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ORIGINAL ARTICLE

The Effect of Aqueous Extract of *Cariandrum Sativum* on Fetal Weight and Height in Pregnant Mice

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ABSTRACT

Background: Herbal medicine may have irreparable effects on fetal development. This study investigated the effect of *Cariandrum sativum* (coriander) aquous extract on mice fetal height and weight.

Methods: In an experimental study, 120 pregnant mice were divided into four equal groups. The control group was without any intervention. The experimental group received 3500, 5000 and 6500 mg/kg of aquous extract of coriander. The height and weight of the embryos were recorded in first, second and third week of pregnancy.

Results: The height and weight of embryos in experimental groups in first, second and third week was significantly lower than the control group.

Conclusion: Coriander (*C. Sativum*) aquous extract was shown to reduce the fetal height and weight in a dose-dependent manner. These findings can be added to the literature when coriander is going to be used during pregnancy.

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Introduction

Birth defects and congenital anomalies are similar terminologies that describe constructional, functional and metabolic disorders at birth time. Congenital defects can be caused by inherited and environmental factors, while one of the most important environmental factors is the use of herbal medicines during pregnancy (1). It was shown that pregnant women search for herbs as a natural and safe drug during pregnancy (2). In addition to several therapeutic effects of herbs (3, 4), conventional medicine has side effects such as teratogenic and toxic impacts during pregnancy for both the mother and the fetus causing fetal abnormalities (5).

Severe uterine contractions and abortions were reported following use of herbs leading to expansion of the uterus muscles, opening of the cervix are also other side effects during pregnancy (6). For example, barberry extract (1) and *Stachys lavandulifolia vahl*

(7) were demonstrated to have decreasing effect on fetal height and weight. Ginseng was found to induce dehydration through an increase in sex hormones (5). Echium extract was shown to have a negative effect on reproductive factors and fetal development (8). The teratogenic effect of fennel extract to cause exohepaty in the fetus was previously demonstrated (9).

Coriander know as *Coriandrum Sativum L.* too belongs to *Apiaceae* family (10). Coriander's seeds contain mannitol and flavonoid glycosides such as quercetin, isoquercitrin, and rutin. There is also tannin, coumarin, mucilage, starch and chlorogenic and caffeic acid in its seeds (11). Flavonoids in plants produce blue and red pigments in flowers and protect against the attack of germs and insects. In addition, they have antioxidant, anti-allergic, anti-inflammatory, antimicrobial and anticancer activity (12).

Quercetin is known as the most active flavonoid in studies. Quercetin with its anti-inflammatory properties directly inhibits the onset of inflammatory processes. For example, it prevents the synthesis and release of histamine, a mediator of inflammatory reactions (13). Additionally, it has antioxidant activity and reduced vitamin C activity (12). Quercetin antitumor activity has also been proven (13). Recent studies have shown that quercetin can help men in the treatment of chronic prostate inflammation due to its inhibitory effects on mast cells (14).

Tannins are highly complex compounds that produce polyhydric phenols such as pyrogallol, catechole and Ellagic acid during hydrolysis (15) that can reduce irritations and pain, eliminate oral swelling, local bleeding and promote healing in bronchitis and burns (16). Coriander is used in traditional medicine for food digestion, anti-inflammation, appetite enhancer, and muscle ailments.(10) Regarding the importance of genetic and maternal abnormalities in infants and the excessive use of certain herbs during pregnancy without any knowledge on the side effects, the aim of this study was to investigate the effect of coriander extract on mice fetal height and weight.

Materials and Methods

In an experimental study, for preparation of coriander extract, after harvesting the samples and their scientific and systemic identification, the green and fresh leaves of coriander were provided. They were dried at room temperature under shadow and kept in refrigerator in glass containers until use. For preparation of aqueous extract, 100 g of the dried powder was weighed by a digital scale, and 60 mL of sterile distilled water was added while the glass container was heated to 80°C. It was placed in the water bath at 60°C for 24 hours. Finally, the mixture was passed through a funnel and filter paper.

Determination of lethal dose of coriander was done by LD50 method. Three different doses were selected based on previous studies. Dose with 50% mortality was considered as LD50 dose defined as 6500 mg/kg. A standard two milliliters syringe equipped with a feeding needle or gavage was used for administration purposes. The skin of the neck region was stretched and kept to open the mouth and enter the gavage into the mouth and the esophagus and release the solution.

For mating, 5 female and 2 male mice were kept in one cage for 24 hours. Vaginal plaque was regarded as a sign of pregnancy. After mating, they were separated and tested in different weeks of pregnancy. One hundred and twenty pregnant mice were divided into four equal groups. The control group was without any intervention. Cesarean section was undertaken after one, two and three weeks of pregnancy to assess the embryos. Experimental group 1 received a daily dose of 3,500 mg/kg of coriander extract in gavage form. The experimental group 2 was fed by 5000 mg/kg of barberry extract per day via gavage. Experimental group 3 received a daily dose of 6500 mg/kg of barberry extract by gavage.

