

Herbal Medicines and Natural Products

Authors : Indrani Sonar¹, Mohit Sharma¹, Rajeev Kumar², Deepika Biswas²

¹ D. Y. Patil Vidyapeeth, Pune

² Combined Institute of Medical Sciences and Research, Dehradun

Corresponding Author

Deepika Biswas

biswas.deepika89@gmail.com

Herbal Healing for PCOS (Polycystic Ovary Syndrome): Embracing Nature's Wisdom for Hormonal Harmony!

KEY POINTS :

Understanding PCOS: Polycystic Ovary Syndrome (PCOS) is a hormonal disorder that affects females, primarily during their reproductive years. It is one of the most common endocrine disorders among women of childbearing age.

Role of Herbal Remedies: Herbal remedies play a significant role in the management of Polycystic Ovary Syndrome (PCOS) by offering potential benefits in alleviating symptoms and improving overall health. While herbal remedies may not cure PCOS, they can complement conventional treatments and lifestyle modifications.

Herbal Properties: There are several common herbs used in the management of Polycystic Ovary Syndrome (PCOS) along with their key properties.

Common Herbal Remedies: Aloe Vera , Cinnamon, Garlic, Ginger, Fennel

Clinical Evidence: Research on the clinical effectiveness of herbal remedies for Polycystic Ovary Syndrome (PCOS) is ongoing, and while some studies have shown promising results, more robust evidence is needed

Herbal / Polyherbal Formulations: Herbal and poly herbal formulations refer to products that contain a combination of herbs or plant extracts, often formulated to address specific health conditions or symptoms. These formulations are commonly used in traditional medicine systems, such as Ayurveda, Traditional Chinese Medicine (TCM), and Western herbal medicine.

Lifestyle Considerations: Lifestyle considerations play a crucial role in managing Polycystic Ovary Syndrome (PCOS) and can help alleviate symptoms, improve overall health, and reduce the risk of long-term complications.

Consultation and Safety: Consultation with a healthcare provider and prioritizing safety considerations are essential before using herbal medicines for the management of Polycystic Ovary Syndrome (PCOS).

POLYCYSTIC OVARY SYNDROME

PCOS is a complicated hormonal condition that primarily affects women who are fertile. It affects between 5–10% of women in reproductive age globally, making it one of the most prevalent endocrine diseases in this demographic. It is a complex condition which can be represented by high testosterone levels, irregular menstruation, or tiny cysts on one or both ovaries. [Umland EM, et. al., 2011] The disorder may be primarily

biochemical(hyperandrogenemia) or morphological (polycystic ovaries).PCOS is mostly treated symptomatically with lifestyle changes and drugs including antiandrogens, metformin, and oral contraceptives.[Rashidi Set. al., 2012] Pharmacotherapy adverse consequences include flutamide liver toxicity, oral contraceptives venous thromboembolism, weight gain, and cardiovascular issues, and metformin lactic acidosis, both fatal and nonfatal. Pharmacological treatment for PCOS is available, but it is always accompanied by some negative consequences or side effects. As a result, researchers are now concentrating on herbal medications as PCOS therapy choices. Herbal medications can be used to treat PCOS because they have extremely few or no side effects [Domecq, Juan Pablo, et. al., 2013].

1. A VARIETY OF SYMPTOMS ARE INDICATIVE OF PCOS, AND THEY MAY INCLUDE:

1.1. Menstrual Cycle Irregularities: PCOS-affected women sometimes may suffer from irregular menstrual cycles, which may be infrequent, prolonged, or even absent altogether. Hormone imbalances, especially high levels of androgens (male hormones) like testosterone, are the cause of this irregularity.

1.2. Ovarian Cysts: Contrary to popular belief, not all PCOS-affected women have ovarian cyst development. However, ultrasound imaging reveals that many PCOS patients develop several little cysts on their ovaries. These cysts are basically follicles that have not matured properly due to hormonal imbalances.

1.3. Hyperandrogenism: Excessive growth of hair, especially on the face, chest, and back (Hirsutism), as well as symptoms like acne and male-pattern baldness can result from elevated levels of androgens.

1.4. Insulin Resistance: Several women with PCOS possess insulin resistance, a condition in which the body's cells become less responsive to insulin, leading to high levels of insulin in the bloodstream. Insulin resistance can contribute to weight gain, difficulty losing weight, and even an increased risk of type 2 diabetes.

1.5. Metabolic Issues: PCOS is associated with an increased risk of metabolic problems, including obesity, dyslipidaemia (abnormal levels of lipoproteins), and hypertension (high blood pressure).

1.6. Fertility Challenges: PCOS is one of the main causes of female infertility. Irregular ovulation can make it difficult for women with PCOS to conceive naturally. Although the precise origin of PCOS is unknown, a mix of hormonal, environmental, and genetic variables are thought to be involved. PCOS is thought to be increasing in incidence in both developing as well as developed nations because of lifestyle-related changes in diet, reduced physical activity, ubiquitous environmental endocrine-disrupting chemicals, varying light exposures, sleep disturbance, heightened levels of stress and other environmental factors (**Figure 1**) [Parker, J, et. al., 2022]. A patient's medical history, physical examination, hormone level-assessing blood tests, and ovulation evaluation with imaging investigations like ultrasound are often used in the diagnosis of PCOS.

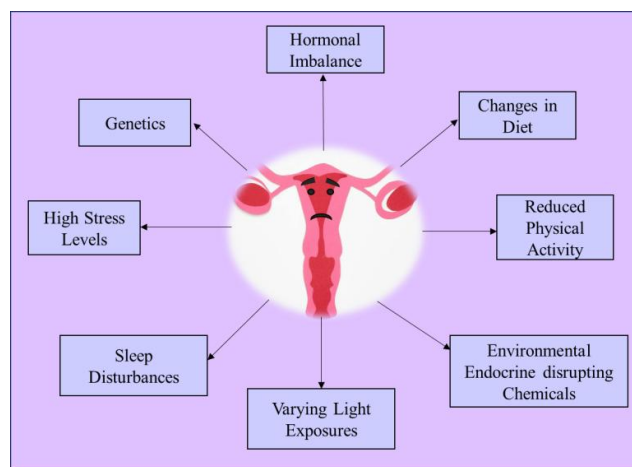


Figure 1: Origin of PCOS

Upon reviewing the research, it was found that herbs like chamomile and Aloe Vera increase ovarian follicle count, which in turn increases fertility. Moreover, by lowering testosterone and androgen levels, vitex agnus-castus and octane diminish hirsutism. Licorice, ginseng, cinnamon, and de chiro isoisotol have also been demonstrated to mitigate the negative consequences of PCOS-induced diabetes by reducing blood glucose and cholesterol levels. Moreover, by lowering oestrogen and hyperplasia, Stachys lavandulifolia and fennel have been shown to be useful in altering endometrial tissue parameters in PCOS [Manouchehri, A et. al., 2023].

