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Improvement of sperm parameters and achievement of pregnancy in idiopathic male infertility using *Daucus carota* L. seed extract: A Case Report based on Persian Medicine

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Abstract

Background: Male infertility is one of the main diseases in medicine, causing marital, economic, and public problems in patients. Idiopathic male infertility is a condition in which sperm parameters are abnormal without a specific cause and has no specific standard treatment. After all, many current treatments have side effects and are expensive or invasive.

Antioxidants are considered one of the non-invasive and cost-effective treatments that are commonly prescribed by specialists in this field. Herbal antioxidant remedies can also bring about better sperm quality and be useful to infertile patients. One of the medicinal plants available in the references of Iranian medicine to help treat infertility and improve the quality of semen is the Zardak (*Daucus carota* L. var. carota). Zardak and its seed contain large amounts of phenols and flavonoids that have antioxidant effects. Additionally, Zardak is used in sources of traditional Iranian medicine as a brain, heart, and liver tonic, which can help male fertility through improving body health.

This study is a case report of idiopathic infertility that lasted for 3 years. A 36-year-old, non-smoking, overweight male case was referred to a traditional Iranian medicine clinic by a urologist due to idiopathic infertility. The patient underwent various drug treatments for 3 years before the referral, which did not change the parameters of semen or pregnancy. The patient received the dry extract of *Daucus carota* L. seeds for 3 months. All semen parameters improved after the intervention.

In this study, following the treatment of the male case suffering from idiopathic infertility by receiving dried *Daucus carota* L. seed extract, his wife became pregnant in the 8th week after starting the treatment. In conclusion, using *Daucus carota* L. seed can be suggested as another treatment for the management of idiopathic male infertility.

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Introduction

Infertility is defined as the inability to become pregnant after 12 months or more of unprotected sex, affecting 50-80 million couples globally (1). Infertility can cause psychosocial and economic impacts in couples (2). Male factors contribute to 40-50% of cases, with idiopathic etiology accounting for > 50% (3). Despite advances, standardized treatments remain elusive (4). Due to the unknown and non-homogeneous causes of male factor infertility, its management is still unclear, expensive, difficult, and sometimes impossible in many cases (5).

Assisted reproductive technology (ART) and drug treatments, such as hormone therapy and antioxidant combinations (Including nutritional supplements), are the two main treatment approaches for male factor infertility that are widely used today (6). However, it should be noted that ART is an invasive and expensive process with a low success rate (7). Therefore, both patients and therapists prefer drug treatments more (8).

One of the drugs used in Persian medicine as an aphrodisiac improving the condition of semen is Zardek (*Daucus carota* L. var. carota) or Persian carrot (9,10). Zardek belongs to the Umbellifers (Apiaceae) family (10). *Daucus carota* seed contains terpene compounds, monoterpenes, sesquiterpenes (11), and polyphenols with antioxidant and anti-inflammatory effects (12). Antioxidants can lead to the improvement of sperm activity and safety (5). Various oxidants can reduce sperm production, motility, and morphology, cause an imbalance between the production of reactive oxygen species (ROS) and antioxidant capacity, and lead to infertility (13). This case study reports the efficacy of *Daucus carota* L. seed extract in improving semen parameters in idiopathic infertility. The patient's spouse achieved a natural pregnancy within 8 weeks.

Case presentation

A 36-year-old non-smoking male (Body mass index [BMI]: 28), with a 6-year history of marriage and 3 years of conventional infertility treatments, presented with primary infertility. According to Persian medicine, the diagnosis was based on a cold and wet (Sard-o-tar) temperament imbalance in his body. The patient worked as a driver and had a sedentary lifestyle with minimal physical activity. There was no history of exposure to radiation, toxins, or excessive computer use.

The couple had been trying to conceive for 3 years, during which he took supplements, including vitamins E and C, L-carnitine, omega-3, and zinc, during the first 3 years, but without any effect. His medical history revealed no childhood mumps and no history of smoking, alcohol consumption, drug abuse, or surgical interventions in any organ. Apart from infertility, his medical background was unremarkable. Liver function tests were within normal limits, and his diet remained unchanged during the course of treatment.

The patient's wife was evaluated by a gynecologist and showed no abnormalities. After an initial urological examination and relevant workup, the patient was diagnosed with idiopathic infertility and underwent a 3-month treatment course with *Daucus carota* L. Seed Extract according to traditional recommendations. Before and after 3 months of treatment, semen analysis was conducted in the same laboratory with the same method and technicians (Table 1). Semen analysis was performed in the same lab with the same methodology and technicians before and after 3 months of treatment (Table 1). The criteria were used to evaluate the semen parameters.

Table 1. Semen parameters before and after intervention

Sperm parameters	Before intervention	After intervention
Volume	3 ml	3 ml
pH	7.2	7.2
Quantity	72 million	402 million
Concentration	24 million/ml	128 million/ml
Progressive motility	25%	33%
Total motility	28%	46%
Normal morphology	19%	22%

According to the World Health Organization's (WHO) standards for normal semen parameters since 2010, the normal values are defined as follows: a semen volume of at least 1.5 mL, sperm concentration of at least 15 × 106/mL, total motility of at least 40%, and sperm morphology (Normal forms) of at least 4% (14). Table 1 displays the outcomes of spermatograms performed prior to the intervention. Additional lab tests, including those for prolactin, testosterone, follicle-stimulating hormone (FSH), luteinizing hormone (LH), and thyroid-stimulating hormone (TSH), were all within normal ranges (Table 2).

