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The Effect of *Dekokta Jamu Cekok* on Short Term Memory of White Rats (*Rattus norvegicus* L.) Male Wistar Strain

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Abstract

The rising prevalence of dementia in Indonesia has resulted in a decline in memory and cognitive abilities. This condition is believed to be linked to oxidative stress caused by an imbalance between free radicals and antioxidants. Jamu cekok, a traditional herbal remedy composed of rhizomes such as *Kaempferia galanga*, *Zingiber officinale*, *Curcuma longa* L., and *Curcuma xanthorrhiza*, is known for its antioxidant properties. These antioxidants have the potential to neutralize free radicals, thereby helping to prevent degenerative diseases like dementia and Alzheimer's, which are associated with short-term memory impairment. This study aimed to evaluate the effects of jamu cekok decoction on the short-term memory of male Wistar rats (*Rattus norvegicus* L.). A laboratory-based experimental study with a post-test-only control group design was conducted. Male Wistar rats were divided into three treatment groups receiving *jamu cekok* doses of 100, 200 and 400 mg/kg BW, and a negative control group was included. Short-term memory was assessed using the Y-maze test. The highest Y-maze alternation percentage of 65.12% was observed in the treatment group receiving a dose of 400 mg/kg BW. However, statistical analysis using the Kruskal-Wallis test showed no significant difference in Y-maze alternation percentages among the groups receiving *jamu cekok* ($p = 0.626$). The findings indicate that jamu cekok decoction did not have a significant effect on the short-term memory of male Wistar rats. Further studies with larger sample sizes and alternative assessment methods are recommended to explore its potential cognitive benefits.

Keywords: Antioxidants; Herbal; Memory; Plant extracts; Short-term.

Abbreviations: Alzheimer's disease (AD); Reactive oxygen species (ROS).

INTRODUCTION

Memory decline or loss can be caused by many factors, including aging, unhealthy lifestyle, and neurodegenerative diseases such as Alzheimer's disease (AD). (Larasati, 2021). Dementia is a decline in memory and other cognitive skills that is severe enough to reduce a person's ability to carry out daily activities. It is characterized by a progressive and persistent deterioration of cognitive function (Emmady et al., 2022). Alzheimer's disease (AD) is the most common type of dementia, with up to two-thirds of dementia cases in people aged 65 years and older. This is because neurons in the brain that participate in cognitive function are damaged or no longer function normally (Larasati, 2021).

In Indonesia approximately 1.2 million people were estimated to have dementia in 2016, which will increase to 2 million in 2030 and 4 million people in 2050. The incidence of AD globally is increasing rapidly and is currently estimated to be close to 46.8 or 50 million people diagnosed with dementia in the world, 20.9 million in Asia Pacific, there are about 10 million new cases every year (Alzheimer Indonesia, 2019). The prevalence of dementia in Indonesia is estimated to be 27.9%, affecting more than 4.2 million individuals (Kementrian Kesehatan Republik Indonesia, 2023).

One of the main factors causing the pathophysiology and potential progression of AD is oxidative stress in the brain, defined as oxidative damage to proteins and lipids (and other cellular components) resulting from an imbalance between the production free radicals and the ability of antioxidants and antioxidant related enzymes (Barone et al., 2021). Antioxidants are a group of compounds that neutralize free radicals and reactive oxygen species (ROS) in cells (Abuajah et al., 2015).

Antioxidants are found in various Indonesian medicinal plants, including *Curcuma xanthorrhiza* and *Curcuma aeruginosa*, which are commonly used in traditional herbal preparations (Afandi et al., 2021; Ibroham et al., 2022). One such preparation is *jamu cekok*, a traditional herbal medicine widely known among Javanese communities. *Jamu cekok* is a herbal

medicine consisting of natural ingredients that is intended to overcome feeding difficulties in children aged 1-3 years. The term *jamu cekok* refers to the method of administering jamu that is forcibly inserted into the child's mouth (Marni & Ambarwati, 2015).

Formulary of Indonesian traditional medicine, there are two boiling methods that can be used to prepare traditional medicine, such as infusion and decoction because they are more applicable to the community and tend to be close to the way traditional medicine is made by the community (Formularium Ramuan Obat Tradisional Indonesia, 2017). The decoction method is an extract that is heated for 30 minutes from the time the temperature reaches 90°C. The administration of decoction *jamu cekok* to male Wistar rats to see the cognitive function of short-term memory of the test animals and then observed motor activity using the Y-maze method. As there are several natural ingredients containing flavonoids that have antioxidant activity in *jamu cekok* and no previous research has been conducted, this study is needed to assess the effect of *decoction jamu cekok* on cognitive function of short-term memory in test animals.