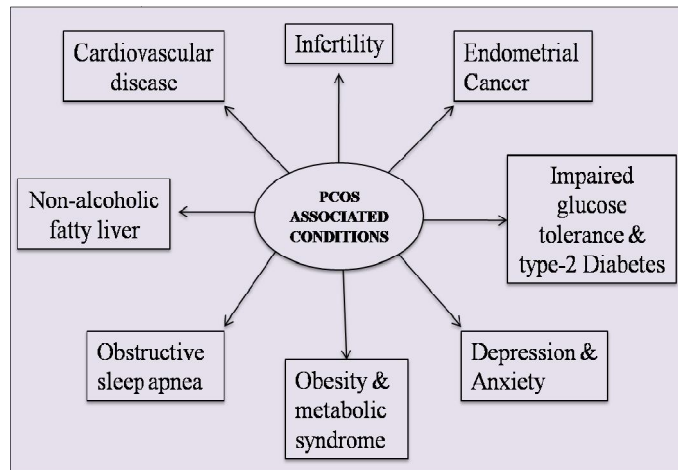


Figure showing the PCOS associated conditions

2. THE HERBAL HEROES OF PCOS WELLNESS:

As once a famous personality said "Nature has provided us with a bounty of health-promoting herbs. Let us embrace these gifts and cultivate a lifestyle of well-being." (Mahatma Gandhi)

Herbal medicine is basically using medicinal plants to prevent and treat illnesses, it can take numerous forms, ranging from the administration of standardized and tritiated herbal extracts to traditional and widely used remedies from around the world. This is particularly true for herbal medicine, where the tradition largely relies on remedies that contain active ingredients at extremely low or ultra-low concentrations, or that rely on magical-energetic principles. Herbs are natural goods, and as such, their chemical composition differs from individual to individual and from vigorous decoctions to the application of herbal extracts in accordance with Modern methods of conventional treatment. Traditional medicine has a very long history. It is the culmination of all the theories, beliefs, and experiences from various cultures and eras that are used to maintain health as well as to diagnose, treat, and prevent illnesses. These practices are frequently unexplained [*Firenzuoli, F, et. al., 2007*]

Herbs' therapeutic effects and applications are widely acknowledged. In an environment where modern man has confronted the side effects and complexities of chemical drug usage, a reintroduction to nature and the use of natural and plant-based drugs arises. Research has shown that using herbs as part of complementary therapy can be both safe and beneficial in treating a variety of disorders.

2.1 ALOE VERA :

Aloe Vera is a versatile plant with numerous medicinal properties that have been utilized for centuries. A perennial herbaceous plant belonging to the family Liliaceae or *Aloe arborescens*. Here are some of its herbal properties and remedies, along with the diseases it can treat: (Lee YS et al.,)



2.1.1. Anti-inflammatory: Aloe Vera contains several compounds like salicylic acid, which have anti-inflammatory properties. It can help reduce inflammation associated with conditions like arthritis and inflammatory skin conditions such as psoriasis and eczema.

2.1.2. Wound Healing: Aloe Vera gel is rich in polysaccharides and glycoproteins, which promote wound healing. It can be applied topically to minor burns, cuts, and abrasions to soothe the skin and accelerate the healing process.

2.1.3. Antibacterial and Antifungal: Aloe Vera exhibits antibacterial and antifungal properties, making it effective against various pathogens. It can be used topically to treat minor skin infections and wounds.

2.1.4. Moisturizing: Aloe Vera gel has excellent moisturizing properties and is commonly used in skincare products to hydrate the skin. It can help alleviate dryness and soothe irritated or sunburned skin.

2.1.5. Digestive Aid: Aloe Vera juice can be consumed internally to support digestive health. It contains enzymes that aid in digestion and can help alleviate symptoms of conditions like acid reflux, indigestion, and irritable bowel syndrome (IBS).

2.1.6. Immune Support: Aloe Vera contains antioxidants, vitamins, and minerals that support immune function and promote overall health. Regular consumption of Aloe Vera juice may help boost the immune system and enhance resistance to infections.

2.1.7. Blood Sugar Regulation: Some research suggests that Aloe Vera may help regulate blood sugar levels in people with diabetes. It contains compounds that improve insulin sensitivity and may help lower blood glucose levels.

2.1.8. Dental Health: Aloe Vera gel can be used as a natural mouthwash or toothpaste ingredient due to its antibacterial properties. It may help reduce plaque buildup, prevent gum disease, and promote oral hygiene.

2.1.9. Skin Conditions: Aloe Vera is beneficial for various skin conditions, including acne, sunburn, insect bites, and allergic reactions. Its soothing and anti-inflammatory properties help alleviate itching, redness, and irritation.

2.1.10. Hair Care: Aloe Vera gel can be used as a hair conditioner to hydrate the scalp, reduce dandruff, and promote healthy hair growth. It can also help soothe scalp conditions like seborrheic dermatitis.

Aloe Vera gel directly affects important enzymes like 3 β HSD, lowering enzyme activity and influencing the production of estradiol. [Hemayatkhah-Jahromi, et. al., 2016]

2.2 CINNAMON:

Cinnamon is a popular spice derived from the inner bark of trees belonging to the genus



Cinnamomum. It has been used for centuries in traditional medicine for its various health benefits. Here are some of its herbal properties and remedies, along with the diseases it can treat: (Ranjbar A et al., 2006)

2.2.1. Antioxidant: Cinnamon is rich in antioxidants, such as polyphenols, which help protect the body from oxidative stress and damage caused by free radicals. Antioxidants play a role in reducing the risk of chronic diseases like heart disease, cancer, and diabetes.

2.2.2. Anti-inflammatory: Cinnamon contains compounds with anti-inflammatory properties that may help reduce inflammation in the body. Chronic inflammation is linked to various health conditions, including arthritis, cardiovascular disease, and inflammatory bowel disease.

2.2.3. Antimicrobial: Cinnamon has antimicrobial properties due to its essential oils, which can help inhibit the growth of bacteria, fungi, and viruses. It may be effective against various pathogens, including E. coli, Salmonella, and Candida albicans.

