Testing the Antidepressant Activity of Fennel (Foeniculum vulgare Mill) In Vitro Using the Forced Swimming Test (FST) Method

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Abstract: Antidepressants are a therapy used for depression sufferers with the aim of reducing symptoms, minimizing side effects and returning them to their original condition. Treatment of depression requires safe and effective therapy to prevent severity. Currently, there are many plants that have potential as antidepressants, such as fennel. The method that can be used to evaluate the effect of antidepressants is the forced swimming test (FST). 24 mice were divided into 8 groups and each group was treated with amitriptyline as a positive control, Na-CMC 0.5% as negative control and fennel infusion as test sample. The data obtained consisted of duration of immobility, climbing, and swimming which was then analyzed using SPSS with the one-way ANOVA test. The results of one-way ANOVA test for immobility, climbing, and swimming time showed that sig. values sequencely are 0.03, 0.006, and 0.016 (P < 0.05). It means that immobility, climbing, and swimming time have significant differences between group of control and treatment.

Keyword: Antidepressant, Fennel, Extract

Introduction

Depression is a prevalent illness that carries substantial personal, social, and economic burdens. Depression is identifiable through certain indicators such as changes in cognitive functions and mood, and is associated with a noticeable impairment in social functioning, which can result in a reduced quality of life. Various research studies have shown that drugs that block the reabsorption of monoamines like serotonin and dopamine are commonly used to treat depression. However, monoamines play a role in the development of depression, with a lack of their functioning leading to the primary symptoms of the condition (Maleki and Maleki, 2021).

Depression is considered an affective mood disorder characterized by mood swings, lack of self-confidence, lack of interesting the environment and is estimated to affect 21% of the world's population and can vary from mild to severe depression called psychotic depression (WHO, 1998). According to the World Health Report, about 450 million people suffer from mental or behavioral disorders (WHO, 2001). Today, depression is the most common cause of suicide. It is estimated that 3000 people die every day and 1 million people die by suicide every year (WHO, 2002).

Depression is the most common disorder, and depressive symptoms alter the levels of brain neurotransmitters such as norepinephrine, serotonin, and dopamine (Gold et al., 1988). A number of synthetic drugs are available to treat depression, including SSRIs (selective serotonin reuptake inhibitors) - fluoxetine, fluvoxamine, sertraline, paroxetine, TCA (tricyclic antidepressants) - imipramine, amitriptyline, Clomipramine, Desipramine, Doxepin, MAOI (Monoamine Oxidase Inhibitors) - Selegiline, Atypical Antidepressant Bupropion, Duloxetine, Trazodonelafapine, Ayflegül and other drugs. However, due to their effective treatment, drugs are also associated with side effects such as sexual dysfunction (Csoka et al., 2007), nausea (MacKay et al., 1997), insomnia (MacKay et al., 1997), mania (Settle et al., 1984), tremor (Chouinard et al., 1986), dystonia (Lavin et al., 1993), dry mouth, hypertension (Aubin et al., 2002).

Foeniculum vulgare, commonly known as fennel, is a traditional and popular herb native to the southern Mediterranean region and growing wild in the eastern and western hemispheres. Preclinical evidence suggests that aerial EOs from Foeniculum vulgaris have shown promising anxiolytic activity. In addition, the study found that EO from fennel seeds had antidepressant-like effects in mice although its effectiveness in humans has not yet been established. Another study also found that EOs extracted from F. vulgare seeds improved anxiety and depression in laboratory rats, indicating significant potential for clinical application in the treatment of these diseases. However, there is no evidence for this oil in human models (Alvarado-García, 2022). In this sense, the aim of this study was to determine the antidepressant effects of the infusa of Foeniculum vulgare.

Methods

This research was conducted in the Drug Testing Laboratory of the Pharmacy study program, Faculty of Medicine and Health Science, Mataram University from February to March 2024. There are several tools needed for anti-depressant testing, including analytical scales, mouse cages, mice drinking bottles, stopwatch, cell phone, mortar, stamper, measuring cup, beaker, stir bar, mouse joints, light bulb and hair dryer while the ingredients needed are amitriptyline, aquades and rice husks.
Acclimatization of experimental animals
Before being submitted for acclimatization is carried out by keeping mice in cages at a room temperature of 23°C.