MATERIALS AND METHODS

Research Type

This study design falls under experimental research using a Post-Test Only Control Group Design. The research was conducted at Laboratory of Universitas Tanjungpura and Pharmaceutical Animal Laboratory, Universitas Tanjungpura. The experimental animals used in this study were male Wistar rats (Rattus norvegicus L.) aged 2–3 months. Short-term memory performance was assessed using the Y-maze test.

Procedures

Collection and Preparing of Jamu Cekok

Jamu cekok was prepared using *Kaempferia galanga*, *Zingiber officinale*, *Curcuma longa* L., *and Curcuma xanthorrhiza.* All plants materials were cleaned with running tap water prior to use. The rhizomes were purchased from a market in Pontianak City, West Kalimantan, Indonesia. Each rhizome was weighed 100 g, based on empirical traditional practice.

Preparation of Extract

The decoction extract of *jamu cekok* was prepared from the rhizomes of *Kaempferia galanga*, *Zingiber officinale*, *Curcuma longa* L., and *Curcuma xanthorrhiza* that have blended with 400 mL of distilled water and heated at 90°C for 30 minutes. The decoction was subsequently concentrated using a rotary evaporator to obtain a viscous extract.

Sample Size Determination

The sample size was determined based on a commonly used experimental design guideline derived from Federer's principles, which recommends sufficient error degrees of freedom (t-1) (n-1) ≥ 15 (Federer, 1955). In this study, t represents the number of experimental groups and n represents the number of animals per group. With four experimental groups (t = 4), the minimum required sample size was $n \geq 6$ animals per group. To account for potential dropouts, one additional animal was included in each group, resulting in a total of seven rats per group and 28 rats overall.

Preparation of Experimental Animals

Before the Y-maze test, each rat was marked with picric acid on different parts of the body for individual identification. The order of testing was randomized without categorization (Nurmasitoh et al., 2018). The rats were randomly divided into four groups (n = 7 per group): three treatment groups received *jamu cekok* decoction at doses of 100, 200, and 400 mg/kg BW, while the negative control group received distilled water at a volume adjusted to body weight. The decoction administered to the experimental animals was prepared by dissolving 1, 2, and 4 g of post-evaporated extract in 100 mL of distilled water, respectively. All treatments were administered for 12 consecutive days, during which food was provided ad libitum and body weight was monitored. On day 12, behavioral analysis was conducted using the Y-maze test between 14:00 and 19:00.

Experimental Animals

The experimental animals used in this study were healthy male Wistar rats aged 2–3 months, with no body weight loss exceeding 20% during the acclimatization period. Prior to the experiment, the rats were acclimatized for 8 days under the experimental conditions. The acclimatization process was successful, as the rats showed no signs of illness, based on behavioral observations, and no decrease in body weight exceeding 20%. This study has applied the "3 Rs" principle or Russell and Burch's Three Rs concept, as described in the book "The Principles of Human Experimental Technique," which are: replacement, reduction, and refinement (Cheluvappa et al., 2017). All experimental procedures involving animals were approved by the Ethics Review Division of the Faculty of Medicine, Universitas Tanjungpura (approval number: 9545/UN22.9/PG/2024) and were conducted in accordance with international ethical guidelines for animal care and use.

Materials

The materials included *jamu cekok* decoction extract, prepared from *Kaempferia galanga*, *Zingiber officinale*, *Curcuma longa* L., and *Curcuma xanthorrhiza*, as well as distilled water.

Y-maze Test

Y-maze test was performed in a closed and quiet room. The room lighting was kept dim to reduce anxiety in the rats. Each rat was allowed to freely explore the three arms of the Y-maze for 8 minutes. If a rat climbed the maze wall, it was immediately returned to the last arm visited.

The starting arm varied for each rat to avoid placement bias, and the arms were labeled A, B, and C. Between sessions, all arms of the Y-maze were cleaned with 70% alcohol and left to dry to eliminate odor cues. The test animal was considered to enter the arm when 85% of the rat's body or all four limbs entered the arm (Figure 1).

Short-term memory was assessed using spontaneous alternation (%). A spontaneous alternation was successful when the test animal entered all three different arms in sequence, counting from the overlapping set of triples. The order of the areas entered by the rats was recorded manually (Nurmasitoh et al., 2018).