Table 2. Hormones before intervention

Marker	Result	Normal range
TSH	3.6 mlu/ml	0.3 - 4
Testosterone	3.2 ng/ml	2.27 - 10.3
LH	2.8 mlu/ml	1.7 - 12
FSH	4.1 mlu/ml	1.1 - 7
Prolactin	7.1 ng/ml	2.1 - 17.7

Abbreviations: TSH: Thyroid-Stimulating Hormone; LH: Luteinizing Hormone; FSH: Follicle-Stimulating Hormone

Before starting traditional medicine, all medicines were stopped for 3 months. The patient underwent the assessment of medication side effects and monthly clinical examinations. Liver function tests were also conducted at the beginning of the intervention and at the conclusion. At the conclusion of the intervention, liver function tests were within the normal range. The pair opted to undergo a course of traditional medicine, although the woman underwent the ovulation procedure and the ova were maintained at "Nahal Center of the Infertility in Sayad Shirazi Hospital of Gorgan" in Golestan, Iran.

For 3 months, the patient took two 500 mg capsules of dried *Daucus carota* L. seed extract powder twice daily. The subject has given their written consent. The treatment was not associated with any side effects. The patient's sperm parameters greatly improved 3 months after the start of the treatment. In the 8th week of treatment, the pregnancy occurred spontaneously without the use of reproductive technologies, such as in vitro fertilization (IVF).

Discussion

There is no established therapy to enhance sperm characteristics in idiopathic infertility (14). However, the use of empirical medical treatments, such as hormone therapy and antioxidant therapy (15), plays a significant role in the management of idiopathic male infertility (16). Treatment with the herbs and conventional treatments (e.g., vitamins E/C, L-carnitine, zinc, and selenium) (17) was shown to significantly improve the sperm quality of infertile patients in spermogram in certain studies (18,19). Additionally, some herbal remedies, including Sesamum indicum (20), Crocus sativus (18), Withania somnifera (1), Alpinia officinarum (21), and Medicago sativa (22), have been said to be efficient in sperm parameters, especially their antioxidant actions.

In traditional Persian medicine, herbal treatments, such as *Daucus carota* L., were used as aphrodisiacs and infertility cures (9,23,24). In the present case, a male patient with unexplained infertility was treated using dried *Daucus carota* L. seed extract powder. The patient's sperm motility, count, and morphology were also improved, and the patient's wife became pregnant without the need for assisted reproductive procedures, such as IVF.

For healthy sperm function and fertilizing ability, a specific amount of ROS is necessary. Increased ROS in seminal fluid might be one of the primary causes of damage in spermatogenesis and the male reproductive system (25), which can lead to male infertility and be considered the failure of ART (26). *Daucus carota* L. seed contains terpene compounds, such as granyl acetate, cedarone, and azarone, which are present in its volatile oil as oxygenated monoterpenes and sesquiterpenes (11). In addition to alkaloids and a variety of steroids, it includes flavonoids, coumarins, and other polyphenolic molecules, all of which have antioxidant properties (12).

Recent research has demonstrated that the polyphenolic substances found in *Daucus carota* L. seed, such as flavonoids, hydroxycinnamic acid, and anthocyanin, are helpful in addressing infertility (27,28). The retention time of standard quercetin, as determined by high-performance liquid chromatography (HPLC) chromatogram, was 25.21 minutes; however, it was reported as 25.22 minutes at 270 and 360 nm. According to the present study, the concentration of quercetin was 8.2 mg per gram of dried carrot seed dry extract. Therefore, the improvement in semen parameters brought about by dried *Daucus carota* L. seed extract powder might be due to its ability to scavenge the ROS that harm the lipid and protein composition of sperm (29). In future studies, the ROS content of the semen should be measured both before and after the treatment, since it was impossible to determine it for this case.

Conclusion

In this study, the semen parameters of a male patient, particularly sperm count, motility, and morphology, improved following the treatment with *Daucus carota* L., and pregnancy occurred in the case's spouse. In studies aimed at finding effective treatments and achieving better outcomes in managing idiopathic male infertility, the use of herbal and traditional medicine alongside modern medical treatments can increase the chances of therapeutic success.

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Ethical statement

The code of ethics for this study was approved by Golestan University of Medical Sciences (IR.GOUMS.REC.1400.319) and subsequently registered under Clinical Trial Registration Number: IRCT20210911052430N1 in Iran's clinical trials registry.

Conflicts of interest

None declared.

Author contributions

Abolhasan MousaviKhorshidi: The provision of study patients; Conduction of the study; Writing, Review, and Editing. Fatemeh Kolangi: Project administration, Supervision, and Editing of the original draft.

Data availability statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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