i4.869

IMPROVING SLEEP QUALITY OF ELDERLY PEOPLE WITH HYPERTENSION AT HOME: THE THERAPEUTIC EFFECTS OF A RELAXATION WITH ATSIRI OIL AROMATHERAPY

Syarifah Lubbna[1], Raden Nur Abdurakhman[1], Didi Taswidi[1], Healthy Seventina Sirait[1], Yudi Budianto[1]

[1]Department of Nursing, Cirebon College of Health Science, Cirebon, Indonesia

ARTICLE INFO

Recieved: 21 Augst 2024
Revised: 29 Sept 2024
Accepted: 17 Oct 2024

Keywords:
Atsiri Oil Aromatherapy, Elderly, Sleep quality

Corresponding Author:

Syarifah Lubbna

Email: lululubbna@gmail.com

ABSTRACT

Poor sleep quality will cause negative effects on the health of elderly, including those with hypertension. The sleep pattern may change, physiologically or be disturbed by certain conditions. Therefore, several non-pharmacological interventions are needed to improve their sleep quality, such as relaxation and Atsiri oil aromatherapy. This study aims to analyse the effect of the combination of these two therapies on the elderly's quality of sleep in Kadu Village, Jatigede district, in Sumedang, West Java Province. This study used the Quasy Experimental method with control group. The elderly population were 189 people, with 36 respondents as our samples that were divided into two groups, the intervention and control group. A purposive sampling technique was utilised and the Pittsburgh Sleep Quality Index (PSQI) questionnaire was used for the pre and post-test. It is found that in the intervention group, before the therapies were implemented, the sleep quality of the elderly was categorised in 6% had good sleep quality and 94% of them had poor sleep quality. After being given the interventions for two weeks, they showed a better the sleep quality, with the results of good and poor sleep quality were 72% and 28% respectively. The Wilcoxon Signed Rank Test of the intervention group showed the p-value 0.004 (< 0.05). It means that there was a positive effect of relaxation with atsiri oil therapy on elderly's sleep quality. It is because there several substances in atsiri oil's extraction that may increase the relaxation hormones like serotonin and melatonin when it was inhaled. In relaxed mind, the elderly tend to feel more peaceful and calmer before sleep. It is concluded that the use of aromatherapy of Atsiri oil is effective in improving sleep patterns and the results of this study show that relaxation with essential oil aromatherapy has potential to improve sleep patterns in the elderly.

INTRODUCTION

Hypertension is one of the biggest risk factors of various cardiovascular diseases, especially in the elderly population. By definition, hypertension is a condition where systolic and diastolic blood pressure at rest is more than 130 mmHg and 80 mmHg (1). The prevalence of hypertension is still very high globally, with an estimated 1.28 million people aged 30-79 years experiencing hypertension and 2/3 of them are from low and middle-income countries (2). Unfortunately, less than 42% of patients with hypertension globally have been diagnosed and controlled, while around 21% have uncontrolled hypertension (2). If hypertension is not treated for a long periode of time, it will negatively impact on the elderly's health status, such as increasing the risk of cardiovascular diseases, heart failure, atrial fibrillation, chronic kidney failure, heart valve disease, aortic

syndrome, dementia, coronary heart disease, and stroke (3). These diseases can cause death, with premature or degenerative patterns.

The number of people with hypertension, including old people is predicted to continuously growing. A study by Framingham suggested that for people aged 55-65 years may have >90% lifetime risk of hypertension development (4). Based on the World Population Prospects (2022), from 1990 to 2019, the number of people living with hypertension doubled from 650 million to 1.3 billion. In the WHO South-East Asia Region, the increase of hypertension prevalence was from 29% in 1990 to 32% in 2019, in adults aged 30-79 years. In Indonesia, data from RISKESDAS (2013) showed that the prevalence of hypertension increased from 7.6% in 2007 to 9.5% in 2013 (5). Moreover, in 2018, the total percentage of people with hypertension was 34.11% (6), with the proportion of people with hypertension aged 55-65 years was 55,23%; aged 65-74 years was 63,22%; and people more than 75 years old was 69,53%. These number shows the increasing numbers compared to the prevalence in 2013 which was only 25.8% (6).

The increasing prevalence of hypertension is also reported in West Java Province. In 2023, the total number was 3.2 million people with hypertension, which increased 39,09% from 2019 (7). In Sumedang, hypertension is the top most prevalent non-communicable disease within the last 10 years, with only around 124.964 people have been identified (50.35%) in 2021 (8). As a silent killer, hypertension may be affected as well as caused by several factors that may lead to the disturbance of patients' life patterns, such as sleep quality and sleep quantity.