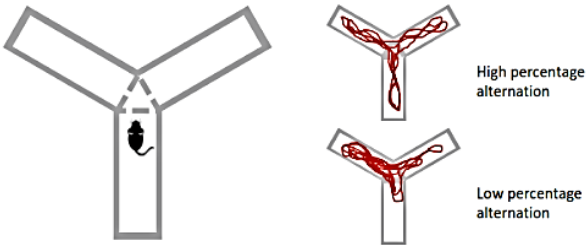

Figure 1. Measurement of spontaneous alternation in the Y-maze.

Measurement of spontaneous alternation in the Y-maze. A high percentage alternation is seen as a high proportion of entries into consecutive arms. A low percentage alternation (e.g., poor working memory) is seen as a higher proportion of repeated entries into the same arm.

$$Alternation\ (\%) = number\ of\ alternation\ / (total\ arms\ entry - 2)\ x\ 100$$

Spontaneous alternation (%) is measured as the number of correct entries in 3 different arms (ABC) divided by the number of possible alternations (total number of arm entries minus 2). For example, the arm entered by rats ABCABACA (8 arms), the possibility of spontaneous alternation is 8-2=6, while the correct alternation is 4 (ABC-BCA-CAB-BAC), then the percentage of spontaneous alternation = (4/6) x 100= 67% (Nurmasitoh et al., 2018).

Data analysis

Univariable analysis was conducted to describe the results of the Y-maze test following the administration of *jamu cekok* decoction at doses of 100, 200, and 400 mg/kg BW. Prior to bivariate analysis, data normality was assessed using the Shapiro–Wilk test, as the sample size was fewer than 100. The data were considered normally distributed if the p-value was > 0.05. The results indicated that the data were not normally distributed.

Bivariate analysis was performed to evaluate the effect of *jamu cekok* decoction at doses of 100, 200, and 400 mg/kg BW on Y-maze test outcomes. As the data did not meet the assumption of normality, the Kruskal–Wallis test was applied. Differences were considered statistically significant at $p < 0.05$. All statistical analyses were conducted using Statistical Product and Service Solutions (SPSS) for Windows, version 26.0.

RESULTS AND DISCUSSION

Y-maze Test

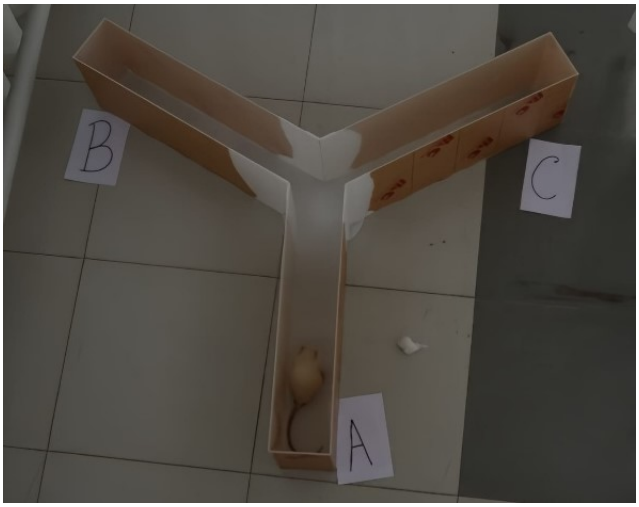

Figure 2. Top view of the Y-maze apparatus with arms labeled A, B, and C, used to evaluate short-term memory in rats through spontaneous alternation behavior.

The results showed that negative control had an alternation percentage of 46%, while the group with a dose of 100 mg/kg BW showed a decrease to 43%. Group with a dose of 200 mg/kg BW had an increase in alternation percentage to 50%, and the highest increase in alternation percentage was seen at a dose of 400 mg/kg BW with a percentage of 65.12% (Figure 3).