Preparation of 0.5% Na-CMC Solution
Weighed 0.05 grams of Na-CMC using an analytical balance. Heated the water on the stove and measured 10 mL using a measuring cup. Next, about 5 mL of water is poured into the mortar. Sprinkle Na-CMC into the mortar until it is dispersed and expands. The expanded powder is crushed until a suspension forms and the remaining water is added to the mortar.

Preparation of amitriptyline suspension
Amitriptyline suspension is made by crushing 1 amitriptyline tablet using a mortar and stamper until a fine powder is formed. Weighed 1.3 mg of powder using an analytical balance. The powder was put into a mortar containing 0.5% Na-CMC and ground again until homogeneous.

Making plant infusions
Before making the infusion, the ingredients are washed first using running water. Each plant is weighed using an analytical balance. Then the plants are put into a beaker with sterile distilled water added. The beaker containing the plant is boiled on the stove while stirring and the juice is taken.

Preparation and testing of antidepressant effects on test animals
A total of 24 mice were grouped into 8 groups with treatment, namely amitriptyline as a positive control, Na-CMC as a negative control and fennel infusion as a test sample. Each group consists of 3 mice with a weight of around 15 to 25 grams. The method used is forced swimming test (FST) with a cylinder tube that has been modified with a height of 50 cm and a diameter of 20 cm. The cylinder tube is filled with sufficient water by adjusting the size of the machine so that the tail does not touch. The bottom of the tube before testing, the water temperature was measured using a thermometer, prepared with a cell phone camera in front of the cylinder tube to observe the movement of mice. Mice that had been given treatment were put into the cylinder tube. The test was carried out for 6 minutes during the first 2 minutes of the pretest and the last 4 minutes of observation. The results obtained were in the form of immobility, climbing, and swimming (Ramadhlan et al., 2023).

Result
Table 1. Data of immobility, climbing and swimming time

<table>
<thead>
<tr>
<th>Group</th>
<th>Mice</th>
<th>Measurement (minutes)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Immobility</td>
</tr>
<tr>
<td>Positive control</td>
<td>1</td>
<td>1.15</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>1.09</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>2.05</td>
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<tr>
<td>Mean</td>
<td>1.43</td>
<td>1.82</td>
</tr>
<tr>
<td>Negative control</td>
<td>1</td>
<td>3.53</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>3.71</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>2.96</td>
</tr>
<tr>
<td>Mean</td>
<td>3.4</td>
<td>0.42</td>
</tr>
<tr>
<td>Fennel treatment</td>
<td>1</td>
<td>2.53</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>2.21</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>2.23</td>
</tr>
<tr>
<td>Mean</td>
<td>2.32</td>
<td>1.26</td>
</tr>
</tbody>
</table>

Discussion
Based on the results of data analysis, one-way ANOVA test for immobility, climbing, and swimming time showed that sig. values sequence are 0.03, 0.006, and 0.016 (P < 0.05). It means the immobility, climbing, and swimming time have significant differences between group of control and treatment. The effect of fennel infusa to mice is caused by some active compunds in the fennel infusa. Some researches showed that the main components of Foeniculum vulgare essential oil (FEVO) include anethole, α-Thujone, 1-methoxy-4-(2-propenyl)benzene, limonene, and 4-mitoxoxybenzaldehyde; this is consistent with studies most commonly using anethole or limonene and anethole. Important components are mentioned (Maleki and Maleki, 2021).

Depression is a common mood disorder general illness, affects mood, lack of interest environment, low energy level, lack of confidence, weak concentration, sleep disturbances and poor awakening thoughts. Mainly related to stress. Ayurveda offers there are medicinal plants to prevent these effects. Foeniculum vulgare is one of the most important medicinal plants to know different drugs (Singh et al., 2013).

The another research explained that fennel appears to be effective in women suffering from post-menopausal depression and anxiety. Research implications for clinical practice and future research: Further studies with larger sample sizes are needed to confirm the true effects of fennel in clinical settings (Ghazanfarpour et al., 2017).
Conclusion

Based on one-way ANOVA test for immobility, climbing, and swimming time showed that sig. values sequencely are 0.03, 0.006, and 0.016 (P< 0.05). It showed that fennel extract has antidperesan activity.

References


MacKay, FJ; Dunn, NR; Wilton, LV; Pearce, GL; Freemantle, SN; Mann, RD., 1997, A comparison of fluvoxamine, fluoxetine, sertraline and paroxetine examined by observational cohort studies. Pharmacoepidemiology and drug safety; 6 (4): 235–246.


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