

## FOODS FOR MANAGING MULTIPLE DISEASES

### Abstract

Diabetes mellitus is described as a group of many metabolic disorders like severe hyperglycemia resulting from inadequate secretion of Insulin or resistance in insulin action or both. Almost seventy percent of world's population is still relying on natural medicine for the management of their diseases there is rich flora worldwide which if conquered will prove beneficial.

Infertility is a medical disorder that is characterized by inability to conceive a child or a pregnancy to full term. Infertility may be of two types: primary infertility, which is described as situation in which a couple has never been able to conceive a child, and secondary infertility, in which a couple has previously carried a child to term but is now unable to conceive, here in this chapter we tried to give multiple scientifically proven medicine from folk lore that are proven beneficial for managing both male and female infertility issues.

Dysmenorrhea refers to the medical condition of painful menstrual cramps in the lower abdomen of the body, experienced by more than half women during their menstrual periods that remain for one to two days each month during menstrual cycle. Chronic pain can range from mild to severe, and it primarily affects younger women, causing discomfort, annoyance, mood swings, and interfering with their normal activities we explore different natural sources for managing these problems without interfering there other hormonal systems

**Keywords:** Diabetes mellitus, Dysmenorrhea, Chronic pain, Preveillence

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## I. FOOD FOR DIABETES MELLITUS

Diabetes is the disease which was first time given via Egyptians. It is shown by polyuria and weight loss. Although the term “Diabetes mellitus” was given by Greek physician “Aertaeus”. The Greek word “Diabetes” meaning “to pass through” while Latin word “mellitus” meaning “Honey”.

Diabetes mellitus is a significant cause of long-term poor health & early death & took many lives/ year more than AIDS, approximately 1 death in each 10secs.

Diabetes mellitus is described as a group of many metabolic disorders like severe hyperglycemia resulting from inadequate secretion of Insulin or resistance in insulin action or both. [1,2]

**1. Types of Diabetes Of Mellitus:** There are two types of diabetes mellitus,

- Type 1 diabetes mellitus
- Type 2 diabetes mellitus
- **Type 1 Diabetes Mellitus:** Type 1 diabetes mellitus is severe autoimmune disorder having symptoms like increased blood sugar levels because of the destruction of  $\beta$ -islet cells of pancreas. It represented 5 to 10% cases. It is a usual metabolic & endocrine disorder can occur in childhood.

In type 1 diabetes mellitus, there is formation of autoantibodies several months/ years prior the symptoms occur. These antibodies are not only pathogenic but also considered as biomarkers of autoimmunity development.[2,3]

- **Type 2 Diabetes Mellitus:** Type 2 diabetes mellitus is a type of metabolic disorder having a high rate of morbidity globally. It represented 90 to 95% cases globally. It is shown via resistance of insulin, hyperglycemia, chronic inflammation & hyperlipidemia. This type can reduce the immune system efficiency and lead to increased bacterial infections susceptibility. [2,4]

**2. Incidence:** Major causes of diabetes morbidity and mortality in all ethnic groups are diet, obesity and seasonal changes. The high cholesterol in foods like egg, butter, red meat & edible oil, can impair the function of  $\beta$ -islet cells of pancreas and effects glucose metabolism. So, it is recommended to take low cholesterol in diet. The rate of incidence of type 1 & type 2 diabetes mellitus in children & adults is due to increased obesity and can be managed by the maintenance of weight. The disease can also occur due to variation in seasons. The increased diabetes rate occurs in Winter, Autumn and Summer. The causes of diabetes occurs due seasonal incidence are viral infections, less physical activity, changes in diet, obesity, changes in weather.[5, 6, 7]

**3. Prevalence:** In a study prevalence of diabetes mellitus between rural and urban areas was investigated. It was found that in both areas mean FBG level was 91.16mg/dl. In urban areas mean FBG level was 94.73 mg/dl which was higher than mean FBG level of rural area having 87.71mg/dl. The increased risk of diabetes in urban areas are due to

diseases like obesity, hypertension, viral infections like AIDS, childhood malnutrition and alcohol consumption.[8]

4. **Pathophysiology:** Diabetes can occur due to exocrine pancreatic disorders & heart failure. Type 2 Diabetes can occur after pancreatectomy which is known as “**Post total pancreatectomy diabetes mellitus**”. It is characterized as resistance or loss of secretion of insulin which normalizes blood glucose level. It requires long term insulin therapy. Diabetes is also connected with ischemic heart disease & metabolic diseases like lipotoxicity and glucose toxicity as a result of resistance of insulin. Hyperinsulinemia and hyperglycemia as a result of diabetes causes myocardial hypertrophy, myocardial fibrosis, capillary damage and myocardial dysfunction. [9,10]

5. **Treatment:** Herbal medicines are used extensively around the world for prevention and treatment of diabetes. Majority of developing countries depend on plants derived medicines to treat Diabetes mellitus. Because these medicinally important plants are cheap, easily available and effective in the treatment of diabetes. There are following herbal treatments of diabetes.

