

The Effect of Fennel and Black Seed, on Breast milk, Prolactin Levels and Anthropometric Index in Human and Animal Samples: A Review

Farzaneh Barkhordari Ahmadi¹, Amir Pourghorban², Sara Kharghani³, Arash Rezaei Shahmirzadi⁴, Seyed Masoud Haghjoyan⁵, Omolbanin Heydari⁶, Fatemeh Babakhanian⁷, *Sara Ghahremani⁸

¹Mother and Child Welfare Research Center, Hormozgan University of Medical Sciences, Bandar Abbas, Iran. ²Department of Infection, Faculty of Medicine, Mashhad University of Medical Sciences, Mashhad, Iran. ³Department of Anesthesiology, Faculty of Medicine, Mashhad University of Medical Sciences, Mashhad, Iran. ⁴Medical Student, Student Research Committee, Golestan University of Medical Sciences, Gorgan, Iran. ⁵Student Research Committee, Bu-Ali Sina University, Hamedan, Iran. ⁶Students Research Committee, Razi School of Nursing and Midwifery, Kerman University of Medical Sciences, Kerman, Iran. ⁷Semnan Fazilat Institute of Higher Education, Semnan, Iran. ⁸Assistant Professor of Pediatrics, Department of Pediatrics, Faculty of Medicine, Mashhad University of Medical Sciences, Mashhad, Iran.

Abstract

Background: Breastfeeding is the best food for infants. Prolactin is combined with the corresponding receptors on the alveoli that produce milk, and milk production begins. We aimed to review the effect of fennel and black seed on breast milk, prolactin levels and anthropometric index in human and animal samples.

Materials and Methods: After selecting the keywords related to the research question, searching of the online databases (Medline, EMBASE, Scopus, Web of Science, SID and Magiran) were done. After reviewing the retrieved studies based on the title, abstract and full text, and related articles were selected according to the inclusion criteria.

Results: Ten studies were included into review. One study indicated the arousal serum levels of prolactin in lactating mothers using fennel. Four studies showed the fennel as alone or embodied in the herbal tea can increase breast milk. In contrast to the above four studies, a combination of fennel, anise, cumin, dill, parsley and fennel flower had no effect on breast milk volume and neonate weight gain. Two studies inspected the effects of fennel in animal studies. Although 140 and 280 μ L doses of fennel have significantly increased prolactin in comparison with 35 and 70 μ L g doses, this increment is not sufficient to increase breast milk and, subsequently, to elevate neonates weight with fennel to dairy goats have enhancement and reduction effect, respectively on performance and negative energy balance in early lactation. In another study, black seed improved milk production in cows, while it did not change composition of milk and prolactin.

Conclusion: Based on the results, fennel is recommended to increase breast milk, prolactin levels in lactating women.

Key Words: Animal, Anthropometric Index, Black seed, Fennel, Prolactin.

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Corresponding Author:

Sara Ghahremani, Department of Pediatrics, Faculty of Medicine, Mashhad University of Medical Sciences, Mashhad, Iran.

Email: ghahremanis@mums.ac.ir

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1- INTRODUCTION

A society's future depends on the health of its children. In the start-up phase, breast milk is the ideal food approximately encompassing beneficial nutrition attributes; due to its accessibility (1), appropriate temperature, freshness, immunity against bacteria and accordingly less intestinal disorders, it is the first-line suggestion for neonates. Breast milk is a golden standard of nutrition, which provides immunity for neonates. Successful breastfeeding depends on a number of physiological and psychological factors. Breastfeeding is efficient in a variety of infections, specifically gastrointestinal and respiratory infections and reduces neonatal death rate. Besides the immunity properties of breast milk, studies have indicated that it is cost-effective to the family as well as creates a close relationship between mother and neonate (2, 3).

