

Original Research Paper

## The effect of hydroalcoholic extract of *Coriandrum sativum* on rat appetite

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### Abstract

**Objective:** Losing weight in consequence of appetite loss can be a sign of a serious underlying condition. Currently, the most widely prescribed medication for anorexia is cyproheptadine hydrochloride. However, the clinical use of cyproheptadine hydrochloride is limited by its side effects. In Iranian traditional medicine, *Coriandrum sativum* stimulates the appetite. Therefore, the effect of *Coriandrum sativum* (coriander) hydroalcoholic extract was investigated on food intake in rats.

**Material and Methods:** Thirty male Wistar rats were randomly divided into five groups. Two control groups were used, one group received 0.5 ml water per day (vehicle group), and another group did not receive anything (control group). The other 3 groups were daily treated by 50, 100 or 150 mg/kg of coriander for 7 days, respectively. The daily amount of the food eaten by each rat was measured for 10 days. The amount of energy intake of each rat was also calculated for 7 days during the intervention. The difference in energy intake was calculated and compared between groups.

**Result:** There was no significant change in energy intake between control and vehicle groups. The change in energy intake after treatment by 100 and 150 mg/kg of the extract was significantly higher than other groups ( $p=0.030$  and  $p=0.007$ )

**Conclusion:** This study indicated that coriander had positive effects on appetite of rats. Future studies are needed to evaluate the mechanisms of the effects of this plant on appetite.

**Keywords:** *Coriandrum sativum*, Appetite, Energy intake, Rat

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## Introduction

Most people have experienced a temporary loss of appetite at some time. This is rarely a worrisome symptom unless it lasts for more than a day or two. It can also be a sign of a serious underlying condition, such as depression or cancer cachexia. It also commonly occurs during a sudden illness, such as an infection (Chapman and Nelson, 1994). When loss of appetite continues for a long time, a person is at risk for malnutrition and micronutrients deficiencies (Brownie 2006; Chandra *et al.*, 1991).

Appetite stimulants have been used to help overcome decreased appetite. A few examples of stimulants are megestrol acetate (MA), cyproheptadine hydrochloride (CH), cannabinoids, hydrazine sulfate, anabolic hormones, and growth hormone. Currently, the most widely prescribed medication for anorexia is cyproheptadine hydrochloride (Kardinal *et al.*, 1990). However, the clinical uses of cyproheptadine hydrochloride is limited by its side effects such as somnolence, excitation, hallucinations, ataxia, tachycardia, and muscle twitching, and occasionally gastric pain, dry mucous surfaces, mydriasis, and rubeosis of the face (Von Mühlendahl and Krienke 1978). Some contraindications of using these medications are lactation, pregnancy, and hypersensitivity (Anon 2009). MA, has substantial side effects and may not be suitable for prolonged use (Homnick *et al.*, 2005).

Plants not only provide food and shelter but also serve humanity by preventing and curing different ailments. Herbs and spices have always been useful to cure diseases (Tipu *et al.*, 2006). The practice of herbal medicine dates back to the very earliest period of known human history. There is evidence of herbs having been used in the treatment of diseases and for revitalizing body system in almost all ancient civilizations, the Egyptian, the Chinese and even Greek and Roman civilizations (Aftab

and Sial 1999). Currently, there is a high interest in recognition of new potential medications that have minimal side effects which can be used in medicine and the food industry (Srivastava *et al.*, 1993).

*Coriandrum sativum* (Coriander) is an herb in the family Apiaceae. Although, all parts of the plant are edible, its fresh leaves and dried seeds are most frequently used (Benzie and Wachtel-Galor 2011), which contain an essential oil and the monoterpenoid-linalool (Eikani *et al.*, 2007). In traditional medicine, *Coriandrum sativum* was used in the preparation of many household medicines to relief anxiety and insomnia, and may have potential sedative, hypotensive, and muscle relaxant effects. Its beneficial effects in bed cold, seasonal fever, nausea, vomiting, and stomach disorders have been suggested. It has also been used as a drug for rheumatoid disorders, pain in the joints, and against worms (Emamghoreishi *et al.*, 2005; Medhin *et al.*, 1986; Rajeshwari and Andallu, 2011). Several animal studies provide evidence that coriander seeds can promote the hepatic antioxidant system (Anilakumar *et al.*, 2001; Aruna *et al.*, 2006). Study of Emamghoreishi and colleagues suggests that the aqueous extract of *Coriandrum sativum* seed has anxiolytic effect and may have potential sedative and muscle relaxant effects (Emamghoreishi, Khasaki & Aazam 2005).