2.2.4. Blood Sugar Regulation: Cinnamon has been studied for its potential to improve insulin sensitivity and lower blood sugar levels. It may help regulate blood glucose levels in people with diabetes or insulin resistance, reducing the risk of complications associated with high blood sugar.

2.2.5. Cholesterol Management: Some studies suggest that cinnamon may help lower LDL (bad) cholesterol and triglyceride levels while increasing HDL (good) cholesterol. This can contribute to improved heart health and reduced risk of cardiovascular disease.

2.2.6. Digestive Health: Cinnamon is believed to aid digestion by stimulating the secretion of digestive enzymes and improving gastrointestinal motility. It may help alleviate symptoms of indigestion, bloating, and gas.

2.2.7. Weight Management: Cinnamon may have potential benefits for weight management by improving insulin sensitivity and metabolic function. It may help reduce appetite, increase satiety, and promote fat loss, although more research is needed in this area.

2.2.8. Neuro protective Effects: Some studies suggest that cinnamon may have neuroprotective effects and could help protect against age-related cognitive decline and neurodegenerative diseases like Alzheimer's and Parkinson's disease.

2.2.9. Menstrual Health: Cinnamon has been used traditionally to alleviate menstrual cramps and regulate menstrual cycles. Its anti-inflammatory and antispasmodic properties may help reduce pain and discomfort associated with menstruation.

2.2.10. Oral Health: Cinnamon has antibacterial properties that may help inhibit the growth of bacteria in the mouth and prevent dental problems like cavities and gum disease.

Cinnamon has hepatoprotective, antioxidant, anti-obesity, antihyperlipidemic, and antidiabetic properties when used as a traditional remedy. Cinnamon supplements have been shown in randomised controlled clinical research to enhance menstrual cyclicality and may be a useful therapy for certain PCOS-affected individuals. The improvement in insulin sensitivity that cinnamon brings about may be attributed to the underlying mechanism of its benefits on PCOS. (Dou, L, et. al., 2018).

2.3 ALLIUM SATIVUM LINN (GARLIC):



Garlic, known scientifically as *Allium sativum*, has been used for centuries for its culinary and medicinal properties. It contains various bioactive compounds, including sulphur compounds like allicin, which are responsible for many of its health benefits.

Here are some of the herbal properties and remedies of garlic, along with the diseases it can treat: (Capasso A. *et al.*, 2013)

2.3.1. Antimicrobial: Garlic exhibits strong antibacterial and antiviral properties, making it effective against a wide range of pathogens, including bacteria, viruses, and fungi. Its antifungal properties can help prevent and treat infections such as the common cold, flu, and fungal skin infections.

2.3.2. Antioxidant: Garlic is rich in antioxidants, including vitamin C and selenium, as well as sulphur-containing compounds like allicin. These antioxidants help neutralize free radicals and reduce oxidative stress in the body, which can help prevent chronic diseases like cancer and cardiovascular disease.

2.3.3. Cardiovascular Health: Garlic has been extensively studied for its cardiovascular benefits. It can help lower blood pressure, reduce LDL (bad) cholesterol levels, and prevent the formation of blood clots, thus reducing the risk of heart disease, stroke, and atherosclerosis.

2.3.4. Immune Support: Garlic contains compounds like allicin which stimulates the immune system and enhances the body's natural defence mechanisms against infections. Regular consumption of garlic may help boost immunity and reduce the frequency and severity of infections.

2.3.5. Anti-inflammatory: Garlic contains sulphur compounds like allicin and diallyl sulphides that have anti-inflammatory properties, which can help reduce inflammation in the body. Chronic inflammation is linked to various diseases, including arthritis, inflammatory bowel disease, and certain types of cancer.

2.3.6. Antifungal: Garlic has antifungal properties and can help inhibit the growth of fungi like *Candida albicans*, which can cause yeast infections, oral thrush, and other fungal infections. Garlic may help support overall fungal balance in the body.

2.3.7. Detoxification: Garlic supports liver health and aids in detoxification processes in the body. It can help eliminate toxins and heavy metals, promote liver function, and improve overall detoxification pathways.

2.3.8. Digestive Health: Garlic stimulates digestion and can help alleviate digestive problems such as bloating, gas, and indigestion. It may also help prevent and treat gastrointestinal infections caused by bacteria and parasites.

2.3.9. Cancer Prevention: Some studies suggest that garlic may have cancer-preventive properties due to its antioxidant and anti-inflammatory effects. Regular consumption of garlic may help reduce the risk of certain cancers, including stomach, colon, and prostate cancer.

2.3.10. Respiratory Health: Garlic has mucolytic properties and can help loosen mucus and relieve congestion in the respiratory tract. It may be beneficial for respiratory conditions such as asthma, bronchitis, and sinusitis.

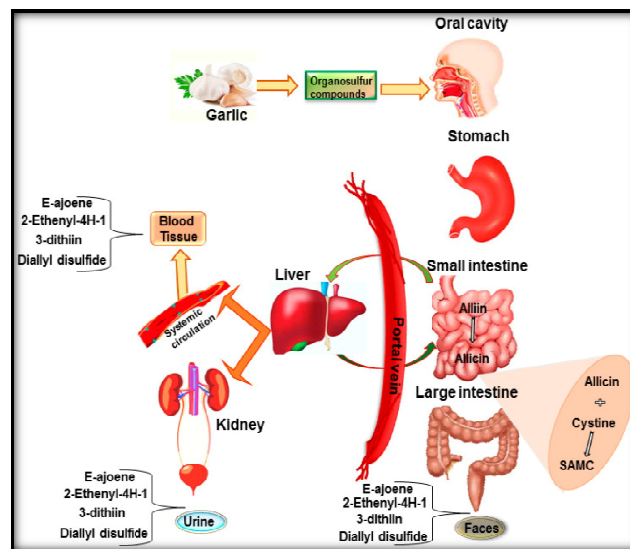


Diagram showing the gastrointestinal (GI) tract's distribution, metabolism, and absorption of garlic's organosulfur components. [Ansary et. al., 2020]

Allicin, a vital component of garlic that possesses anti-inflammatory and antioxidant properties, is the primary sulfur molecule found in both raw and powdered garlic [Deswal R et. al., 2020; Gunathilake et. al., 2015]. Additionally, it has an anti-inflammatory impact that might help with PCOS. Research has shown that compared to normal women, adult women

with DM-2 at reproductive age have a higher risk ratio of PCOS. Therefore, as garlic is said to heal diabetes mellitus, and its more effective for PCOS [Gunathilake et al., 2015].