The change of blood pressure and sleep quality may affect each other's. Automatic cardiovascular control changes during sleep. Blood pressure, peripheral vascular resistance, and heart rate decrease progressively during the Non-Rapid Eye Movement (Non-REM) stage. Thus, disturbances in the quality and quantity of sleep may increase the nocturnal blood pressure and result in an increased risk of hypertension. Sleep disorders such as obstructive sleep apnea are closely related to the occurrence of hypertension, insomnia, sleep deprivation, and restless legs syndrome (9). Some previous studies found that sleep restriction is associated with a higher blood pressure, hypertension risks is related to the pattern of short sleep, shift work, and Obstructive Sleep Apnea (OSA), which is a sleep disorder with partial/ complete upper airflow cessation during sleep and recurrent circadian disruption (10). In 2016, the American Heart Association stated that strong epidemiological evidence was found, that self-reported short sleep duration is a risk factor for hypertension and may be harmful if combinates with sleep disturbance, and <5% hours of sleep duration will increase the likely of hypertension by 80% (11).

If elderly patients with hypertension experience disturbance in quality or quality of their sleep routine, some negative effects may accumulate and worsen their health status in the future. This is because sleep is an essential process of life that have a pivotal role in the functions of brain and systemic physiology such as appetite regulation, cardiovascular system, hormonal, metabolism system as well as the immune system (12). Sleep problems or sleep disruption is related to further health consequences, increased activity of the sympathetic nervous system and hypothalamic-pituitary-adrenal axis, metabolic effects, changes in circadian rhythms, and proinflammatory response (13). There are a lot of sleep disorder categories, yet typically they are manifested in the presence of failure to obtain the necessary amount or quality of sleep (sleep deprivation), an inability to maintain sleep continuity (disrupted sleep or sleep fragmentation or middle insomnia), and events that occur during sleep (sleep apnea, restless legs syndrome) (14). These changes will result in some health changes, both in short-term and long-term consequences. Short-termly, the lack of a good sleep may increase stress responsivity, somatic problems, and may reduce Quality of Life (QoL), emotional distress, mood disorders and other mental health problems, cognition, memory, and performance deficits, and behavior problems. For long-term consequences, sleep disruption may cause hypertension, dyslipidemia, CVD, weight-related issues, metabolic

syndrome, and type 2 diabetes mellitus (13). Other evidences suggested that it may also increase the risk of certain cancers, worsen some gastrointestinal disorders and death.

In Indonesia, some research found that around 76% of elderly people suffered from sleep disorders, 40% reported difficulty in starting sleeping, and 30% reported frequent waking up at night (15). Sleep problems affect around half of the population aged 65 years in Indonesia, with a prevalence of 65%. So, it is essential to prevent elderly people with sleep disturbance experiencing these potential negative effects.

There are several ways to improve the quality of sleep in patients with sleep disturbance, both pharmacological and non-pharmacological alternatives. Focusing on the role of nurses as one of health professionals who are able to help improving patients' sleep quality, the attempts in implementing non-pharmacological interventions needs to be researched, such as aromatherapy and relaxation therapy. Aromatherapy is an alternative treatment that has quite a lot of benefits including as a sedative or calming agent, reducing anxiety, relaxation effects, and antidepressant (16). Aromatherapy is delivered by using a diffuser and the patients inhale the aroma through the sense of smell which may stimulates the nerves and sends signals to the brain. The aroma released from the diffuser has a sedative chemical effect that can create a feeling of calm, and stimulates the brain to increase serotonin production, which helps facilitate sleep (17). The aromatherapy uses essential oils, or in Indonesia called Atsiri oils, which produced by distillation process, and it is mixtures of volatile liquid or solid compounds, with varying compositions and boiling points. The substance of Atsiri oils has a calming effect and can affect the limbic system or emotional regulation when the compound enters the body and binds to aroma receptors in the nose. This makes Atsiri oils become popular as ingredients in aromatherapy to overcome psychological problems and sleep disorders (18). If aromatherapy is combined with relaxation therapy, the therapeutic effects may be greater as relaxation therapy is a natural way to modify the way of breathing, also called breathing exercises, to create a sense of calm. Patients are instructed and focused on taking slow and deep breath repeatedly until the relaxation response is achieved and they drift off to sleep naturally.

