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A Systematic Review of the Most Important Medicinal Plants Native to Iran Effective on Testicular Morphology and Hormonal Testicular Function

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Abstract

Reproductive disorders and infertility are complicated disorders with different types of consequences including medical and psychological. Infertility affects both women and men. Evidence indicates that half of the infertility is due to male factor infertility. Using medicinal plants that are effective on the reproductive disorders and infertility is considered a suitable therapeutic approach. In this review, the search terms testicle, spermatogenesis, and medicinal plants were used to retrieve relevant publications in the databases including PubMed, Scopus, Google Scholar, and SID. This review focused on animal studies on the effect of medicinal plants on testicular morphology and hormonal testicular function. According to the findings, several herbal plants are effective on the testicular tissue, the physiology of the testicles, and hormonal testicular function. Bioactive compounds and antioxidant study has plants that have therapeutic effects on the tissue and testicular physiology.

Keywords: Testicle, spermatogenesis, testicular function, plant, Iran

INTRODUCTION

Humans are exposed to certain agents in living and work environments that can threaten their reproductive system function [1]. Reproductive disorders and infertility are complicated disorders with different types of consequences including medical and psychological [2]. Infertility affects both men and women. Evidence indicates that half of the infertility is due to male factor infertility [3]. Male reproductive system consists of testicles, genital tract, appendix glands, and external genitals. External genitals include endocrine and exocrine glands. Exocrine glands release sperm and endocrine glands do testosterone, i.e. male sex hormone [4]. Spermatogenesis refers to conversion of spermatogonia into spermatozoa in the testicles. In mature testicle, with development of sertoli cell cytoplasm around the germ cells, it is necessary to feed and maintain these cells and establish cellular communication throughout spermatogenesis process [5]. Impaired serum LH and FSH levels can lead to impaired serum testosterone level that causes certain changes in the spermatogenesis [6].

Urinary and reproductive system disorders is one of the problem of today's medical sciences which their treatment is important [7-10]. Medicinal plants are not only a food source [11,12] but are also considered an available source of drugs and supplements [13-18]. Historically, the research and use of medicinal plants and nature-based products has been on rise [9-11]. Because chemical drugs cause side effects, much research has been conducted to investigate the use of plant-based pharmaceutical products [12-14]. Currently, development of various types of herbal drugs and their pharmaceutical effects are being studied [15,16]. Medicinal plants can exert potent antioxidant effects due to certain compounds such as polyphenols [15-18]. Because chemical drugs cause many side effects, the use of medicinal plants has attracted much attention in different countries including Iran where rich sources of plants are available [11-19]. The optimal effects of medicinal plants have been investigated in boosting fertility and treating different disorders such as prostate inflammation, oligospermia, low sperm motility, hormone imbalance, impotence, and varicocele [18,19]. In Iran, numerous medicinal plants are used to treat infertility and testicular disorders. The aim of this review was to report the findings of animal studies on medicinal plants' effects on hormonal testicular function and testicular tissue.

METHODOLOGY:

In this review, the search terms testicle, spermatogenesis, and medicinal plants were used to retrieve relevant publications in the databases including PubMed, Scopus, Google Scholar, and SID.

RESULTS:

The number of identified plants

Based on the results, 24 medicinal plants are used as antimicrobials for treatment of testice.

Additional information on medicinal plants

Medicinal herbs with remedies effects on testice along with their km information are shown in Table 1.