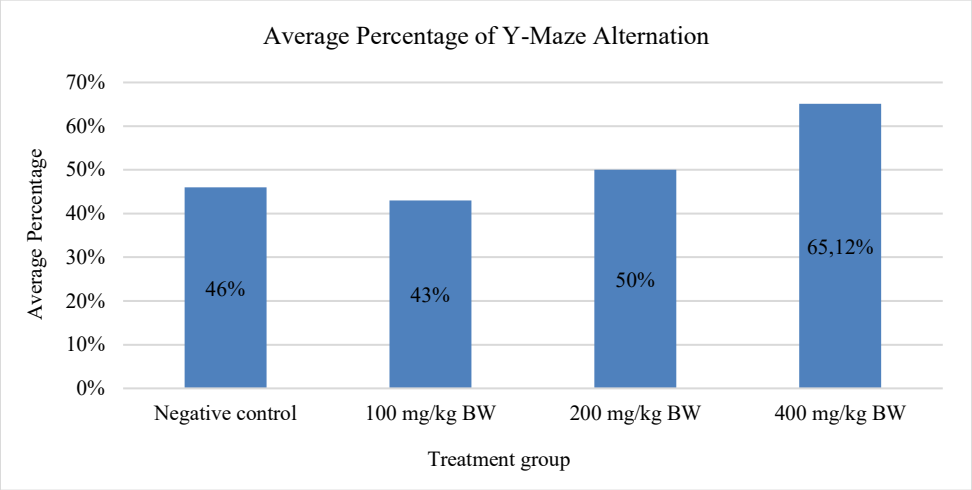

Figure 3. Y-maze Test Result.

The average percentage of alternation in the Y-maze test of rats from the negative control group and treatment groups receiving *jamu cekok* at doses of 100, 200, and 400 mg/kg BW for 12 days.

Prior to statistical analysis, the data were first assessed for normality using the Shapiro–Wilk test. The results indicated that the data for the 200 mg/kg BW dose were not normally distributed ($p = 0.007$). In contrast, the negative control group and the groups receiving 100 and 400 mg/kg BW showed normally distributed data, with p-values of 0.462, 0.075, and 0.200, respectively ($p > 0.05$). Therefore, the data were further analyzed using the non-parametric Kruskal–Wallis test.

Table 1. Effect of Dekokta *Jamu Cekok* Extract on Short-term memory.

Group	Number of Samples (n)	p-Value
Negative Control	7	0.626
100 mg/kg BW	7	
200 mg/kg BW	7	
400 mg/kg BW	7	

Note: Kruskal-Wallis Test Result

The Kruskal–Wallis test was performed to evaluate the effect of the decoction on short-term memory in rats. The analysis revealed a p-value of 0.626 ($p>0.05$), indicating no statistically significant differences among the groups. These results suggest that administration of the *jamu cekok* decoction did not significantly affect short-term memory.

Discussion

The results of the Y-maze test showed that administration of *jamu cekok* decoction at doses of 200 and 400 mg/kg BW resulted in a higher alternation percentage compared with the negative control group. This finding indicates a dose-dependent trend toward improved short-term memory performance. In contrast, the group receiving the lowest dose (100 mg/kg BW) showed a lower alternation percentage than the negative control, suggesting that low doses of the decoction may not provide sufficient concentrations of active compounds to exert cognitive-enhancing effects in male Wistar rats.

Several studies have reported potential cognitive-related effects of rhizomes commonly used as constituents of *jamu cekok*, including *Curcuma longa* L. and *Curcuma xanthorrhiza*. Limited human-based investigations, including academic theses, have suggested improvements in short-term memory following the consumption of *Curcuma xanthorrhiza* and *Curcuma longa* preparations. Wardono and Agustia (2017) reported an improvement in short-term memory in human subjects following the administration of *Curcuma xanthorrhiza* in the form of a steeped preparation at a dose of 10 g (Wardono & Agustia P., 2017). Nathanael (2017) observed an increase in short-term memory performance after the administration of *Curcuma longa* L. steeping powder at a dose of 10 g (Nathanael, 2017). These findings are generally in line with an experimental study by Indrisari et al., which demonstrated that administration of *Moringa oleifera* leaf extract at a higher dose (200 mg/kg BW) significantly improved memory performance in rats, whereas lower doses (50 and 100 mg/kg BW) were less effective or associated with reduced memory compared with the negative control (Indrisari et al., 2023).

Although no statistically significant effect was observed, the dose-dependent trend in Y-maze alternation suggests a potential biological effect of the decoction. Curcumin, a major bioactive compound in *Curcuma longa* L., possesses lipophilic properties that allow it to cross the blood-brain barrier and exert neuroprotective effects, including reducing neuronal toxicity associated with oxidative stress and neurodegenerative conditions such as AD (Amadi et al., 2019). In addition, zingerone, a bioactive compound found in *Zingiber officinale*, has strong antioxidant activity against ROS, free radicals, and

peroxides, which may contribute to treatment for various diseases such as AD (Wei et al., 2017).