Based on our preliminary study conducted on February 20, 2024, data was obtained that the number of elderly populations (>60 years old) that was identified have hypertension was 189 people. The researchers also had interviews with 11 older adults with hypertension in the Kadu village, Jatigede District, Sumedang. They experienced poor sleep patterns, such as waking up in the middle of the night and cannot start sleeping (8 out of 11), discomfort in the back neck or pain (7 out of 11), and tension headache (5 out of 11). Also, 9 of them reported that feeling tired in the morning. Almost all of them (10 out of 11) said that they never tried aromatherapy or breathing relaxation therapy to help meet their sleep needs. So, it is important to conduct research about the effectivity of relaxation with aromatherapy, using local Atsiri oils, on the sleep quality of elderly with hypertension.

METHODOLOGY

Research design

This study used quantitative approach which is an attempt to quantify the knowledge of the influence of Atsiri oil aromatherapy relaxation methods on the sleep quality of elderly patients with hypertension. The quasy experimental design was utilised in this study, with intervention and control group seperation. The type of atsiri oil that we used was combined extracts of lime and lavender. The procedure of interventions were divided into two steps and done within 2 weeks. In the first week, the patients were guided and instructed by the team of researchers. In short, in the bed time at night, the patients were instructed to lie down (low fowler) and explained about the procedures; the atsiri oil and diffuser were prepared close to the respondents. Then, we drop the

atsiri oil on the diffuser (7 drops) and 150 ml water was added and the diffuser was turned on. The respondents were instructed to breath and relax, inhale and exhale slowly (deep breath relaxation), and calm their minds for about 15 minutes. After that the equipments were tydied up. For the second week, the procedure was explained to the family members/ caregivers so they could do the intervention and reported to the researchers.

Research setting

This study was conducted from 25th February 2024 to 2nd May 2024 in Kadu Village, Jatigede District, Sumedang, West Java Province.

Population and Sampling

Based on the data of Jatigede Community Health Center (PUSKESMAS Jatigede), the number of older adults (>60 years old) with hypertension was 189 people. The sampling carried out in this study used the Slovin formula with a 90% confidence level, and it was calculated that the sample of this study was 36 participants. A purposive sampling technique was utilised and the Pittsburgh Sleep Quality Index (PSQI) questionnaire was used for the pre and post-test (after two weeks of interventions).

Research variables

The independent variable in this study is the relaxation with Atsiri oil aromatherapy, and the dependent variable in this study is the sleep quality of elderly people with hypertension.

Data analysis

Data was analysed by SPSS tool version 16, with using Wilcoxon Signed Rank Test as the data analysis because the distribution data was abnormal.

RESULTS AND DISCUSSION

Univariate Data

Frequency distribution of sleep quality before relaxation with Atsiri Oil Aromatherapy in the intervention group (n=18)

In the intervention group, the result of the frequency distribution of sleep quality before the therapy is showed in the table below:

Tabel 1: Frequency distribution of sleep quality of elderly people (intervention group) before therapy (n=18)

Category	Frequency	Precentage
Good Sleep Quality	1	6 %
Poor Sleep Quality	17	94 %
Total	**18**	**100 %**

Based on the table.1 above, it is found that almost all the respondents had poor sleep quality (94%) before the therapy was given.

Frequency distribution of sleep quality after relaxation with Atsiri Oil Aromatherapy in intervention group (n=18)

In the intervention group, the result of the frequency distribution of sleep quality after the therapy is showed in the table below:

Tabel 2: Frequency distribution of sleep quality of elderly people (intervention group) after therapy (n=18)

Category	Frequency	Precentage
Good Sleep Quality	13	72 %
Poor Sleep Quality	5	28 %
Total	18	100 %

Based on the table.2 above, it is found the majority of the respondents had good sleep quality (72%) after the therapy was given. There were changes in the number of respondents who had a better sleep quality measured by the PSQI instrument.

Frequency distribution of sleep quality in control group (n=18) without intervention

In the control group, the result of the frequency distribution of sleep quality pretest and post-test after two weeks without any non-pharmacological intervention is showed in the table below:

Tabel 3: Frequency distribution of sleep quality of elderly people in control group (n=18)

Category	Pretest		Postest	
	Frequency	Percentage	Frequency	Percentage
Good Sleep Quality	2	11 %	2	11 %
Poor Sleep Quality	16	89 %	16	89 %
Total	18	100 %	18	100 %

Based on the table.3 above, it can be concluded that the majority of respondents had poor sleep quality (72%) both pre-test and two week after without therapy given.