- ***Allium sativum:*** *Allium sativum* is garlic's scientific name. It belongs to the family Amaryllidaceae. Garlic is found helpful in maintaining BP, reducing cholesterol & improving immune system. It is also found helpful in treating diabetes. Studies proved that garlic can reduce Blood glucose levels & treats sensitivity of insulin which is effective in treating diabetes.

**Chemical Constituents:** The main constituents found in garlic are

- Allicin
- Sulphur compound
- Flavonoids
- Fructans (Carbohydrate)

**Dose:** It is found in a study that aqueous extract of *Allium sativum* produced decrease in serum Cholesterol, glucose & lipid levels at dose of 300mg/Kg IP for 6 weeks.

**Pharmacological Actions:** It is found in clinical trials that giving garlic with other anti-diabetic drugs treats type 2 diabetes. It was found that garlic can decrease resistance of insulin. Moreover, constituents of garlic can donate hydrogen sulphur that treats type 2 diabetes. It is found in another trial that garlic decreases profile of lipids & parameters of glucose like HbA1C & FBG levels. [11, 12]

- ***Momordica Charantia:*** *Momordica charantia* Linn commonly called Bitter melon, Karela and bitter gourd. It belongs to family Cucurbitaceae. It is an annual plant. It is found in East India & commonly cultivated in temperate, tropical & subtropical areas. It is in light green colour having a cone shape. It has bitter taste. It has biological activities like antidiabetic, antioxidant, anthelmintic, anti viral, anti-mutagenic, anti-inflammatory, hepatoprotective, immunomodulatory, anti ulcer and wound healing activities.

**Chemical Constituents:** There are following phytochemicals present in *Momordica charantia* L.,

- Protein
- Carbohydrate
- Lipids
- Sterol
- Triterpenoids
- Saponin
- Flavonoids
- Polypeptide
- Alkaloids

**Doses:** *Momordica charantia* aqueous extract in the dose of 100mg/Kg & nanoparticles in the dose of 50mg/Kg can reduce blood sugar levels in 11 days. When *Momordica charantia* fruit ethanolic extract, given in the doses of 150, 300 & 600mg/Kg to diabetic rats, can decrease blood sugar levels & HbA1c levels in one month.

**Pharmacological Action:** When in Streptozotocin induced diabetes rats, *Momordica charantia* extract was given then it can decreased sodium dependent uptake of glucose in intestinal mucosa. Its extract can regulate main enzymes like phosphofruktokinase, hexokinase & glucokinase and improves metabolism of glucose in diabetic mice. Therefore, facilitates oxidation of glucose. It also stimulates gluconeogenesis & increase muscle & hepatic glycogen levels. [13, 14]

- **Minerals & Vitamins:** Minerals & Vitamins are indirectly & directly linked with resistance of insulin. It is found in research that any changes in homeostasis of calcium, magnesium, selenium, vitamin K & Vanadium may increase the risk of diabetes. A reduction in these minerals & vitamins regulations can impair  $\beta$ -cells functions & alter metabolism of glucose.

**Doses:** 1000 IU of Vitamin OD till three months.

It was found in studies that daily intake of 300mg/Kg to 1000mg/ Kg Calcium can decrease risk of type 2 diabetes till, 7, 14 & 23%. {{

It was observed in a study that selenium supplementation in the dose of 200mg/Kg/day for six month can decrease HbA1c, Fasting blood glucose, triglycerides & total serum cholesterol levels.

**Pharmacological Actions:** Improper intake of magnesium linked with chances of diabetes. When there is decrease in concentration of magnesium intracellularly, then it can effects activity of tyrosine kinase leading to sensitivity of insulin. Selenium is an antioxidant can prevents the chances of diabetes. Taking supplements of vitamin K can reduced HbA1c & FBG and insulin levels.

Abnormality in lipid profile can complicate type-2 diabetes mellitus & resulting in increased chances of CVD. It was found that taking Vanadium

supplement can not only lower total cholesterol but can treats diabetes and prevents cardiovascular diseases. [15, 16, 17, 18]

- ***Rosa roxburghii* Tratt:** *Rosa roxburghii* Tratt fruit is a medicinally important Chinese fruit. It has many pharmacological activities like anti-inflammatory, antioxidant, anti-diabetic, anti apoptosis, anticancer and anti-radiation activities. Clinical researches show that it has glucose lowering activity but its mechanism in treating diabetes still needs to be identified.