Table 1. Herbal plants effective on physiology and histology of testice

Row	Botanical name	Family	Persian name	Main findings	Reference
1	*Centella asiatica* (L.) Urban.	Apiaceae	Ab-boshghabi	A study with male Wistar rats demonstrated that testosterone concentration was 16.4±2.8 and 14.1±0.09 nm/l in control and sham groups, respectively, and 15±1.32, 9.8±0.05, and 8.4+0.31 nm/l in experimental groups treated with 10, 50, and 80 mg/ml *C. asiatica* extract, respectively.	[19]
2	*Ferula asafoetida*		Anghouzeh	An experimental study on rats demonstrated that testicular weight was not significantly different among different treatments. Increasing *F. asafoetida* dose caused decrease in the thickness of the seminiferous cell layers. The number of Leydig cells and Sertoli cells decreased in rats treated with 150 and 300 mg/ml *F. asafoetida* gum extract. *F. asafoetida* gum extract caused decrease in blood testosterone level compared to control treatment. This study showed that over 150 mg/ml *F. asafoetida* extract caused degradation of spermatogenesis tissue.	[20]
3	*Plantago major*	Liliaceae	Barhang	A study demonstrated that treatment with *P. major* leaf extract caused significant increase in testosterone concentration and sperm number compared to other group. *P. major* can help to boost infertility through improving spermatogenesis in diabetic mice.	[21]
4	*Dorema aucheri*		Bilhar	Four hundred mg/kg hydroalcoholic *D. aucheri* extract helped to improve spermatogenesis and increase sperm number in rats.	[22]
5	*Vitex Agnus Castus*	Verbenacea	Panj-angosht	An experimental study with mice demonstrated that *V. agnus castus* fruit extract caused decrease in LH and testosterone compared to control group. This observation was most marked when 365 mg/kg of the extract was administered.	[23]
6	*Allium cepa*	Liliaceae	Piaz	A study with adult male BALB/c mice showed that the mean internal diameter of seminiferous tubules in the experimental group increased significantly compared to the control group (56.32±1.42 µm vs. 31.27±3.16 µm). In addition to affecting the structure of the seminiferous tubules, treatment with raw *A. cepa* extract affected cell proliferation in the mice's seminiferous tubules and accelerated spermatogenesis compared to the controls.	[24]
7	*Dactylorhiza Lancibracteata*		Saalab	A study with adult male BALB/c mice showed that aqueous *D. lancibracteaca* root extract caused increase in mean LH level in experimental group (0.6±0.9) compared to placebo (0.39±0.006) and control (0.38±0.007) groups.	[25]
8	*Camellia sinensis*		Chaye-sabz	A study on adult male NMRI mice reported that hydroalcoholic *C. sinensis* extract caused significant decrease in sperm number, motility, viability, and normal morphology as well as significant decrease in seminiferous tubule diameter and germinal epithelial thickness in mice treated with sodium arsenite compared to control group.	[26]
9	*Launaea acanthodes*	Asteraceae	Charkheh	An experimental study with male Wistar rats showed that 300 mg/kg aqueous *L. acanthodes* caused significant increase in progressive motility percentage, normal morphology, and number of sperm in diabetic rats.	[27]
10			Khorma	A study with Wistar rats showed that serum testosterone level decreased significantly in groups treated with 0.05 and 0.1 g/kg extract compared to control group.	[28]
11	*Cinnamomum zeylanicum*		Darchin	An experimental study with mice reported that LH and FSH concentrations increased with increase in the dose of hydroalcoholic *C. zaylanicum* extract up to 200 and 400 mg/kg. Fifty and 100 mg/kg hydroalcoholic *C. zaylanicum* extract caused increase in serum testosterone level compared to control group.	[29]
12	*Berberis integerrima*	*Berberidaceae*	Zereshk-afshan	A study showed that 6-week treatment with 500 mg/kg body weight *B. integerrima* extract caused increase in testosterone level.	[30]
13	*Crocus sativus* L.		zafaran	A study with laboratory mice reported that primary spermatocytes number increased significantly in group treated with 100 mg/kg *C. sativus* for 48 hours.	[31]