Despite the observed increase in alternation percentage with increasing doses, statistical analysis did not show significant differences between treatment groups. This may be attributed to several factors, including insufficient dosage, short duration of decoction administration, and variability in the concentration of bioactive compounds within the extract. Longer treatment durations may be required to allow the active compounds to exert maximal cognitive effects, as suggested by previous experimental studies (Belahusna et al., 2023).

Another possible explanation for the absence of statistically significant effects is the interaction among multiple active compounds in the *jamu cekok* formulation. The interactions among active ingredients in multicomponent drugs are very likely to occur, and combinations of active compounds may exhibit either synergistic or antagonistic effects (Syahrir et al., 2016). Favorable combinations are those that result in synergistic effects, whereas antagonistic interactions may reduce the biological activity of individual components. Previous studies have demonstrated decreased antioxidant activity following the combination of certain rhizome extracts, indicating antagonistic interactions (Marianne et al., 2018). In addition, limited information is available regarding the cognitive effects of *Kaempferia galanga*, making it difficult to assess its contribution to the overall activity of the formulation. Consequently, the combined effects of multiple rhizomes in the *jamu cekok* decoction may not simply reflect the additive effects of each individual component. Instead, interactions among active and secondary metabolites may attenuate the expected cognitive-enhancing effects observed when individual rhizomes are administered separately. This may partly explain why the *jamu cekok* decoction did not produce statistically significant improvements in short-term memory despite the reported cognitive benefits of its individual constituents.

Despite the observed dose-dependent trend in Y-maze alternation performance, this study has several limitations. One limitation is the absence of phytochemical standardization of the decoction extract, which may affect reproducibility and the consistency of its biological activity. In addition, the relatively small sample size and the short duration of administration may have limited the ability to detect statistically significant effects. Furthermore, although the sample size met the minimum requirement based on the experimental design guideline derived from Federer's principles, the relatively small number of animals per group may have limited the statistical power to detect subtle differences among treatment groups. Future studies should include phytochemical characterization, longer treatment durations, and larger sample sizes to better elucidate the cognitive effects of *jamu cekok* decoction.

CONCLUSIONS

The study showed a trend towards an increase in the percentage of Y-maze alternation, especially at a dose of 400 mg/kg BW. Although an increasing trend in Y-maze alternation percentage was observed with increasing doses, the statistical analysis showed no significant difference.

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Competing Interests: The authors declare that there are no competing interests.

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REFERENCES

Abuajah, C. I., Ogbonna, A. C., & Osuji, C. M. (2015). Functional components and medicinal properties of food: a review. *Journal of Food Science and Technology*, *52*(5), 2522–2529. https://doi.org/10.1007/s13197-014-1396-5

Afandi, M. R. Z., Iswandi, & Safitri, C. I. N. H. (2021). Formulasi dan stabilitas mutu fisik ekstrak temu ireng (*Curcuma aeruginosa* Roxb.) sebagai body butter. *Seminar Nasional Pendidikan Biologi Dan Saintek (SNPBS) Ke-VI*, 359–365.

Alzheimer Indonesia. (2019, April 22). *Statistik tentang Demensia*. Alzheimer Indonesia. https://alzi.or.id/statistik-tentang-demensia/

Amadi, C. N., Offor, S. J., Frazzoli, C., & Orisakwe, O. E. (2019). Natural antidotes and management of metal toxicity. *Environmental Science and Pollution Research*, *26*(18), 18032–18052. https://doi.org/10.1007/s11356-019-05104-2

Barone, E., Di Domenico, F., Perluigi, M., & Butterfield, D. A. (2021). The interplay among oxidative stress, brain insulin resistance and AMPK dysfunction contribute to neurodegeneration in type 2 diabetes and Alzheimer disease. *Free Radical Biology and Medicine*, *176*, 16–33. https://doi.org/10.1016/j.freeradbiomed.2021.09.006

Belahusna, D. F., Santoso, P., & Rahayu, R. (2023). Efektivitas Ekstrak Biji Teratai (*Nymphaea pubescens* Willd) dalam Meningkatkan Perilaku Neurokognitif pada Mencit yang Diinduksi Trimetiltin. *Jurnal Sains Farmasi & Klinis*, *9*(sup), 152. https://doi.org/10.25077/jsfk.9.sup.152-159.2022

Cheluvappa, R., Scowen, P., & Eri, R. (2017). Ethics of animal research in human disease remediation, its institutional teaching; and alternatives to animal experimentation. *Pharmacology Research & Perspectives*, *5*(4). https://doi.org/10.1002/prp2.332

Emmady, P. D., Schoo, C., & Tadi, P. (2022). Major Neurocognitive Disorder (Dementia). In *StatPearls* (Internet). StatPearls Publishing. https://www.ncbi.nlm.nih.gov/books/NBK557444/

Federer, W. T. (1955). *Experimental Design: Theory and Application*. Macmillan.