**Chemical Constituents:** It has following chemical constituents,

- Unsaturated fatty acids
- Polysaccharides
- Triterpenes
- Dietary fibers
- Flavonoids
- Trace elements
- Superoxide dismutase
- Vitamins

**Dose:** 400mg/Kg for 8 weeks

**Pharmacological Action:** By using bioinformatics and pre-clinical studies, it was proposed that its constituents flavonoids and triterpenoids can decrease serum triglyceride and glucose levels and increased levels of serum insulin in alloxan induced diabetes mice models. Its extract reduces melandialdehyde activity & enhances catalase & superoxide dismutase activities. Moreover, its extract of flavonoids, polysaccharides and triterpenoids had inhibitory activity towards  $\alpha$ -glucosidase,

Its polyphenols have significant hypoglycemic activity. It can activate P13K/ AKT signaling mechanism and regulates Fork-head box protein expression that can controls hepatic gluconeogenesis, improves resistance of insulin towards stored glycogen in liver & treats symptoms of Type-2 diabetes. [19]

- ***Syzygiumcumini* L.:** *Syzygiumcumini* Linn, commonly known as Indian black berry or Jamun. It belongs to family “Myrtaceae”. It is cultivated in subtropical & tropical areas around the world. Nutritionally, *Syzygiumcumini* L. has various pharmacological and food applications. Almost its every part leaves, seeds, fruits & bark are used for centuries for food & pharmaceutical applications. Its fruit has purplish or bluish color & oblong in shape. It has various pharmacological properties like antioxidant, antidiabetic, anti-fertility, anti-diarrheal, gastroprotective, anti-ulcer & anti-inflammatory properties.

**Chemical Constituents:** It has various chemical constituents, some of them are following,

- Quercetin
- Kaempferol
- Eugenol-triterpenoid
- Myricetin

- Oleanolic acid
- Quercetin-3-D galactoside

**Dose:** 200mg/Kg 95% of *Syzygiumcumini* fruit ethanolic extract

**Pharmacological Action:** In a study it was evaluated that 200mg/Kg of *Syzygiumcumini* fruit ethanolic extract (95%) in diabetic rats orally, can reduce concentration of blood glucose & enhances storage of glycogen in muscles & pancreatic  $\beta$ -islet cells degranulation leads to antidiabetic activity.

The mechanism behind *Syzygiumcumini* fruit antidiabetic action is PPAR $\gamma$  modulation and decrease in oxidative stress, TNF- $\alpha$  & dyslipidemia leads to correction in  $\beta$ -islet cells function & resistance of insulin. [20, 21]

## II. FOOD FOR DYSMENORRHEA

1. **Dysmenorrhea:** refers to the medical condition of painful menstrual cramps in the lower abdomen of the body, experienced by more than half women during their menstrual periods that remain for one to two days each month during menstrual cycle. Chronic pain can range from mild to severe, and it primarily affects younger women, causing discomfort, annoyance, mood swings, and interfering with their normal activities. [22, 23]

- **Etiology:** Numerous theories have been put forth since the 1960s to explain the causes of dysmenorrhea, encompassing psychological, biochemical, and anatomical factors. Within the anatomical perspective, irregular uterine positions and variations in the shape or length of the cervix were considered. It has been shown in studies that there is a positive association between the cervical length and the severity and volume of dysmenorrheal. However, the biochemical studies have emerged as a more robust explanation, supported by numerous consistent studies. [24]

2. **Classification of Dysmenorrhea:** Menstrual cramps or Dysmenorrhea can be classified into two types: primary and secondary.

- **Primary Dysmenorrheal:** It refers to painful menstruation in the absence of detectable changes in the reproductive organs. It probably caused by the prostaglandin produced in the mucous membrane of the uterus. The physiopathology of the primary condition is often attributed due to the up regulation of COX-1 and COX -2 pathways, leading to increased prostanoids production, predominantly the prostaglandin (PGs). increased levels of prostaglandin cause the contraction of the uterine wall, which narrows the blood vessels, reducing bloodflow and leading to the formation of anaerobic metabolites that activate the nociceptors. The most effective and empirically supported treatments for dysmenorrhea are NSAIDs, oral contraceptive, and menopausal hormones. This condition can be treated with a single therapy or in combination with other therapies. [25]

**Symptoms for Primary Dysmenorrheal:** It includes crampy lower abdominal pain that may radiate to the lower back or thighs as well as accompanying symptoms such as nausea, vomiting, diarrrhea, headache and fatigue. [26]

- **Secondary Dysmenorrheal:** It is associated with an underlying pelvic pathology or medical condition such as endometriosis, uterine fibroids, adenomyosis, pelvic inflammatory disease, ovarian cyst. The pain in secondary dysmenorrheal may be more severe as compare to primary, it may occur earlier in menstrual cycle. The treatment for secondary dysmenorrheal focuses on addressing the underlying cause. [24]

