

The Effect *Foeniculum vulgare* Mill (*Fennel*) Essential Oil on Blood Glucose in Rats

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Abstract: *Foeniculum vulgare* Mill belongs to the Umbelliferae family and is a highly aromatic and flavorful herb with culinary and medicinal uses. The medicinal parts of the plant are the oil, the dried ripe fruit and the seeds. The objective of the study is to comparison the water-distilled essential oil of Iranian *Foeniculum vulgare* Mill seeds (*Fennel*) and Estradiol valerate for hypoglycaemic activities in rats. After oil analysis by GC, 5 components were identified in the oil. Among them, trans-anethole (72.67%) was the major component. Healthy female albino rats were divided into 4 groups of 6 animals each including sham operated (control), animals receiving *Foeniculum vulgare* Mill essential oil (FEO 250, 500 mg kg⁻¹) and estradiol valerate (5 mg kg⁻¹) for 28 days. The findings showed that *Foeniculum vulgare* Mill essential oil (250 mg kg⁻¹) reduce blood glucose even more than essential oil 500 mg kg⁻¹ and Estradiol. Therefore, *Foeniculum vulgare* Mill has estrogenic activity on blood glucose level and this effect is dependent to dose. Also, can suggest that effect of essential oil on blood glucose level is due to trans-anethole.

Key words: *Foeniculum vulgare* Mill, essential oil, hypoglycaemic, estradiol valerate

INTRODUCTION

Foeniculum vulgare Mill (*Fennel*) has a long history of herbal use and is a commonly used household remedy, being useful in the treatment of a variety of complaints, especially those of the digestive system (Phillips and Foy, 1990).

The seeds, leaves and roots can be used, but the seeds are most active medicinally and are the part normally used (Grieve, 1984). *Fennel* is widely cultivated, both in its native range and elsewhere, for its edible, strongly-flavoured leaves and seeds. The flavour is similar to that of anise and *star anise*, though usually not as strong (Katzner's Spice Pages). *Fennel* and *anise* are plants which have been used as estrogenic agents for millennia. Albert (1980) *Fennel* seed contains essential oil (4-6%), of which 50-70% is trans-anethole, 9-22% fenchone (Wichtl and Bisset, 1994).

The major component of essential oil of *fennel*, trans-anethol, had a low antioxidant activity (Misharina and Polshkov, 2005).

It contains natural estrogenic substances-flavonoids-also called "phytoestrogens. Phytoestrogens are of biological interest because they exhibit both *in vitro* and *in vivo* weak estrogenic and antiestrogenic actions (Price and Fenwick, 1985). Recently, phytoestrogens have gained increasing attention because of accumulating evidence suggesting their protective roles against numerous chronic diseases, including cancers, CVD,

dyslipidemia and diabetes. One pilot study reported that flaxseed (Umbelliferous) mucilage significantly decreased postprandial blood glucose in young healthy volunteers. In another clinical trial, flaxseed supplements were also found to decrease glucose and insulin levels in 25 hypercholesterolemic postmenopausal women (Pan *et al.*, 2007).

The female sex hormone 17-β estradiol (E₂) has been shown to increase lipid and decrease carbohydrate utilization in animals (Carter *et al.*, 2001). Estrogen has been shown to have profound effects on insulin and glucose metabolism *in vivo*. Indeed, estrogens were recently shown to modulate ion channel and secretory activities in endocrine cells (Horn *et al.*, 2000). The studies indicate that since the umbelliferous fruits are used in the preparation of foods, they may be useful in the control of postprandial rise of blood glucose particularly in diabetic condition. Additionally, their daily use may help in reducing complications associated with chronic diabetes (Sushuta *et al.*, 2006). On the basis of the above facts, In this study, we evaluate effect of *Foeniculum vulgare* Mill (umbelliferous) essential oil and estradiol valerate on blood glucose level during treatment in Rats.

MATERIALS AND METHODS

Plant and essential oil: An essential oil (pH = 5) of dried seeds was used in this study. Fennel seeds were collected

from Tabriz district, Iran. The freshly dried seeds of fennel were segmented and the volatile fraction was isolated by a water-distillation method for 2 h. The oil obtained in Ca⁺² 3.0% yield was dried over anhydrous sodium sulfat and refrigerated at 4°C (Jaffary *et al.*, 2006).

Essential oil analysis: The oil was analyzed by GC. Gas chromatography analysis was carried out on a GC-Agilent-6890 gas chromatograph with FID detector and a capillary column omegawax.

Chemicals: Stradiol valerate was obtained from drug store.

Animals: Twenty four Female Wistar Albino Rats (180-200 g; Faculty of Science; Urmia University) were used. Animals were housed in groups of 6, under a standard 12 h light/dark cycle in room maintained at 22±4°C with free access to food and water. All the experiments were performed from 9-11 am.

Experimental procedure: Twenty four rats were divided into 4 groups of 6 animals. Group 1, which served as normal control, received isotonic salin solution 0.2 mL intraperitoneally (i.p.), two groups of rats received intrapritoneal injections of 250, 500 mg kg⁻¹ of FEO, ingroup 4, estradiol valerate was injected intramuscular at a dose of 5 mg kg⁻¹ to 28 days.

The animals were killed 28 days after treatment. Blood samples were collected by direct cardiac puncture of each rat at 2 h after essential oil administration and analyzed for glucose content.

Statistical analysis: The data were analyzed using Analysis of Variance (ANOVA). Means were separated by using the Tukey Multiple Test at p = 0.05. Values are the mean±SE of 6 replicates.

RESULTS AND DISCUSSION

Analysis of the essential oil: Fruits of *F. vulgare* yielded an essential with a spicy pleasant odor. Five components were characterized. The chemical composition of the essential oil of *F. vulgare* fruits has been showed in Table 1 with their percentage composition. The major constituent of essential oil was Trans-anethol (72.67%).

Effects of *F. vulgare* on blood glucose levels are shown in Fig. 1. In the essential oil (250 mg kg⁻¹) treated group, serum glucose levels was quite lower. In contrast, in the control group glucose levels was more than other groups. Test compounds produced hypoglycaemi which

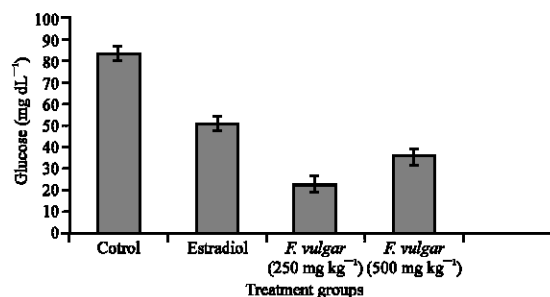


Fig. 1: Effects of *F. vulgare* and estradiol valerate on the blood glucose. Results are shown group treated with *F. vulgare* (250 mg kg⁻¹) had lower levels of glucose when compared with control group and other groups

Table 1: List of the components of *F. vulgare* oil

Compound	(%)
Trans-anethol	72.67
Limonene	9.92
Methyl chavicol	5.41
Fenchone	4.47
α-pinene	3.38

was not significant different from that of control animals. Finally it can be concluded that *F. vulgare* (250 mg kg⁻¹) was found to be best among the compounds evaluated for glucose lowering activity. Since, the umbelliferous fruit is used in the preparation of curries etc particularly in Indian/Chinese foods they are likely to be useful to control postprandial rise of blood glucose particularly in diabetic condition. Additionally, their daily use may help in reducing complications associated with chronic diabetes. Also, can suggest that effect of essential oil on blood glucose level is due to trans-anethole.

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