2.4 ZINGIBER OFFICINALE (GINGER):



Ginger is well known for its flavoring and its pharmacological properties such as carminative, anti-seizures and anti-inflammatory. It is also used for management of rheumatoid arthritis. The primary components in ginger, which include gingerol and shogaols, are what give it its antioxidant qualities.

Here are some of the herbal properties and remedies of ginger, along with the diseases it can treat: (El-Sharaky A et al., 2009).

2.4.1. Anti-inflammatory: Ginger possesses potent anti-inflammatory properties, which can help reduce inflammation throughout the body. It may be beneficial for conditions such as arthritis, osteoarthritis, rheumatoid arthritis, and muscle soreness.

2.4.2. Digestive Aid: Ginger is well-known for its ability to promote digestion and alleviate gastrointestinal discomfort. It can help relieve symptoms of indigestion, bloating, gas, and nausea. Ginger stimulates the production of digestive enzymes and accelerates gastric emptying, which may aid in the digestion of food.

2.4.3. Antiemetic: Ginger is effective in alleviating nausea and vomiting, including motion sickness, morning sickness during pregnancy, and chemotherapy-induced nausea. Its antiemetic properties are attributed to its ability to soothe the stomach and suppress nausea signals to the brain, because of its active compounds gingerol and shogaol.

2.4.4. Antioxidant: Ginger contains antioxidants that help neutralize harmful free radicals and reduce oxidative stress in the body. Antioxidants play a role in protecting cells from damage and reducing the risk of chronic diseases such as heart disease, cancer, and neurodegenerative disorders.

2.4.5. Immune Support: Ginger has immune-boosting properties and may help enhance the body's natural defense mechanisms. Regular consumption of ginger may help reduce the risk of infections and support overall immune health.

2.4.6. Anti-nausea: Ginger is effective in relieving nausea and vomiting, including motion sickness, morning sickness during pregnancy, and chemotherapy-induced nausea. Its anti-nausea properties are attributed to its ability to soothe the stomach and suppress nausea signals to the brain.

2.4.7. Pain Relief: Ginger has analgesic properties and may help alleviate pain associated with various conditions, including headaches, menstrual cramps, and muscle soreness. It works by inhibiting pain-causing chemicals and reducing inflammation in the body.

2.4.8. Respiratory Health: Ginger may help relieve respiratory symptoms such as cough, congestion, and sore throat. Its warming properties can help soothe the throat and promote expectoration of mucus, making it easier to breathe.

2.4.9. Cardiovascular Health: Ginger may have cardiovascular benefits, including lowering blood pressure, reducing cholesterol levels, and improving blood circulation. It may help reduce the risk of heart disease, stroke, and other cardiovascular conditions. According to publications, ginger can prevent ovarian cells from growing uncontrollably and plays significant part in the management of an irregular menstrual period [Atashpour Set. al., 2017]. The regular administration of ginger can boost blood testosterone levels, improve the fertility index, and inhibit anti-fertility action. Furthermore, it helps with nausea and vomiting in pregnant women, when taken as a natural remedy. It also possesses antipyretic, antiemetic, anti-ulcer, antioxidant, and anxiolytic properties, because ginger inhibits cyclooxygenase (COX)-1 and COX-2, and it lowers the creation of prostaglandin, which sets it apart from non-steroidal anti-inflammatory medicines (NSAIDS) [Deswal et. al., 2020; Gunathilake et. al., 2015]. It also have anti-clotting, and analgesic property. Additionally, analgesic, and anti-clotting properties have been demonstrated. Regular consumption of ginger has no impact on blood glucose levels, but it can change serum total cholesterol (TC), TG, and insulin levels. In animals with DM-2, it can also prevent kidney and body weight loss. According to a recent study, ginger may also help to enhance endocrine processes [Pournaderilet. al., 2018].

2.5 FOENICULUM VULGARE (FENNEL/SAUF):



Fennel (*Foeniculum vulgare*) is a flavorful and aromatic herb commonly used in culinary dishes and traditional medicine. It contains various bioactive compounds that contribute to its medicinal properties. It has been used for the past years

astraditional medicine and as a spice, having a fragrant odor and a pleasant aromatic taste.

Here are some of the herbal properties and remedies of fennel, along with the diseases it can treat: (Choi E et al., 2004)

2.5.1. Digestive Aid: Fennel seeds and fennel tea are well-known for their digestive benefits. They contain volatile oils such as anethole, which can help relieve digestive discomfort, bloating, gas, and indigestion. Fennel is often used as a carminative to promote healthy digestion and alleviate symptoms of gastrointestinal distress.

2.5.2. Antispasmodic: Fennel has antispasmodic properties, meaning it can help relax smooth muscles in the digestive tract. This makes it useful for relieving cramps, spasms, and colic, particularly in infants and young children.

2.5.3. Anti-inflammatory: Fennel contains compounds with anti-inflammatory properties that can help reduce inflammation throughout the body. It may be beneficial for conditions such as arthritis, gout, and inflammatory bowel disease (IBD).

2.5.4. Antimicrobial: Fennel exhibits antimicrobial activity against various pathogens, including bacteria and fungi. It may help inhibit the growth of harmful bacteria in the digestive tract and prevent infections.

2.5.5. Respiratory Health: Fennel has expectorant properties and can help loosen mucus and phlegm, making it easier to expel from the respiratory tract. It may be beneficial for respiratory conditions such as coughs, bronchitis, and asthma.

2.5.6. Menstrual Health: Fennel has been traditionally used to regulate menstrual cycles and alleviate symptoms of PMS (premenstrual syndrome) and menstrual cramps. It may help balance hormone levels and reduce discomfort associated with menstruation.

2.5.7. Breastfeeding Support: Fennel is known for its galactagogue properties, meaning it can help promote lactation and increase milk production in breastfeeding mothers. Consuming fennel tea or fennel seeds may help nursing mothers maintain adequate milk supply.

2.5.8. Antioxidant: Fennel contains antioxidants such as flavonoids and phenolic compounds, which help protect cells from oxidative damage caused by free radicals. Antioxidants play a role in reducing the risk of chronic diseases and supporting overall health.

2.5.9. Heart Health: Fennel may have cardiovascular benefits, including lowering blood pressure and cholesterol levels. It contains potassium, which helps regulate blood pressure, and fiber, which can help reduce cholesterol absorption in the gut.

