

Abstract

Background: Diabetes mellitus (DM) as a chronic disease can disrupt the entire body system including the brain, by raising blood sugar. This chronic disease also affects the hippocampus in various ways, including intensifying the oxidative reaction, which leads to impaired cognitive and emotional functions, as well as learning and memory. The main cause of oxidative stress in DM is increased blood glucose, which does this in several ways.

Aim: There is sufficient evidence indicating the antidiabetic, anti-anxiety, antioxidant, and neuroprotective effects of *Foeniculum Vulgare* effects. This study aimed to determine the effect of hydroalcoholic extract of *Foeniculum Vulgare* on, passive avoidance learning and memory, anxiety-like behaviors, pain threshold, and hippocampal level of antioxidant parameters and oxidative stress in streptozotocin-induced diabetic male rats.

Materials and Methods: In this experimental study, seventy male Wistar rats were randomly selected and divided into seven groups: 1- Control: 2- Sham (DMSO) 3- *Foeniculum Vulgare*; for a month received *Foeniculum Vulgare* extract (200 mg/kg) 4-diabetic (induction by streptozotocin at a dose of 50 mg per kg - single dose and after one-month behavioral tests were performed) 5- diabetic (induced by streptozotocin injection (50 mg/kg, single dose) and after two months followed by performing behavioral tests. 6- Diabetic + *Foeniculum Vulgare*: Immediately after the confirmation of diabetes, they have received *Foeniculum Vulgare* after one-month DM confirmation for one month, 7- Diabetics+*Foeniculum Vulgare*: received *Foeniculum Vulgare* extract for two months after the diabetes is confirmed. Finally, anxiety-like behavior tests including, open field and elevated plus-maze. Additionally, a shuttle box test was used to examine the effects of diabetes and *Foeniculum Vulgare* consumption on learning and memory. A hot plate was also used to assess the effect of *Foeniculum Vulgare* on pain threshold in diabetic rats. Blood glucose levels were measured at the beginning of the study and before the behavioral tests. After the behavioral test performing, the rats were deeply anesthetized and after that, the hippocampi of the brain were removed for oxidative stress (MDA), and antioxidants (SOD and GPX) parameters determination. The

were analyzed using a one-way ANOVA test followed by Tukey post hoc test using SPSS20 software.

Results: Results of the study showed that induction of diabetes increased anxiety-like behaviors, impaired passive avoidance memory and increased oxidative stress (MDA), and decreased antioxidants (SOD and GPX) in the hippocampus, while *Foeniculum Vulgare* treatment adjusted disorders that were induced by diabetes. Remarkably, *Foeniculum Vulgare* consumption could exert both therapeutic and preventive effects. *Foeniculum Vulgare* also increased the pain threshold in diabetic rats.

Conclusion: Therefore, it can be concluded that *Foeniculum Vulgare* can have protective and therapeutic effects on the cognitive and emotional disruptions in diabetes patients, hence, it might be used for different drug productions because of therapeutic and pharmacological potential.

Keywords: Learning-Memory-Anxiety-Behavior-*Foeniculum Vulgare*-Blood Glucose, Pain Response