Breastfeeding not only promotes health in infancy but also guarantees life and health in different stages of life, namely adolescence, adulthood, middle age and even senior years (4). Poor breastfeeding is the most common cause of no breastfeeding, and a decline in breastfeeding can occur in many situations, such as premature birth, mother or neonate's illness, resulting in the separation of the neonate, anxiety and emotional stress in the mother. All of these conditions act as lactation failure. Milk production can be increased in several ways, such as psychological support and relaxation techniques. However, many mothers seek the guidance of their physicians by requesting medical products to increase breast milk supply (5). Despite these benefits, the prevalence of breastfeeding is relatively low, especially in several high-income countries in North America and Europe, where only 40% of mothers breastfeed their baby six months after birth (6). One of the treatment

approaches for inadequacy of breast milk is to use chemical drugs, including mitochromamide, domperidone, sulfur, and cytochrome accommodating with side effects (7). Medicinal herbs have been used for thousands of years not only as food but also as powerful medicines all over the world (8). The use of medicinal plants, especially in Asian countries, is increasingly growing (9). Fennel (*Foeniculum vulgare*) has been used in traditional medicine for thousands of years in East Asian countries, India and China (10). Siah et al. (2009) showed that aqueous extract of fennel was effective on prolactin secretion in female rats (10). Shirafza is defined as a kind of medicine or herb that initiates, induces and maintains milk production (11).

Several chemical medicines and herbal remedies have been prescribed as Shirafza. However, chemical drugs such as domperidone or metoclopramide potentially result in side effects such as arrhythmia or hypothyroidism in mothers and children. This is why herbal fats such as fennel, anise, barley, milk thistle or garlic are more popular for increased lactation and among these herbal compounds; fenugreek is probably the most consumed (6). A study by Shariati et al. (12) in 2004 on the effect of using Shirafza drops (including alcoholic extract of six herbs including fennel, anise, cumin, dill, parsley and black seed) by breastfeeding mothers on the weight of 0- to 6-month-old neonates exclusively breastfed. The results of this study indicate no significant effect on neither the milk volume nor the neonate's weight progress. However, the study conducted in 2013 by Dehkhoda et al. showed that Shirafza tablets containing fennel cause enhancement in mother's milk and consequently increment in neonate weight (9). According to the results of a clinical trial, the positive effect of fenugreek seed and fennel seed on improving lactation

adequacy in breastfeeding mothers was observed (7). According to a UNICEF report, 2 percent of children in the world are breastfed and breastfeeding by the age of 6 months (14). According to the WHO guidelines, about 5% of mothers should be able to breastfeed exclusively with their babies up to 6 months (15). According to a previous study, exclusive breastfeeding rates in rural areas of Iran are 58% and 29% at four and six months; while in urban areas these are reported 56% and 27%, respectively (16). Limited review studies and low level of exclusive breastfeeding impel the researcher to conduct review studies in this area. Henceforth, the current study aimed to review studies on the effect of fennel and black seed on breast milk and prolactin and anthropometric index in human and animal samples.

2- MATERIALS AND METHODS

In this review, the following databases were searched for relevant papers and reports: Medline, Scopus, EMBASE, Web of Science, SID and Magiran. Key references from extracted papers were also hand-searched. Terms to evaluate the texts and websites, the singular or combination forms of the following keywords were used to search for the relevant literature: (Black Seed OR Black Caraway OR Black Cumin OR Kalonji OR Black Onion Seed OR Fennel OR *Foeniculum vulgare*) AND (Milk, Human OR Breast Milk OR Prolactin OR Anthropometric Index), and equivalent Persian words using bulletin index such as AND, OR.

Included articles were: all Persian and English randomized control trial, and non-randomized prospective or retrospective clinical studies, which have the mentioned keywords in the title and abstract and related to the purpose of the research, published to end-December 2019, that used fennel and black seed as a galactagogue plants on breast milk and prolactin levels in human and animal

samples. We also excluded articles with incomplete data. From other languages, 10 studies were ultimately included in this review. The procedure of the search and selection of studies appeared in study selection was done by two reviews.

3- RESULTS

Ten studies were included in this study, four in the animal domain (9, 10, 17, 18), and six in the human domain (7, 12, 13, 16, 19, 20).

3-1. Effect of Fennel and Black Seed on Animal studies

In the first study, 75 adult Wistar rats, 2 to 3 months old (approx. 200-180g) were used. Animals were divided into 4 experimental and one control group. Four experimental groups received 35, 70, 140 and 280 μ L doses of aqueous extract of fennel seed for 5, 10 and 15 days, respectively. Simultaneously, the control group received intraperitoneal (IP) saline. According to the results of hormonal assay, the prolactin level in Wistar rats is normally 7, 3 - 13, 23 ng/ml. Injection of the aqueous extract of fennel seed did not alter this range.