It is considered that it contains diuretic, analgesic, antioxidant, and anti-inflammatory properties. Fennel seeds are used to lessen symptoms associated with female climacteric syndrome, and encourage menstruation [Kavousi, et. al., 2019]. Additionally, it can increase libido, improve milk flow, and lessen menopausal symptoms in PCOS patients. Therefore, it could be beneficial to regulate metabolic abnormalities that are associated with PCOS. In recent years, various components of plants are employed for the management of a variety of complications, including kidney stones, pneumonia, diabetes, nausea, vomiting, and persistent cough [Vickers et. al., 2017].



3. CLINICAL EVIDENCE OF SUCCESSFUL HERBAL REMEDIES FOR PCOS:




An analysis of the literature revealed that ovarian follicle counts are increased by herbs like chamomile and Aloe Vera, which increase fertility. In addition, octane and Vitex agnus-castus lower testosterone and androgen levels, which in turn lower hirsutism. Additionally, studies have demonstrated that by reducing blood glucose and lipid levels, liquorice, ginseng, cinnamon, and de chiro inositol mitigate the negative consequences of PCOS-induced diabetes. Furthermore, by lowering oestrogen and hyperplasia, Stachys lavandulifolia and fennel have been shown to be beneficial in altering endometrial tissue parameters in PCOS.

A study employed five groups of rats to assess the effectiveness of Aloe Vera hydroalcoholic extract in treating polycystic ovary syndrome (PCOS). The groups included the control group, the PCOS group (which received a daily dose of 4 mg/kg estradiol valerate intramuscularly), and treatment groups 1, 2, and 3. Each group received 100, 200, and 400 mg/kg of intraperitoneal yellow aloe extract, respectively, in addition to the 4 mg/kg of estradiol valerate from the study. In comparison to the control group, the PCOS group's oestrogen levels dramatically rose, but in treatment groups 2 and 3, it significantly reduced. When compared to the control group, the progesterone concentrations in the PCOS group and all therapy groups significantly decreased. Thus, Aloe Vera seems to have positive effects on fertility and improvement of polycystic ovary syndrome [Hemayatkhah-Jahromi et. al., 2016].

In another study, the impact of Fennel and Metformin on progesterone and oestrogen levels in the blood and uterine tissue was studied in PCOS-affected rats. Fifty female rats in all were split up into five groups: Following the induction of polycystic ovarian syndrome, there were five groups: a control group that was given normal water and food; a PCOS group that received an intramuscular injection of estradiol valrite at a dose of 4 mg/kg body weight; a PCOS group that received fennel at a dose of 150 mg/kg body weight; a PCOS group that received fennel at a dose of 100 mg/kg body weight following PCOS induction; and a PCOS group that received metformin at a dose of 111 mg/kg body weight. Following a 63-day course of therapy, all rats had their uterine tissue removed for histological study and their blood samples obtained for biochemical analysis. The findings demonstrated that in PCOS rats, fennel boosted progesterone and uterine endometrial thickness while decreasing oestrogen and uterine epithelial thickness. Consequently, fennel may benefit rats with PCOS by protecting their uterine tissue. [Meena et al., 2019; Sadr Fozalae et al., 2015].

Table 1 : Specifications of Medicinal Plants

PLANT	SCIENTIFIC NAME	FAMILY	EFFECTIVE COMPOUND (S)	IMPACT ON PCOS
Aloe Vera 	<i>Aloe barbadensis miller</i>	Liliaceae	Polysaccharide compounds	Favorable as well as encouraging effects on folliculogenesis and ovarian tissue.
Cinnamon 	<i>Cinnamomum zeylanicum</i>	Lauraceae	Eugenol, cinnamaldehyde, and cinnamic acid	Lowering blood sugar and cholesterol levels, raising insulin sensitivity, producing more glycogen and phosphorylating

				insulin receptors, and increasing glucose absorption.
Garlic 	<i>Allium sativum</i>	Amaryllidaceae	Allicin	Anti-inflammatory, antioxidant, and hormonal modulation properties
Ginger 	<i>Zingiber officinale</i>	Zingiberaceae	Gingerol	Anti-inflammatory, antioxidant, improvement in insulin sensitivity, as well as hormonal modulation.
Fennel 	<i>Foeniculum vulgare</i>	Apiaceae	Anethole	Anti-inflammatory, antioxidant, improvement in insulin sensitivity, as well as hormonal modulation.

4. WHY CHOSE HERBAL REMEDY?

Herbal remedies for Polycystic Ovary Syndrome (PCOS) offer several potential advantages over allopathic drugs, including:

4.1 *Natural Approach:* Herbal remedies often offer a more natural approach to managing PCOS symptoms. They are derived from plants and botanical sources, which some individuals prefer over synthetic medications.

4.2 *Fewer Side Effects:* Herbal remedies tend to have fewer side effects compared to allopathic drugs. While all treatments carry some risk of adverse effects, many herbal remedies are generally well-tolerated when used appropriately.

4.3 *Holistic Health Benefits:* Herbal remedies for PCOS often provide holistic health benefits beyond symptom management. For example, certain herbs may support hormonal balance, improve metabolism, enhance fertility, and promote overall well-being.

4.4 *Personalized Treatment:* Herbal remedies can be tailored to individual needs and preferences. Different herbs may target specific symptoms or underlying imbalances, allowing for personalized treatment plans.

4.5 *Long-Term Sustainability:* Herbal remedies may offer long-term sustainability for managing PCOS, as they can be integrated into lifestyle changes and wellness practices. This may include dietary modifications, stress reduction techniques, and other supportive measures.

4.6 *Complementary Therapy:* Herbal remedies can complement conventional treatments for PCOS. Integrating herbal medicine with allopathic care may enhance the effectiveness of treatment and reduce reliance on pharmaceuticals.

4.7 *Accessible and Affordable:* In many cases, herbal remedies are more accessible and affordable than prescription medications. This can be particularly beneficial for individuals who face barriers to healthcare access or have limited financial resources.

4.8 *Potential Synergistic Effects:* Some herbal remedies may work synergistically with each other or with conventional treatments, amplifying their therapeutic effects. This synergism can enhance treatment outcomes and improve overall health.



4.9 Cultural and Traditional Practices: Herbal remedies often have deep roots in traditional and cultural healing practices. For many people, incorporating herbs into their wellness routines aligns with their cultural heritage and personal beliefs.

4.10 Empowerment and Self-Care: Using herbal remedies for PCOS empowers individuals to take an active role in their health and well-being. Engaging in self-care practices, such as herbal medicine, can foster a sense of empowerment and autonomy in managing one's health.