Row	Botanical name	Family	Persian name	Main findings	Reference
14	*Zingiber officinale*		Zanjabil	A study on *Z. officinale* extract effect on male mice demonstrated that this extract caused significant increase in blood testosterone level, decrease in testicular malondialdehyde, and increase in antioxidant enzymes activities in the testicles (*P* 0.05). According to the findings, testicular structure and spermatogenesis process were normal in the mice treated with *Z. . officinale* extract.	[32]
15			Soya	Administration with 30, 60, and 120 mg/kg hydroalcoholic soybean extract caused no adverse effects on body weight, gonads structures, testicular function parameters, and histometric parameters. Soybean extract caused significant decrease in plasma LH level, decrease in germinal epithelium length and reproduction coefficient. Histological examinations showed no adverse effects on testicular tissue.	[33]
16	*Anethum g*		Shevid	An experimental study on hydroalcoholic *A. graveolens* seed extract effects on testicular tissue and spermatogenesis showed that testicular weight and volume decreased significantly in experimental groups compared to control group, but no significant difference was observed in the weight of epydidym and defran cannal between the experimental groups and the control group. Seminiferous tubules diameters decreased significantly in the experimental groups compared to control group. The number of spermatogonia and primary spermatocytes decreased significantly compared to the control group. The number of sperm and spermatids decreased *significantly* compared to the control group only when 100 mg/kg *A. graveolens* extract was administered.	[34]
17	*Aloe vera*		Sabre-zard	An experimental study with rats demonstrated that 400 mg/kg body weight hydroalcoholic *A. vera* extract caused increase in the number of spermatogonia, Sertoli cells, and Leydig cells in the testis in the diabetic rats.	[35]
18	Calligonum		kaligonum	Thirty mg/kg calligunum extract caused significant improvement of sperm parameters such as motility, viability, and normal morphology in male mice.	[36]
19	*Cucurbita pepo* L.		Kado-tanbal	The use of 40% and 8% of *C. pepo* caused increase in the number of spermatogonia, primary spermatocytes, and spermatids.	[37]
20			Gerdou	A study with male Wistar rats demonstrated that 10-50 mg walnut kernel extract exerted effects on the progression and continuation of spermatogenesis till final steps and increase in Leydig cells and sperm in testicular tissue, but no remarkable effects on the seminiferous tubules tissue structure.	[38]
21	*Heracleum persicum*	Umbelliferae	Golpar	Alcoholic *H. persicum* extract (0.1, 0.2, and 0.4 g/kg) caused significant decrease in serum testosterone level in treated groups compared to control group.	[39]
22	*Carthamus tinctorius*		Golrang	Intraperitoneal administration with 1.4 and 8.2 mg *C. tinctorius* extract per day for 20 days caused significant increase in testosterone concentration.	[40]
23	*Capparis spinosa*	Capparidaceae	Logji	Thirty mg/kg hydroalcoholic *C. spinosa* extract caused significant increase in sperm motility and normal morphology in male rats.	[41]
24	*Salvia officinalis*	Labiatae	Maryam-goli	Treatment with 150 and 200 mg/kg *S. officialis* extract caused significant increase in serum testosterone level, seminiferous tubules diameters, and sperm number in the tubes tunnels in male Wistar rats.	[42]

DISCUSSION

Infertility refers to the failure to conceive after 12 months or more of regular unprotected sexual intercourse. Global statistics show that 15% of young couples suffer from infertility. In Iran, the prevalence of infertility was reported to be 13-18.5%, which is approximately similar to the global statistics. The causes of infertility are widely various including infectious causes such as genital tuberculosis, as well as inflammation, hormone causes, low sperm count, sterility, congenital causes, medications, trauma, and endocrine disorders. The mechanism by which these plants enhance the chance of fertility is not clear. However, these plants mostly have phenolic compounds especially flavonoid compounds which both have shown to possess

antimicrobial and anti-inflammatory activities [43-65]. Furthermore, high oxidative stress is also associated with increase in the chance of infertility and flavonoids have antioxidant activities [66-74]. The compounds with antioxidant activity are able to scavenge free radicals, preventing organ damage [75-87]. There are a lot of other plants which have flavonoid compounds with antioxidant activity [88-100]. Other natural methods are also accepted and acknowledged by people [101].

CONCLUSION:

Therefore, these plants may also have anti-fertility activity which worth examining. This is due to the active pharmaceutical ingredients in the herbal plants

AUTHORS CONTRIBUTION

This work was carried out in collaboration among all authors.

CONFLICT OF INTEREST

The authors declared no potential conflicts of interests with respect to the authorship and/or publication of this paper.

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