However, 140 and 280 μ L doses showed a significant increase in comparison with 35 and 70 μ L doses in this range, this increase in prolactin was not sufficient to increase breast milk and, consequently, to increase neonatal weight (10). In the second study, researchers evaluated the effects of fennel seed meal supplementation with corn or barley, digestibility, ruminal fermentation and some blood parameters of Mahabadi goats during the transition period. Twenty-four pregnant goats randomized design for two months from 30 days left to expected delivery time to 30 days postpartum were fed with two levels fennel (0 and 10 g daily) and two types of grain (corn and barley). Daily changes in body weight, daily milk production, and dry matter intake were assessed. Augmenting fennel

to dairy goats can improve performance and reduce negative energy balance in early lactation (17). In third study, the effects of aqueous and ethanolic extracts of *N. sativa* seeds (fennel) on milk production in rats were evaluated. The measurement of milk production was done by measuring pup weight during suckling period. The intraperitoneal LD50 values of aqueous and ethanolic extracts of *N. sativa* were 4.23 and 4.9 g/kg, respectively. The aqueous (0.5 g/kg) and ethanolic extracts (1 g/kg) increased milk production significantly ($p < 0.001$). It is concluded that aqueous and ethanolic extracts of *N. sativa* can stimulate milk production in rats (18). In a randomized design conducted on Holstein cows, black seed improved milk production in cows, while it did not change composition of milk and prolactin (9).

3-2. Effect of Fennel and Black Seed on human studies

In 2013, Honarvar et al. conducted a study on the effect of fennel on serum prolactin levels in lactating mothers, which showed that fennel causes a rise in the serum levels of prolactin in lactating mothers. Mean serum prolactin level before and after intervention was 64.55 ± 32.06 ng/ml and 95.55 ± 65.90 ng/ml, respectively (19). In the second study, group 1 consisting of twenty-one control mothers underwent the same advice on supportive measures, while group 2 consisting of thirty-two mothers received fruit tea [Lemon Grass (*Cymbopogon citratus*), goat's rue (*Galega officinalis*), fennel (*Foeniculi vulgare* Mill), anise (*Pimpinella anisum*), caraway (*Carum carvi* L.), melissa (*Melisa officinalis* L.), and stinging nettle (*Urtica dioica* L.)] for a week. High production of milk from 1st to 7th day was observed in mothers who had utilized herbal tea mixture, 30% and 80% in the control group, and the treatment group, respectively ($P=0.000$). The two groups did not show any statistically meaningful

difference in the neonate's weight gain (20). In the third study, they haphazardly allotted neonates in two intervention groups in which herbal tea mixture of fennel seed powder (7.5 g) plus black tea (3 g) was utilized three times a day and control groups in which herbal tea mixture of black tea powder (3 g) was consumed three times a day. After the fourth week, the fennel caused significant weight gain from 5261.0256 ± 1167.65801 to 6393.3333 ± 1083.42132 ; increased head circumference from 38.6103 ± 2.20033 to 40.1538 ± 2.00510 ; increase wet diapers from 5.5000 ± 1.05131 to 8.5421 ± 1.21182 ; heightened excretion times from 1.7692 ± 1.03139 to 2.6410 ± 1.14655 , and increased the number of breastfeeding times from 9.9359 ± 1.85380 to 16.7399 ± 1.63766 ($P < 0.001$), but no effect on height was seen ($P = 0.066$) (16).

In a fourth study in Mashhad (Iran) that assessed the effect of Shirafza drops on 158 lactating mothers who were exposed to milk deficiency, a clinical trial and a prospective study were conducted with two groups of Shirafza consumers (fennel, anise, cumin, dill, parsley and black seed), and placebo (control group). The results of this study were recorded weekly by measuring the weight, height and circumference of neonate's head. In this study, Shirafza did not affect breast milk volume and neonate weight gain (12).

In a fifth study, in another clinical trial to assess the adequacy of breast milk, 117 mothers with 0- to 4-month-old neonates were allocated to three groups receiving fenugreek seed powder, fennel powder placebo and placebo. The results of this study showed a positive effect of fenugreek and fennel seed on improving lactation adequacy through positive anthropometric indices, number of wet diapers, number of excretion times, and elevated number of breastfeeding times (7). In the sixth study, 60 preterm neonates hospitalized in NICU of Alzahra hospital

(Tabriz, Iran), were randomly put in two groups of 30. The mothers of infants in the control group received customary training and support about relactation; while the intervention group received customary training as well as the designated instructive and supportive relactation program including breast pumping, enhancing milk agents (daily tablets of metoclopramide 10 mg and Shirafza tablets [contain fennel (*Foeniculum vulgare*), cumin seed (*Cuminum cyminum*), fenugreek (*Trigonella foenum-graecum*), dill (*Anethum graveolens*)]), and kangaroo mother care. The intervention groups showed more weight gain in comparison with the control groups (13).