Coriander is digestive and appetite stimulant in ancient medicine (VanNostrand and Sarles 2002). In another study, (Banerjee *et al.*, 1994) observed roughly a doubling in glutathione S-transferase (GST) protein activity in Swiss albino mice that were provided with diets containing coriander oil. Moreover, few studies suggest that coriander may have anticancer properties (Esiyok *et al.*, 2004). Many of healing properties of *Coriandrum sativum* can be attributed to its exceptional phytonutrients and hence, it is often referred to as the store house for

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bioactive compounds (Rajeshwari and Andallu, 2011). However, no pharmacological or medical studies have evaluated the effects of *Coriandrum sativum* on appetite. In Iranian traditional medicine, coriander is used as an orexigenic agent, so in this research for the first time, we investigated the effect of the extract of this plant on food intake in rats.

### Material and Method

#### Animals

Thirty male Wistar rats with age of 8 weeks and 200-220 g weight were purchased from animal house of Mashhad University of Medical Sciences, Mashhad, Iran. Laboratory temperature was  $22\pm 1$  °C with 12 hours light/dark cycle, and all rats had access to the source of food without any limitation.

#### Foods

Laboratory animal food was provided from Javaneh Khorasan Company that includes 21% protein and 6.5 – 7% fat. Every 1000 g of food contain 2750 Kilocalories energy.

#### Preparation of hydroalcoholic extract

*Coriandrum sativum* was provided by University herbarium. Pharmacologic parts of coriander are seed, leaf and stem. These parts were dried at room temperature in shadow, and then powdered. Maceration extraction method was used for extraction. Powder was inserted in closed can and solvent (70% alcohol) was added. Then the solution was kept in the can for 2-4 days and mixed one or two times a day. The solution was filtered and liquid was separated with rotary evaporator. After that, the extract was dried in 40 °C oven. The extract was dissolved in water before gavage every day.

#### Experimental design

Thirty rats were located to five groups randomly. 1- control: the animals in this

group were without any treatment, 2- vehicle: the animals received 0.5 ml water per day instead of the extract, 3, 4, and 5: three types of solution with different concentrations of *Coriandrum sativum* were provided to the animals (50, 100, and 150 mg/kg of the hydroalcoholic extract, respectively). The daily amount of food eaten by each rat was measured for 10 days before intervention to calculate the used calories in 24 hours. The animals of all groups were gavaged with the extract or water. The animals of control group didn't receive anything. The daily energy intake of each rat was calculated for 7 days after the treatment.

This study was approved by Ethics Committee of Vice Chancellor for Research of Mashhad University of Medical Sciences (MUMS), Mashhad, Iran

#### Statistical analysis

All data were analyzed using ANOVA and paired samples t-test. P-values less than 0.05 were considered to be statistically significant

### Result

The mean energy intake before intervention was not different between groups (Table 1). Treatment of the animals with 50 mg/ kg of the extract did not increase the energy intake significantly. In the animals which were treated with 100 mg/ kg of the extract, the daily energy intake was  $58.450\pm 2.230$  Kcal which was significantly higher compared with the amount of energy intake before the treatment ( $p=0.030$ ). The daily energy intake in the animals treated with 150 mg/ kg of the extract was also increased compared with the before treatment ( $56.416\pm 1.800$  Kcal; vs.  $52.483\pm 1.543$ ,  $p=0.007$ ). In addition, comparison of mean energy intake changes along the study (during intervention – before intervention) between first case group and vehicle group,

between first case group and control group, between second case group and vehicle group, and also between second case group and control group did not show any significant change (p=0.997, p=0.999, p=0.555, p=0.690, respectively) (Table 2).

However, assessment of mean energy intake changes along the study between third case group and vehicle group, and also between third group and control group showed significant change (p=0.002, p=0.002, respectively).

Table 1: Mean energy intake in 24 hours before and during intervention in five groups of rats in the study.

Group	Before intervention (Kcal)*	During intervention (Kcal)*	Change (Kcal)	p-value
First case group (received 50 mg/kg coriander solution)	52.066±0.600	53.200±0.727	1.100±1.882	0.496
Second case group (received 100 mg/kg coriander solution)	53.366±0.904	58.450±2.230	3.280±1.640	0.030
Third case group (received 150 mg/kg coriander solution)	52.483±1.543	56.416±1.800	4.360±1.700	0.007
Control group	52.650±1.380	52.916±1.360	0.350±0.615	0.523
Vehicle group	52.783±1.370	53.133±1.250	0.266±0.952	0.222

\* Mean±SEM (KCal), \*\* Paired sample t-test

Table 2. Comparison of mean energy intake in different rats groups.