Formularium Ramuan Obat Tradisional Indonesia, Pub. L. No. HK.01.07/MENKES/187/2017 (2017).

Ibroham, M. H., Jamilatun, S., & Kumalasari, I. D. (2022). A review: Potensi tumbuhan-tumbuhan di Indonesia sebagai antioksidan alami. *Seminar Nasional Penelitian LPPM UMJ 2022*. https://jurnal.umj.ac.id/index.php/semnaslit

Indrisari, M., Nurkhairi, N., Dewingsky, L., Muslimin, L., & Rumata, R. (2023). Potensi Peningkatan Daya Ingat Pada Tikus Putih (Rattus norvegicus) Menggunakan Ekstrak Daun Kelor (*Moringa oleifera*) Dengan Metode Labirin Y Maze. *Media Farmasi*, *19*(2), 67–73. https://doi.org/10.32382/mf.v19i2.208

Kementrian Kesehatan Republik Indonesia. (2023). Mengenal Demensia Alzheimer. *Yankes Kemkes*.

Larasati, F. (2021). Pengaruh ekstrak etanol kulit buah naga merah (*Hylocereus polyrhizus*) terhadap kognitif mencit galur swiss webster dengan induksi alkohol. *Jurnal Mahasiswa Kesehatan*, *3*(1). https://doi.org/10.30737/jumakes.v3i1.1209

Marianne, M., Patilaya, P., & Barus, B. T. (2018). Uji Aktivitas Antioksidan Kombinasi Ekstrak Etanol Rimpang Temu Giring (*Curcuma Heyneana*) dan Daun Pugun Tanoh (*Curanga Fel-Terrae*) Menggunakan Metode Diphenyl Picrylhydrazil(DPPH). *Talenta Conference Series: Tropical Medicine (TM)*, *1*(2), 398–404. https://doi.org/10.32734/tm.v1i2.223

Marni, M., & Ambarwati, R. (2015). Khasiat jamu cekok terhadap peningkatan berat badan pada anak. *Jurnal Kesehatan Masyarakat*, *11*(1), 102. https://doi.org/10.15294/kemas.v11i1.3522

Nathanael, A. (2017). Efek Seduhan Kunyit Kuning *(Curcuma longa)* Terhadap Memori Jangka Pendek [Universitas Kristen Maranatha]. https://repository.maranatha.edu/22883/

Nurmasitoh, T., Sari, D. C. R., & Partadiredja, G. (2018). The effects of black garlic on the working memory and pyramidal cell number of medial prefrontal cortex of rats exposed to monosodium glutamate. *Drug and Chemical Toxicology*, *41*(3), 324–329. https://doi.org/10.1080/01480545.2017.1414833

Syahrir, N. H. A., Afendi, F. M., & Susetyo, B. (2016). Efek Sinergis Bahan Aktif Tanaman Obat Berbasiskan Jejaring Dengan Protein Target. *Jurnal Jamu Indonesia*, *1*(1), 35–46. https://doi.org/10.29244/jji.v1i1.6

Wardono, & Agustia, P. (2017). Pengaruh Temulawak *(Curcuma xanthorrhiza* Roxb*.)* Terhadap Memori Jangka Pendek pada Laki-laki Dewasa [Universitas Kristen Maranatha]. http://repository.maranatha.edu/22890/

Wei, C.-K., Tsai, Y.-H., Korinek, M., Hung, P.-H., El-Shazly, M., Cheng, Y.-B., Wu, Y.-C., Hsieh, T.-J., & Chang, F.-R. (2017). 6-Paradol and 6-Shogaol, the Pungent Compounds of Ginger, Promote Glucose Utilization in Adipocytes and Myotubes, and 6-Paradol Reduces Blood Glucose in High-Fat Diet-Fed Mice. *International Journal of Molecular Sciences*, *18*(1), 168. https://doi.org/10.3390/ijms18010168