5. HERBAL/POLYHERBAL FORMULATIONS:

5.1 *Gymnema (Gymnemasylvestre):* *Gymnema* is traditionally used in Ayurvedic medicine

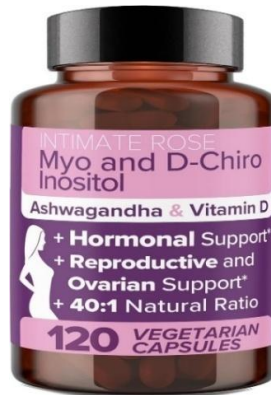


for its blood sugar-lowering effects. It may help improve insulin sensitivity and reduce sugar cravings in individuals with PCOS. *Gymnema* supplements are available in capsule or extract form. According to the findings of another study, *G. sylvestre* and *P. daemia* work better together than they do separately to normalise menstrual irregularities [*Pachiappan, et. al., 2021*].

5.2 *Berberine:* *Berberine* is a compound found in several plants, including *Berberis vulgaris* (barberry) and *Coptis chinensis* (goldthread). It has been studied for its insulin-sensitizing effects and its potential to improve metabolic parameters in women with PCOS. *Berberine* supplements are available in capsule or extract form.



5.3 Myo-Inositol and D-Chiro-Inositol: These two forms of inositol are naturally occurring compounds that have been studied for their potential to improve insulin sensitivity and ovarian function in women with PCOS. They are often combined in specific ratios and are available in supplement form.



Myo-Inositol and D-Chiro-Inositol Capsules

5.4 Shatavari (*Asparagus racemosus*): Shatavari is an herb used in Ayurvedic medicine for its hormone-balancing and adaptogenic properties. It may help regulate menstrual cycles and support reproductive health in women with PCOS. Shatavari supplements are available in capsule or powder form.



There has been a research conducted to develop an effective alternative medicine with multi potential herbs against polycystic ovarian syndrome (PCOS) in rats induced by letrozole treatment.

A mixture of *S. asoca* bark, *G. sylvestre* leaves, *P. daemia* aerial parts, *C. zeylanium* stem bark, *C. bonduc* seeds, and *W. somnifera* roots ethanolic extract were used to make

polyherbal syrup. The Chinese Hamster Ovarian (CHO) cell line was used for an in vitro cell viability investigation, an adenosine monophosphate-activated protein kinase (AMPK) study, and a glucose transporter 4 (GLUT4) gene expression experiment. Letrozole was administered for 21 days in a row as part of the PCOS induction protocol. [Balasubramanian, Et. Al., 2023].

6. LIFESTYLE CONSIDERATIONS:

Managing Polycystic Ovary Syndrome (PCOS) often involves a combination of lifestyle changes and medical treatments. Here are some lifestyle considerations that can help manage PCOS symptoms and improve overall health:

6.1 Healthy Diet: Adopting a balanced diet rich in fruits, vegetables, whole grains, lean proteins, and healthy fats can help regulate blood sugar levels, manage weight, and reduce insulin resistance. Limiting refined carbohydrates, sugary foods, and processed foods may also be beneficial.

6.2 Regular Exercise: Engaging in regular physical activity, such as aerobic exercise, strength training, or yoga, can help improve insulin sensitivity, aid in weight management, and reduce stress levels. Aim for at least 150 minutes of moderate-intensity exercise per week, as recommended by guidelines.

6.3 Weight Management: Achieving and maintaining a healthy weight can help improve hormonal balance and reduce symptoms of PCOS, such as irregular menstrual cycles and insulin resistance. Even a modest weight loss of 5-10% of body weight can lead to significant improvements in PCOS symptoms.

6.4 Stress Reduction: Chronic stress can exacerbate PCOS symptoms and disrupt hormone levels. Practicing stress-reduction techniques such as meditation, deep breathing exercises, mindfulness, or yoga can help lower stress levels and improve overall well-being.

6.5 Adequate Sleep: Prioritize getting enough sleep each night, aiming for 7-9 hours of quality sleep. Poor sleep quality and insufficient sleep duration have been linked to hormonal imbalances, insulin resistance, and weight gain, all of which can worsen PCOS symptoms.

6.6 Limit Alcohol and Caffeine: Excessive alcohol consumption and caffeine intake can disrupt hormone levels, interfere with sleep, and contribute to weight gain. Limiting alcohol and caffeine intake may help improve hormonal balance and overall health.

6.7 Quit Smoking: Smoking is associated with worsened PCOS symptoms and an increased risk of cardiovascular disease. If you smoke, quitting can improve fertility, reduce insulin resistance, and lower the risk of long-term health complications.

6.8 Regular Monitoring and Medical Care: Regularly monitoring PCOS symptoms, menstrual cycles, and metabolic parameters (such as blood sugar levels, cholesterol levels, and blood pressure) is important for early detection of complications and effective management. Regular medical check-ups with a healthcare provider familiar with PCOS are essential for personalized care and treatment adjustments as needed.

Ovulation induction drugs are the first-line treatment for anovulatory infertility; gonadotrophins are the second-line treatment; in vitro fertilisation methods and laparoscopic ovarian surgery are the third-line treatments (International PCOS Guideline 2018). Insulin-sensitizing drugs have become more widely used for both preventive and therapeutic purposes when metabolic characteristics are a concern. They can be used alone or in conjunction with other pharmacological choices, as noted by several experts (International PCOS Guideline 2018; Naderpoor et. al., 2015; Teede et. al., 2007). When compared to surgical and pharmaceutical treatments, lifestyle modifications can often offer a more affordable first treatment plan (Clark 1998). It is advised to implement lifestyle changes to control weight, avoid gaining too much weight, and avoid future metabolic and reproductive issues (International PCOS Guideline 2018).

Opportunities for prevention are especially important as women with PCOS are more likely than the general population to be overweight or obese [Kakoly et. al., 2018; Lim et. al., 2012]. As shown in the general population, lifestyle modification may potentially improve insulin resistance or other PCOS characteristics without requiring weight reduction (Poehlman 2000; Roberts 2013). Therefore, for a significant fraction of PCOS-affected women, lifestyle therapies make sense for both managing weight and correcting underlying hormonal imbalances.

7. SAFETY AND CONSULTATION BEFORE INCULCATING HERBAL REMEDY:

Before using any medicinal remedies for PCOS, it's essential to consult with a healthcare provider, such as a primary care physician, gynecologist, endocrinologist, or a healthcare provider specializing in integrative or holistic medicine. Here's why consultation and safety considerations are important:

7.1 Accurate Diagnosis: PCOS can present with a wide range of symptoms, and its management may vary depending on individual factors such as age, reproductive goals, and the presence of other health conditions. A healthcare provider can confirm the diagnosis of PCOS and assess its severity through a comprehensive evaluation, which may include medical history, physical examination, laboratory tests, and imaging studies.