	Vehicle group (p-value)	Control group (p-value)
First case group	0.997	0.999
Second case group	0.555	0.690
Third case group	0.002	0.002

\* Tukey-Kramer Test

## Discussion

In Iranian traditional medicine there are many medical plants that increase the appetite and probably have fewer side effects as well fewer costs than chemical drugs. One of these medical plants is *Coriandrum sativum*. In traditional medicine, the beneficial effects of *Coriandrum sativum* L. has been suggested for a number of medical

problems such as dyspeptic complaints, loss of appetite, convulsion, insomnia, and anxiety (Mir Heidar 1992; Zargari 1991).

In the present study, 100 and 150 mg/kg of hydroalcoholic extract of coriander increased appetite in rats. The results of the present study confirmed the traditional believe regarding the beneficial effects of *Coriandrum sativum* for increasing the

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appetite (Avecina A, 1992). In contrast to these findings, Gray et al. reported that *Coriandrum sativum* had no significant effect on food intake in diabetic mice (Gray and Flatt, 1999).

The components of *C. sativum* include essential oil, glucose, fructose and sucrose, alkaloids, flavones, resins, tannins, anthraquinones, beta-sitosterol, beta-sitosteroline, fixed oils, linalool, and carotenoids (Trease and Evans, 1996).

Based on the results of the present study, it is impossible to conclude about the effective compound(s) of the extract or mechanism(s) responsible for the effect of the extract. Several endogenous substances have been related to satiety–hunger cycle disorders. TNF- $\alpha$  has been recognized as having an anorexigenic effect under different conditions. TNF- $\alpha$  is associated with anorexia in wasting syndromes (Beutler and Cerami 1986). Coriander seeds have flavonoid compounds including quercetin and rutin (Blumenthal et al., 2000). Some researchers have shown that these compounds decrease TNF- $\alpha$ , so it might be suggested that the extract of coriander stimulate appetite with decreasing TNF- $\alpha$ . Of course coriander may stimulate appetite with other probable mechanisms such as gastrointestinal hormones. No more evidence was found about relation of chemical composition of *Coriandrum sativum* and anorexia. More studies are needed to find the mechanism of coriander extract for increasing appetite. Measuring appetite regulating hormones are also important in evaluating the extract mechanism(s). It has been reported that *Coriandrum sativum* increases insulin secretion in vitro (Gray & Flatt 1999). Regarding this effect and antidiabetic actions of the plant, it is conceivable that the effects of extract on food intake which was seen in the present study may be in part be due to this mechanism.

Linalool is the main ingredient in coriander (Usta et al., 2009). Moreover, it has been reported that linalool reduces the plasma glycerol level and increases food intake and body weight (Shen et al., 2005). Therefore, the increase in food intake which was seen in the present study may at least be in part due to this component.

Regarding the effects of *Coriandrum sativum* on central nervous system and considering some of its effects such as antianxiety, antidepressant, relaxant, and hypnotic effects which have been previously reported (Emamghoreishi, Khasaki, & Aazam 2005; Rakhshandeh et al., 2011; Zargar-Nattaj et al., 2011), the role of neurotransmitter systems such as serotonergic, dopaminergic and opioids system in mediating the possible effects of the plant on appetite which was seen in the present study should not be ignored.

This study indicated that coriander had positive effect on appetite of rats. Future studies evaluating effects of coriander on human appetite are warranted.

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### Conflict of interest

There is no conflict of interest in this study.

### References

- British National Formulary BMJ Group . 2009.
- Aftab K, and Sial AA. 1999. Phytomedicine New and old approach. Hamdard Med, 42: 11-15
- Anilakumar KR, Nagaraj NS, Santhanam K. 2001. Effect of coriander seeds on hexachlorocyclohexane induced lipid peroxidation in rat liver. Nut Res, 21: 1455-1462.