4- DISCUSSION

This study aimed to review the effect of fennel and black seed on breast milk, prolactin levels and anthropometric index in human and animal samples. Ten studies were included into review. Five studies showed the fennel alone or embodied in the herbal tea can increase breast milk and neonatal anthropometry (7, 13, 16, 18, 20). In contrast to the above four studies, a combination of fennel, anise, cumin, dill, parsley and fennel flower had no effect on breast milk volume and neonate weight gain (10, 12, 17, 20). In one study on Holstein cows, black seed improved milk production in cows, while it did not change composition of milk and prolactin (9). Three studies inspected the effects of fennel and black seed in animal studies. Although 140 and 280 doses of fennel have significantly increased prolactin in comparison with 35 and 70 doses, this increment is not sufficient to increase breast milk and, subsequently, to elevate neonates weight with fennel to dairy goats have an increase and a reducing effect respectively on performance and negative energy balance in early lactation (10, 17). In a randomized design conducted on Holstein cows, black seed improved milk

production in cows, while it did not change composition of milk and prolactin (9). Approximately four million (mostly in developing countries) neonates die annually. According to the studies, this rate could be decreased by 1.3 million cases by exclusive breastfeeding in the first six months, continuing to one year. The undeniable importance of breastfeeding to the health and vitality of mother and neonate is universally accepted (2, 3). As stated by the American Academy of Pediatrics in 1997, breastfeeding is the gold standard for breastfeeding and healthy neonates, and in most cases should be the only diet that is breastfeeding up to six months after birth (4). The unique benefits of breastfeeding have led to the introduction of breastfeeding and education as part of child growth and survival policies since the early 1330s (UNICEF) (16).

Furthermore, the transmission of reinforcing immunity, communicating fluent mental relation between mother and neonate, adjusting protein and other nutrients for the neonate and providing the most required minerals are some advantages of breastfeeding for neonates, which consequently provide the most appropriate growth charts in children. On the other hand, mothers can take advantage of breastfeeding too, in that it decreases postpartum hemorrhage, reduces the ovary and breast cancer, has an important part in adjusting the body's function and osteoporosis reduction in mothers. The neonates who are breastfed show less diarrhoea, intestinal bleeding, milk reflux, colitis, atopic eczema, and low rate of asthma, obesity, and diabetes (3, 21). East Asian countries, India and China have utilized fennel in traditional medicine for thousands of years for the treatment of disparate diseases. Aromatic fennel is an herb one to two meters high, broad leaves and it is divided into thin and spiky pieces. There are distinct longitudinal lines on its

detected branches (1). The overall appearance of this plant is very similar to dill in terms of its leaves but is more aromatic, and its flowers are a compound umbrella. Fennel seed has a slender, cylindrical appearance and its dimensions vary according to plant growth. Its surface has no fuzz; the grooves are light green and sometimes yellow in some cases. Fennel contains a little mucilage, sugar content, up to 5% oil and up to 5% essential oil. It also contains minerals and fatty acids. People have been familiar with the fennel plant for a long time. In the Middle Ages, chewing the seed of this plant was an acceptable way to relieve abdominal noise during the formal ceremony. Many of the older herbal remedies have mentioned the properties of fennel seeds in helping to strengthen the eye (10). The mechanism of the effect of black seed extract on blood serum prolactin and milk production is similar to that of rosemary. In the case of Hosseinzadeh et al., milk production from day 6 lactation was significantly higher in rats treated with black seed extract. The study showed that the aqueous (aqueous and ethanolic) extract of black seed stimulated milk production by increasing prolactin (18).

5- CONCLUSION

Ten studies were included into review. Five studies showed the fennel alone or in herbal tea can increase breast milk and neonatal anthropometry. In contrast to the above four studies, a combination of fennel, anise, cumin, dill, parsley and fennel flower had no effect on breast milk volume and neonate weight gain. In one study on Holstein cows, black seed improved milk production in cows, while it did not change composition of milk and prolactin. According to the results of this study, fennel is recommended to increase

breast milk and prolactin levels in lactating women.

6- CONFLICT OF INTEREST: None.

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