Data were analyzed using SPSS software (Version 20, Chicago, Il, USA). After assessing the normal distribution of data using Kolmogorov-Smirnov test, the comparison of quantitative data in different groups at similar times was done by One-way ANOVA and Kruskal-Wallis test. Comparison of quantitative data at different times in each group was performed by Paired T test, while qualitative data was done using Wilcoxon signed rank test. The statistical significant level was defined to be less than 0.05.

Results

Comparison of fetal height and weight in the first, second and third week of gestation in experimental and control groups is presented in Table 1 showing that fetal height in the first week of pregnancy in experimental groups of 1, 2 and 3 decreased significantly when compared to the control group. The reduction was significantly more in experimental group 3 when compared with experimental groups 1 and 2 ($P<0.05$). For fetal weight in the first week of pregnancy, there was a significant decrease in experimental group 1, 2 and 3 in comparison to the control group and the decrease was more prominent in experimental groups 2 and 3 when compared with experimental group 1 ($P<0.05$).

Table 1: Comparison of fetal height and weight in the 1st, 2nd and 3rd week of gestation between experimental and control groups

Variable	Control	Experimental 1	Experimental 2	Experimental 3
Fetal height (first week)	1.94±0.52[c]	1.25±0.26[b]	1.007±0.67[b]	0.42±0.09[a]
Fetal weight (first week)	0.916±0.45[b]	0.67±0.56[b]	0.26±0.129[a]	0.085±0.03[a]
Fetal height (second week)	0.93±0.24[b]	0.87±0.288[b]	0.866±0.533[b]	0.296±0.2[a]
Fetal weight (second week)	2.25±0.353[c]	1.223±0.183[b]	1.193±0.141[b]	0.146±0.042[a]
Fetal height (third week)	2.25±1.06[c]	1.19±0.141[b]	0.433±0.05[a]	0.116±0.0288[a]
Fetal weight (third week)	0.23±0.18[a]	0.186±0.026[b]	0.173±0.171[a]	0.134±0.07[a]

a, b, c: $P<0.05$

Discussion

During the recent decade, the consumption of traditional medicine has increased (15). They can affect several organs including the brain (17), digestive system (18) and reproductive system (19), so women's diet has an important role in safety of pregnancy (20). Herbal consumption during pregnancy can lead to congenital defects and abortions (21), therefore, researchers have investigated on the effect of herbal extracts during pregnancy with more caution (21-23). In this study, the effect of coriander extract on fetal height and weight was investigated showing that fetal height in the first week of pregnancy in experimental groups 1, 2 and 3 had a significant decrease compared to the control group. This decrease was significantly more in experimental group 3 compared to the experimental groups 1 and 2 ($P<0.05$). It was demonstrated that the use of *Matricaria chammomilla* in Balb/C mouse reduced the fetal height in a dose dependent manner (24) that was similar to our findings.

Identically, the use of ginger, which contains coriander-like materials including geraniol, flavonoids and tannins was shown to reduce the fetal height in a dose-dependent manner too. In fact, the geraniol in the coriander affects the dehydrogenase activity (25). Study of teratogenic properties of similar plants, such as chamomile, showed that flavonoids are responsible for these malformations. Also, chamomile compounds, similar to coriander, have the ability to attach to mucopolysacharides of the cartilage tissue and change the appearance of the cartilage and the height of the fetus (25, 26) the same as our results.

Coriander has antioxidant activity and reduces the action of vitamin C (12). Considering that the reduction of vitamin C activity has a prominent role on bone density and osteogenesis, coriander has a negative effect on fetal height. Similar findings were noted in our study. Evaluating the weight of embryos in the first, second and third week of pregnancy revealed that experimental groups showed a significant decrease compared to the control group ($P<0.05$). Tannin (11) and phenolic compounds in coriander were illustrated to increase the excretion of proteins, amino acids and essential amino acids (27). Tannin consumption sometimes leads to a severe poisoning and even death (28). Also, coriander extract was displayed to affect the metabolism of carbohydrates by increasing the activity of glycogen synthase, increasing liver glycogen concentration, inhibition of gluconeogeneic and glycogen phosphorylase enzymes and decreases the level of glucose in the blood, which can reduce the weight of the fetus (29). Coriander extract with an anti-proliferative property and flavonoid contents can induce cell death and weight loss (30-32).

Conclusion

Coriander (*C. Sativum*) aquous extract can cause a reduction in fetal height and weight in a dose-dependent manner during pregnancy. These findings can open a new window and concern for herbal medicines used during pregnancy.

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Conflict of Interest

None declared.

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