- Aruna K, Rukkumani R, Varma PS, and Menon VP. 2006. Role of Cuminum cyminum on ethanol and preheated sunflower oil induced lipid peroxidation. *J herbs, spices med plants*, 11: 103-114.
- Avecina A. 1992. *Ghanoon in Medicine* Tehran, Soroush Co.
- Banerjee S, Sharma R, Kale RK, and Rao AR. 1994. Influence of certain essential oils on carcinogen metabolizing enzymes and acid soluble sulfhydryls in mouse liver.
- Benzie IFF and Wachtel-Galor S. 2011. *Herbal Medicine: Biomolecular and Clinical Aspects*, 28 ed. CRC Press.
- Beutler B and Cerami A. 1986. Cachectin and tumour necrosis factor as two sides of the same biological coin. *Nature*, 320: 584.
- Blumenthal M, Goldberg A, and Brinkmann J. 2000. Coriander seed. *Herbal Medicine-Expanded Commission E Monographs, Integrative Medicine Communications*, Newton, MA 75-77.
- Brownie S. 2006. Why are elderly individuals at risk of nutritional deficiency? *Int J nurs practice*, 12: 110-118.
- Chandra RK, Imbach A, Moore C, Skelton D, and Woolcott D. 1991. Nutrition of the elderly. *CMAJ: Canadian Med Associat J*, 145: 1475.
- Chapman KM and Nelson RA. 1994. Loss of appetite: managing unwanted weight loss in the older patient. *Geriatrics*, 49: 54.
- Eikani MH, Golmohammad F, and Rowshanzamir S. 2007. Subcritical water extraction of essential oils from coriander seeds (*Coriandrum sativum* L.). *J food engin*, 80: 735-740.
- Emamghoreishi M, Khasaki M, and Aazam MF. 2005. *Coriandrum sativum*: evaluation of its anxiolytic effect in the elevated plus-maze. *J ethnopharmacol*, 96: 365-370.
- Esiyok D, Otles S, and Akcicek E. 2004. Herbs as a food source in Turkey. *Asian Pac J Cancer Prev*, 5: 334-339.
- Gray AM and Flatt PR. 1999. Insulin-releasing and insulin-like activity of the traditional anti-diabetic plant *Coriandrum sativum* (coriander). *Br J Nutr*, 81: 203-209.
- Homnick DN, Marks JH, Hare KL, and Bonnema SK. 2005. Long term trial of cyproheptadine as an appetite stimulant in cystic fibrosis. *Pediatric pulmonol*, 40: 251-256.
- Kardinal CG, Loprinzi CL, Schaid DJ, Curtis Hass A, Dose AM, Athmann LM, Mailliard J, McCormack GW, Gerstner JB, and Schray MF. 1990. A controlled trial of cyproheptadine in cancer patients with anorexia and/or cachexia. *Cancer*, 65: 2657-2662.
- Medhin DG, Bakos P, and Verzar-Petri G. 1986. Hypotensive effects of *Lupinus termis* and *Coriandrum sativum* in Anaesthetized Rats. A preliminary study. *Acta Pharm Hung*, 56: 59.
- MirHeidar H. 1992. *Coriandrum sativum*. *Applic Plants Prev Treat Illnesses*, 1: 247-252.
- Rajeshwari U and Andallu B. 2011. Medicinal benefits of coriander (*Coriandrum Sativum* L.). *Spatula DD*, 1: 51-58.
- Rakhshandeh H, Sadeghnia HR, and Ghorbani A. 2012. Sleep-prolonging effect of *Coriandrum sativum* hydro-alcoholic extract in mice. *Nat Prod Res*, 26: 2095-2098.
- Shen J, Nijjima A, Tanida M, Horii Y, Maeda K, and Nagai, K. 2005. Olfactory stimulation with scent of lavender oil affects autonomic nerves, lipolysis and appetite in rats. *Neurosci lett*, 383: 188-193.
- Srivastava Y, Venkatakrishna Bhatt H, Verma Y, Venkaiah K, and Raval BH. 1993. Antidiabetic and adaptogenic properties of *Momordica charantia* extract: an experimental and clinical evaluation. *Phytother Res*, 7: 285-289.
- Tipu MA, Akhtar MS, Anjum MI, and Raja ML. 2006. New dimension of medicinal plants as animal feed. *Pak Vet J*, 26: 144-148.
- Trease GE and Evans WC. 1996. Volatile oils and resins. *Pharmacognosy*, 14: 255-292.
- Usta J, Kreydiyyeh S, Knio K, Barnabe P, Bou-Moughlabay Y, and Dagher S. 2009. Linalool decreases HepG2 viability by inhibiting mitochondrial complexes I and II, increasing reactive oxygen species and decreasing ATP and GSH levels. *Chemico-biol interac*, 180: 39-46.
- VanNostrand J and Sarles CV. 2002. *Alewife's Garden: 7 Radical Weeds for Brewing Herbal Ales Radical Weeds*.
- Von Mühlendahl KE and Krienke EG. 1978. Toxicity of cyproheptadine. Side effects and

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- accidental overdose (author's transl)].  
Monatsschr Kinderheilkd, 126: 123.
- Zargar-Nattaj SS, Tayyebi P, Zangoori V, Moghadamnia Y, Roodgari H, Jorsaraei SG, and Moghadamnia AA. 2011. The effect of *Coriandrum sativum* seed extract on the learning of newborn mice by electric shock: interaction with caffeine and diazepam. Psychol res behav manag, 4: 13.
- Zargari A. 1991. *Coriandrum sativum* L. Herbal Med, 1: 586-590.