Bivariate Data

The effect of Aromatherapy relaxation with Atsiri Oil on the respondents' sleep quality

Tabel 4: Result of the Wilcoxon Sign Rank Test

Group	Pre-test & Post-test (Z)	Sign	n
Intervention Group	-2,856	0,004	18
Control Group	0,000	1,000	18

It can be concluded from the table.4 above, that there was an effect of Relaxation with Atsiri Oil Aromatherapy on the sleep quality of the elderly people with hypertension in Kadu Village, Jatigede District, Sumedang, West Java Province. This is because the Wicoxon Signed Rank Test showed that Z value in intervention group was -2,856 with significance was 0,004 (P-Value < 0,05).

DISCUSSION

This study found that there was a significant change in the total score and category of sleep quality index (PSQI) in the pretest and post test results of the intervention group. In the pretest group, almost all the respondents had poor sleep quality (94%). In contrary, after being given the interventions (post-test), the majority of the respondents had good sleep quality (72%). Also, in the bivariate data analysis using the Wilcoxon Sign Rank Test, the p-value was 0,004 (less than 0,05), so it can be concluded that there was an effect of Relaxation with Atsiri Oil Aromatherapy on the sleep quality of Elderly People with hypertension as our respondents. Looking back on the findings of some previous studies, some common complaints experienced by the elderly include difficulty falling asleep, difficulty returning to sleep after waking up at night, waking up too early, and excessive napping. These can interfere with the normal sleep needs of older adults (60 years and over) which is around 6 hours/day. This condition worsens the physiology of the elderly in fulfilling sleep needs. So, the finding of our study is important to help those patients with sleep problems, in particular older patients with hypertension, and also other chronic conditions in general, to improve the quality of their sleep by experiencing or trying non-pharmacological treatments that aims to enhance the feeling of comfortable and being relaxed before sleep at night.

Non-pharmacological therapy given to the intervention group, aims to reduce tension/anxiety by using a combination of breathing relaxation and aromatherapy techniques with Atsiri oils. The aroma of Atsiri oils (Lime, Lavender) is inhaled to stimulate the olfactory nerves, which then send signals to the brain. The therapy can have a sedative chemical effect, causing a feeling of calm, and stimulate the brain to increase the production of serotonin and melatonin, which help regulate sleep. The extraction of lime and lavender has certain chemical substances that may induce sleep. The Atsiri oils in this research contained of lime and lavender extraction. This oil was dropped into a diffuser; A diffuser can be used to disperse a scent through a room.

All the respondents were instructed to do deep breathing relaxation while inhaling the Atsiri oils, consist of lime and lavender extractions, until they felt more comfortable before starting to sleep at night. Generally, there are several techniques of breathing relaxation therapies, such as deep breath technique, benson's relaxation technique, muscle progressive technique, etc. the procedures are quite the same with different strategies in 'wording' the suggestions delivered by the therapists. For instance, the suggestive sentence used are imagining beautiful scenery of beaches or mountains, or spiritual phrases, etc. A study by Marasabessy et al (2020), used Benson's relaxation therapy performed 10-20 minutes every night before sleep for 14 days, supervised by the researchers. The respondents were asked to close their eyes and listen to the suggestions (using spiritual phrases) said by the therapies, and the respondents were asked to relax their muscles. After 14 days, the study found that this therapy was able to improve significantly the elderly sleep quality (p-value 0,046) (19).

The essential oil of lime is extracted by cold compression of fresh lime peels or by steam distillation of its dried peels. The scientific name of lime is *Citrus aurantifolia*. It is composed of compounds like alpha-pinene, beta-pinene, myrcene, limonene, terpinolene, cineole, linalool, borneol, citral, neral acetate, and geranyl acetate. Also, in aromatherapy, Lime Essential Oil is primarily known for its ability to reduce stress and uplift the mood. It is also believed to reduce symptoms associated with stress and indecisiveness, whilst promoting mental clarity. The aroma profile of lime oil is fresh and energizing, which can cleanse, purify, and renew the mind and spirit.