7.2 Personalized Treatment Plan: Healthcare providers can develop a personalized treatment plan tailored to your specific needs, preferences, and health goals. This may include lifestyle modifications, dietary changes, physical activity recommendations, and medical treatments based on evidence-based guidelines and best practices.

7.3 Evaluation of Risks and Benefits: Healthcare providers can help you understand the potential risks and benefits of using medicinal remedies for PCOS. They can assess your medical history, current medications, allergies, and other relevant factors to determine the safety and suitability of specific treatments.

7.4 Monitoring and Follow-Up: Healthcare providers can monitor your progress, assess the effectiveness of treatment, and make adjustments as needed. Regular follow-up appointments allow for ongoing evaluation of PCOS symptoms, metabolic parameters, and potential side effects of treatments.

7.5 Avoiding Interactions: Some medicinal remedies, including herbal supplements, may interact with medications or other treatments you are currently using. Healthcare providers can identify potential interactions and provide guidance on safe and appropriate use of remedies to minimize risks.

7.6 Evidence-Based Recommendations: Healthcare providers can offer evidence-based recommendations for medicinal remedies supported by scientific research and clinical experience. They can help you navigate through the vast amount of information available online and select treatments that are safe, effective, and appropriate for your individual needs.

7.7 Monitoring for Complications: PCOS is associated with an increased risk of various health complications, such as insulin resistance, type 2 diabetes, cardiovascular disease, and infertility. Healthcare providers can monitor for these complications and provide preventive measures and early interventions to minimize their impact on your health. By consulting with a healthcare provider before using medicinal remedies for PCOS, you can ensure safe and effective management of your condition while addressing your unique health needs and

concerns. Additionally, it's essential to inform your healthcare provider about any changes in your symptoms or treatment preferences over time to optimize your care.

8. SUMMARY OF THE CHAPTER:

The book chapter on herbal remedies for the management of Polycystic Ovary Syndrome (PCOS) offers a comprehensive exploration of various aspects essential for understanding and utilizing herbal treatments effectively. Beginning with an overview of PCOS, including its symptoms, diagnostic criteria, and impact, the chapter delves into the role of herbal remedies in addressing this complex endocrine disorder. It examines the key herbal properties that contribute to their therapeutic effects, such as hormone balancing, insulin sensitizing, and anti-inflammatory properties. Common herbal remedies used for PCOS management, including chasteberry, cinnamon, and fenugreek, are discussed alongside an evaluation of clinical evidence supporting their efficacy. Additionally, the chapter explores herbal/polyherbal formulations from traditional medicine systems, lifestyle considerations, and safety measures, emphasizing the importance of consultation with healthcare providers for personalized and evidence-based treatment plans. Overall, this chapter serves as a valuable resource for individuals seeking holistic approaches to PCOS management, integrating herbal remedies with lifestyle modifications and conventional treatments for comprehensive care.

9. REFERENCES:

1. Umland EM, Weinstein LC, Buchanan EM. Menstruation-related disorders. In: DiPiro JT, Talbert RL, Yee GC, editors. (2011) *Pharmacotherapy: A Pathophysiologic Approach*. 8th ed. New York: McGraw-Hill; p. 1393.
2. Lin LH, Baracat MC, Gustavo AR, et al. Androgen receptor gene polymorphism and polycystic ovary syndrome. *Int J Gynaecol Obstet*. 2013
3. Ndefo, U. A., Eaton, A., & Green, M. R. (2013). Polycystic ovary syndrome: a review of treatment options with a focus on pharmacological approaches. *Pharmacy and therapeutics*, 38(6), 336.
4. Rashidi S, Farajee H, Jahanbin D, Mirfardi A. (2012) Evaluation of Knowledge, Belief, and Operation of Yasouj People Towards Pharmaceutical Plants. *J Med Plants.*; 11:177–84.
5. Domecq, J. P., Prutsky, G., Mullan, R. J., Sundaresh, V., Wang, A. T., Erwin, P. J., & Murad, M. H. (2013). Adverse effects of the common treatments for polycystic ovary

syndrome: a systematic review and meta-analysis. *The Journal of Clinical Endocrinology & Metabolism*, 98(12), 4646-4654.

6. Zambare, K. K., Thalkari, A. B., Tour, N. S., & Reddy, K. V. (2019). Herbal Remedies for treatment of Polycystic Ovary Syndrome. *Asian Journal of Pharmacy and Technology*, 9(2), 112-114.

7. Parker, J., O'Brien, C., Hawrelak, J., & Gersh, F. L. (2022). Polycystic Ovary Syndrome: An Evolutionary Adaptation to Lifestyle and the Environment. *International journal of environmental research and public health*, 19(3), 1336.

8. Pathak, G., & Nichter, M. (2015). Polycystic ovary syndrome in globalizing India: An ecosocial perspective on an emerging lifestyle disease. *Social science & medicine* (1982), 146, 21–28.

9. Manouchehri, A., Abbaszadeh, S., Ahmadi, M., Nejad, F. K., Bahmani, M., & Dastyar, N. (2023). Polycystic ovaries and herbal remedies: A systematic review. *JBRA assisted reproduction*, 27(1), 85–91.

10. Firenzuoli, F., & Gori, L. (2007). Herbal medicine today: clinical and research issues. *Evidence-based complementary and alternative medicine: eCAM*, 4(Suppl 1), 37–40. <https://doi.org/10.1093/cam/nem096>

11. Rashid, R., Mir, S. A., Kareem, O., Ali, T., Ara, R., Malik, A., & Bader, G. N. (2022). Polycystic ovarian syndrome-current pharmacotherapy and clinical implications. *Taiwanese Journal of Obstetrics and Gynecology*, 61(1), 40-50.

12. Manouchehri, A., Abbaszadeh, S., Ahmadi, M., Nejad, F. K., Bahmani, M., & Dastyar, N. (2023). Polycystic ovaries and herbal remedies: A systematic review. *JBRA assisted reproduction*, 27(1), 85.

13. Maharjan, R., Nagar, P. S., & Nampoothiri, L. (2010). Effect of Aloe barbadensis Mill. formulation on Letrozole induced polycystic ovarian syndrome rat model. *Journal of Ayurveda and integrative medicine*, 1(4), 273–279.