Lavender oil has a calming effect on the body, which can help reduce stress and anxiety, both of which can contribute to high blood pressure. Odor of lavender oil, and especially its component linalool, affects autonomic nerves probably through a histaminergic response. Lavender significantly increased rotarod activity and enhanced dopamine receptors subtype D3 in the olfactory bulbs of mice (20). It is believed that, the psychological effects in human studies, inhaled lavender act via limbic system, especially the amygdala and hippocampus (21). To treat sleep problems such as insomnia, lavender has been suggested as an excellent natural source of comfort that can induce a better sleep quality by giving 6-8 drops of lavender oil added each night and can improve the PSQI score by -2.5 points (22). Also, the mixture of essential oils including lavender, basil, juniper, and sweet marjoram can reduce sleep disturbance and improve overall well-being in older patients (23). Despite of the fact that reported study about the combination of lime and lavender aromatherapy with relaxation is still limited, many of previous findings showed the positive effects of each therapy.

This finding is in line with several other studies both in Indonesia and other countries. A literature review study conducted by Kurniawan et.al (2022) found that the use of lavender aromatherapy improves sleep quality in the elderly, with p value = 0.000 (24). The therapeutic effects of lavender aromatherapy were proven through various ways with majority were done by inhalation, both on drop on the pillow, a bowl of boiling water, and through diffusers. Some studies used 5-6 drops of lavender essential oils into a bowl of boiling water around 5 cc that was placed close to the elderly's bed before start sleeping. Other studies gave the aromatherapy every night for 7 consecutive days in elderly with 5-6 drops on the pillows.

According to research conducted by Sri Adayati et al. (2022), aromatherapy as a complementary therapy can reduce the level of insomnia in the elderly. The results of her study showed that the group receiving treatment experienced a significant decrease in the level of insomnia, with the Paired Sample t Test statistical test showing a value of t = 2.702 and a probability of Sig. (2 tailed) = 0.017.

This study is also in line with the study by Ningtiyas (2021), and the results showed a significant difference between the conditions before and after the administration of essential oil aromatherapy in the intervention group, with a significance value of α 0.000 (α <0.05). The Independent Samples t-test also showed a significant difference with a significance value of α 0.001 (α <0.05) (16).

So, this study suggested that elderly patients with sleep problems due to several causes or risk factors, including hypertension, need to be more facilitated by health care providers in getting a better sleep quality. This is because, as explained above, that a lot of serious health problems may happen if the sleep problems are not tackled in a long period of time. It is pivotal for health professionals, in particular nurses, to help reducing discomfort due to hypertension or other etiologies before sleep and giving health education about non-pharmacological treatments to improve sleep quality is essential, including by doing some relaxing in the hour before bedtime with aromatherapy that easy to do and use.

LIMITATION

A Challenging geographical situation as Kadu Village was a remote area and in some cases the respondents' houses were difficult to reach. This challenge influenced the consistency of when the therapy was given.

CONCLUSION

It is concluded from this study that there was a therapeutic effect of atsiri oil relaxation aromatherapy (mix lime and lavender) on sleep quality of elderly respondents (p value 0,004) with hypertension in Kadu Village, Jatigede District, Sumedang, West Java Province.

Acknowledgment

Thank you to the Cirebon College of Heath Science (STIKes Cirebon) for providing funding support for this study. The author would also like to thank the Community Health Center in Jatigede as well as the local government in Sumedang, Indonesia for the great help and cooperation during this study was conducted.

REFERENCES

1. Whelton P, et al. ACC/AHA/AAPA/ABC/ACPM/AGS/ APhA/ASH/ASPC/NMA/PCNA Guideline for the prevention, detection, evaluation, and management of high blood pressure in adults: a report of the American College of Cardiology/American Heart Association Task Force on Clinical Practi. Hypertension. 2018;71:e13–e115.
2. WHO. Hypertension [Internet]. 2023 [cited 2024 Oct 1]. Available from: https://www.who.int/news-room/fact-sheets/detail/hypertension#:~:text=Key facts 1 An estimated 1.28 billion adults,with hypertension have it under control. More items
3. Fuchs FD, Whelton PK. High Blood Pressure and Cardiovascular Disease. Hypertension. 2020;75(2):285–92.
4. Vasan, RS; Beiser, A; Seshadri, S; Larson, MG; Kannel, WB; D'Agostino, RB; Levy D. Residual lifetime risk for developing hypertension in middle-aged women and men: the Framingham Heart Study. JAMA. 2002;287(1):1003–10.
5. Kemenkes. RISKESDAS 2013. 2013.