14. Hemayatkhah-Jahromi, V., & Rahmadian-Koushkaki, M. (2016). Effect of hydro-alcoholic extract of Aloe Vera L. on polycystic ovary syndrome in rat. *KAUMS Journal (FEYZ)*, 20(3), 221-227.

15. Dedov, V. N., Tran, V. H., Duke, C. C., Connor, M., Christie, M. J., Mandadi, S., & Roufogalis, B. D. (2002). Gingerols: a novel class of vanilloid receptor (VR1) agonists. *British journal of pharmacology*, 137(6), 793.

16. Sharma, N., Kumar, V., Langeh, U., Singh, C., & Singh, A. (2023). A review on the pharmacological potential of Indian spices in polycystic ovarian syndrome. *Journal of Reproductive Healthcare and Medicine*, 4(1), 1.
17. Deswal, R., Narwal, V., Dang, A., & Pundir, C. S. (2020). The prevalence of polycystic ovary syndrome: a brief systematic review. *Journal of human reproductive sciences*, 13(4), 261-271.
18. Alsherbiny, M. A., Abd-Elsalam, W. H., Taher, E., Fares, M., Torres, A., Chang, D., & Li, C. G. (2019). Ameliorative and protective effects of ginger and its main constituents against natural, chemical and radiation-induced toxicities: A comprehensive review. *Food and Chemical Toxicology*, 123, 72-97.
19. Atashpour, S., Jahromi, H. K., Jahromi, Z. K., & Maleknasab, M. (2017). Comparison of the effects of Ginger extract with clomiphene citrate on sex hormones in rats with polycystic ovarian syndrome. *International Journal of Reproductive BioMedicine*, 15(9), 561.
20. Deswal, R., Narwal, V., Dang, A., & Pundir, C. S. (2020). The prevalence of polycystic ovary syndrome: a brief systematic review. *Journal of human reproductive sciences*, 13(4), 261.
21. Gunathilake, K. D. P. P., & Rupasinghe, H. V. (2015). Recent perspectives on the medicinal potential of ginger. *Botanics: Targets and Therapy*, 55-63.
22. Pournaderi, P. S., Hejazi, S. H., Yaghmaei, P., Khodaei, H., & Noormohammadi, Z. (2018). Comparing the therapeutic effects of 6-gingerol and hydro-alcoholic extract of ginger on polycystic ovary syndrome in Wistar rat. *Advanced Herbal Medicine*, 4(1), 31-39.
23. Britannica, T. Editors of Encyclopaedia (2024, January 21). ginger. *Encyclopedia Britannica*.
24. Baig, J. A., Bhatti, S., Kazi, T. G., & Afridi, H. I. (2019). Evaluation of arsenic, cadmium, nickel and lead in common spices in Pakistan. *Biological trace element research*, 187, 586-595.
25. Kavousi, M., Ghaebi, N. K., Najafi, M. N., Mokaberinejad, R., Feyzabadi, Z., & Salari, R. (2019). The effect of a natural vaginal product based on honey on the success of intrauterine insemination (IUI) in infertility treatment. *Avicenna Journal of Phytomedicine*, 9(4), 310.
26. Vickers, N. J. (2017). Animal communication: when i'm calling you, will you answer too? *Current biology*, 27(14), R713-R715.

27. Prajapati, D. P., Patel, M., & Dharamsi, A. (2022). Beneficial effect of polyherbal formulation in letrozole induced polycystic ovarian syndrome (PCOS). *Journal of traditional and complementary medicine*, 12(6), 575–583.
28. Lim, S. S., Hutchison, S. K., Van Ryswyk, E., Norman, R. J., Teede, H. J., & Moran, L. J. (2019). Lifestyle changes in women with polycystic ovary syndrome. *The Cochrane database of systematic reviews*, 3(3), CD007506.
29. Dou, L., Zheng, Y., Li, L., Gui, X., Chen, Y., Yu, M., & Guo, Y. (2018). The effect of cinnamon on polycystic ovary syndrome in a mouse model. *Reproductive biology and endocrinology: RB&E*, 16(1), 99.
30. Pachiappan, Sudhakar¹; Ramalingam, Kothai¹; Balasubramanian, Arul² (2021) Combined effects of *Gymnemasylvestre* and *Pergulariadaemia* on letrozole-induced polycystic ovarian syndrome in rats. *Asian Pacific Journal of Reproduction* 10(2): p 68-74, March. | DOI: 10.4103/2305-0500.311610
31. McKennon, S. A. (2021). Non-pharmaceutical intervention options for type 2 diabetes: complementary health approaches and integrative health (including natural products and mind/body practices). *Endotext*.
34. Ansary, J., Forbes-Hernández, T. Y., Gil, E., Cianciosi, D., Zhang, J., Elexpuru- Zabaleta, M., Simal-Gandara, J., Giampieri, F., & Battino, M. (2020). Potential Health Benefit of Garlic Based on Human Intervention Studies: A Brief Overview. *Antioxidants* (Basel, Switzerland), 9(7), 619.
35. Dou, L., Zheng, Y., Li, L., Gui, X., Chen, Y., Yu, M., & Guo, Y. (2018). The effect of cinnamon on polycystic ovary syndrome in a mouse model. *Reproductive biology and endocrinology: RB&E*, 16(1), 99.
36. Lee YS, Ju HK, Kim YJ, Lim TG, Uddin MR, Kim YB, Baek JH, Kwon SW, Lee KW, Seo HS, Park SU. (2013) Enhancement of anti-inflammatory activity of Aloe Vera adventitious root extracts through the alteration of primary and secondary metabolites via salicylic acid elicitation. *PloSone*; 8: e82479.
37. Ranjbar A, Ghaseminejad S, Takalu H, Baiaty A, Rahimi F, Abdollahi M (2007): Anti oxidative stress potential of cinnamon (*cinnamomum zeylanicum*) in operating room personnel; a before/after cross sectional clinical trial. *Int J Pharmacol*. 2007, 3: 482-486.
38. Capasso A. (2013) Antioxidant action and therapeutic efficacy of *allium sativum* L. *Molecules*.;18(1):690–700. doi: 10.3390/molecules18010690.

39. El-Sharaky A. S, Newairy A. A, Kamel M. A, Eweda S. M. (2009) Protective effect of ginger extract against bromobenzene-induced hepatotoxicity in male rats. *Food Chem Toxicol.*;47(7):1584–90.
40. Choi E. M., Hwang J. K. (2004) Antiinflammatory, analgesic and antioxidant activities of the fruit of *Foeniculum vulgare*. *Fitoterapia.*;75 (6):557–565.