6. Kemenkes. RISKESDAS 2018. 2018.
7. DinkesJabar. Jumlah Penderita Hipertensi [Internet]. 2023 [cited 2024 Nov 11]. Available from: https://opendata.jabarprov.go.id/id/dataset/jumlah-penderita-hipertensi-yang-mendapat-pelayanan-kesehatan-berdasarkan-kabupatenkota-di-jawa-barat
8. BPS. Kabupaten Sumedang dalam Angka 2023 [Internet]. Sumedang; 2023. Available from: https://web-api.bps.go.id/download.php?f=ecO12JDC4oQCW3eUhFSy7E9VcGlCUkdMZm9tUTI5WmxEN3pqYm4wNlc4MzY5Q29TVC9PbWRGMlZPUG5pMEVldDFWUTBVK0VkUG83Uk5Rd0xQa2tqaE5YL2ZRcVI1RHdQTnBpRTNrUGhLc200SUJNZkIyOFQvYUw3Ukd5ZHNLZG0zbUxnM0Q1R05ya2NlRVRBV1IvM0ExczN6clJQbXN1cl
9. Pepin JL, Borel AL, Tamisier R, Baguet JP, Levy P, Dauvilliers Y. Hypertension and sleep: Overview of a tight relationship. Sleep Med Rev [Internet]. 2014;18(6):509–19. Available from: http://dx.doi.org/10.1016/j.smrv.2014.03.003
10. Manohar S, Thongprayoon C, Cheungpasitporn W, Mao M, Herrmann S. Association of Rorational shift work and night shift status with hypertension: a systematic review and meta-analysis. J Hypertens. 2017;35:1929–37.
11. Kwok CS, Kontopantelis E, Kuligowski G, Gray M, Muhyaldeen A, Gale CP, et al. Self-reported sleep duration and quality and cardiovascular disease and mortality: A dose-response meta-analysis. J Am Heart Assoc. 2018;7(15):1–26.
12. Watson N, Badr M, Belenky G, Al. E. Joint Consensus Statement of the American Academy of Sleep Medicine and Sleep Research Society on the recommended amount of sleep for a healthy adult: methodology and discussion. J Sleep. 2015;38(8):1161–83.
13. Medic G, Wille M, Hemels MEH. Short- and long-term health consequences of sleep disruption. Nat Sci Sleep. 2017;9:151–61.
14. Institute of Medicine C on SM and R. Sleep Disorders and Sleep Deprivation: An Unmet Public Health Problem. Washington, DC; 2006.
15. Purwati NK. Kualitas Tidur Lansia Meningkat Dengan Aromaterapi Lavender. SEKOLAH TINGGI ILMU KESEHATAN WIRA MEDIKA BALI; 2020.
16. Ningtyas MSS, Anwar Y. Aktivitas Aromaterapi terhadap Insomnia pada Lansia menggunakan Minyak Atsiri. Miny Atsiri Produksi dan Apl untuk Kesehat. 2021;142–63.
17. Nuary AA, Triyanto E. Efektivitas Warm Water Footbath dan Aromatherapy Terhadap Kualitas Tidur Lansia: Systematic Review. J Keperawatan Klin Dan Komunitas. 2022;6(2):125.
18. Rusli MS. Sukses memproduksi minyak atsiri. AgroMedia; 2010.
19. Marasabessy NB, Herawati L, Achmad I. Benson's relaxation therapy and sleep quality among elderly at a social institution in inakaka, Indonesia. Kesmas. 2020;15(2):65–72.
20. Y. Kim, M. Kim, H. Kim and KK. Effect of lavender oil on motor function and dopamine receptor expression in the olfactory bulb of mice. J Ethnopharmacol. 2009;125(1):31–5.
21. Cavanagh H, Wilkinson J. Biological activities of lavender essential oil. Phyther Res. 2002;16(4):301–8.
22. Koulivand PH, Khaleghi Ghadiri M, Gorji A. Lavender and the nervous system. Evidence-based Complement Altern Med. 2013;2013.
23. Graham C. Complementary therapies: in the scent of a good night's sleep. Nurs Stand. 1995;9(21).
24. Dwi Kurniawan A, Sunarno I, Ulum MM. A Literature Review: The Effect of Giving Lavender Aromatherapy On Sleep Quality In The Elderly. JOSAR (Journal Students Acad Res. 2022;7(2):292–8.
25. DI PSTW UNIT BUDI LK. PENGARUH AROMATERAPI TERHADAP INSOMNIA PADA LANSIA