**Symptoms for Secondary Dysmenorrheal:** When secondary dysmenorrheal is suspected, it is recommended to conduct transvaginal ultrasonography. Among the potential causes of secondary dysmenorrheal, endometriosis is the most frequently encountered. Symptoms include menorrhagia or heavy bleeding at menstruation, abnormal vaginal bleeding, dyspareunia or painful sexual intercourse, postcoital bleeding, and infertility. [27]

There is wide range of treatments available for dysmenorrheal; however, it is important to note that certain treatments may have limitations or restrictions. The conventional medicines such as NSAIDs are contraindicated in patients with GI problems, the drugs also have several side effects like drowsiness, renal and cardiovascular problems. However traditional medicines and herbs have been used for centuries for curing and reliving pain in dysmenorrheal due to their less side effects. Several herbs such as saffron, ginger, black cumin, thyme, celery seed, and omega-3 has employed to treat primary dysmenorrhea. [28, 29]

### 3. Nigella Sativa

- **Introduction:** Nigella sativa (N. sativa) belongs to the Ranunculaceae family and is a popular therapeutic plant all over the world. It is also known as HabbatulBarakah, Black Seed, Fennel Flower, Black cumin, kalonji and is widely used in ancient systems of medicine like as Unani, Tibb, and Ayurveda. Seeds and oil have a long history of traditional use in many medical and dietary systems. N. sativa seeds have been widely employed for the curement of various diseases and ailments. Islamic literature regards it as one of the most potent forms of healing medicine. (1, 2) Thymoquinone, which is the major active constituent of N. Sativa, is responsible for the majority its medicinal benefits, other important pharmacological active constituents include Thymohydroquinone, dithymoquinone, nigellone, pinene ( $\alpha, \beta$ ), (3) d-limonene, d-citronellol, p-cymene, and Thymol(4). Because of its crucial significance in human nutrition and health, Nigella seed oil is one of the newest sources of edible oils. According to reports, N. Sativa seed oil has anticancer, antioxidant, anti-inflammatory, antibacterial, anti-nociceptive, hormone modulating and immune system-stimulating properties. [29, 30, 31, 32]
- **Biological Activity:** The extensive utilization of N. Sativa in traditional medicine has served as a catalyst for numerous researchers to explore and identify potential active components. Consequently, they have conducted in vivo and in vitro experiments, aiming to unravel the pharmacological effects associated with this remarkable plant.
- **Effect on Hormones System:** The presence of phytoestrogenic and flavonoid compounds in Nigella sativa extract has been found to effectively decrease the

occurrence of ovarian cysts in mice having polycystic ovary syndrome and thus alleviate secondary dysmenorrhea. The extract derived from this plant has been proposed to enhance the condition of polycystic ovary syndrome by upregulating the mRNA expression of epigenetic genes and maternally imprinted genes, while simultaneously reducing the free radicals and influencing the reproductive activity and regulate the ovarian hormones in human and animals. Specially, it suppress lutenizing hormone and estrogen secretion while promoting follicle stimulating hormone levels. [33]

- **Anti-Inflammatory Effect:** *N. sativa* oil is applied topically to relieve joint pain and stiffness. Due to its anti-inflammatory effect it has been used to cure dysmenorrhea. The anti-inflammatory effect of *N. sativa* is attributed to the presence of thymoquinone, active constituent that effectively reduces the activity of cyclooxygenase and 5-lipoxygenase enzymes. [34]
- **Anti-Oxidant Effect:** Pain is closely linked to an elevation in lipid peroxidation levels and a decline in the activity of superoxide scavenging. It is extensively documented that an imbalance between increased free radicals and decreased antioxidant potential leads to the onset of oxidative stress. This oxidative stress play an important role in manifestation of pain and various symptoms associated with dysmenorrhea.[29]
- **Anti- Nociceptive Effect:** The antinociceptive effect of the *N.sativa* seed oil is primarily attributed to its composition of monoterpenoids, specifically  $\alpha$  and  $\beta$  pinene. Both of these constituents have been recognized for its supraspinal and antinociceptive properties. They inhibit prostaglandin E and exert control over nociception at the dorsal horn by interacting with GABA receptors. The spinal cord has been found to possess a significant abundance of GABA inhibitory neurons, indicating their crucial functional role in pain inhibition. [35]
- **Dose:** For topical application, the oil was administered with precision, typically consisting of one or two drops on the fontanel area (particular region that corresponds to the junction where two frontal and two parietal bones converge). A gentle massage was then performed for a duration of one to two minutes, ensuring a thorough and delicate application technique.(2) This therapeutic intervention offers various preparations, including powder, tablet or capsule. The recommended dosage involves a regimen of three times a day, initiated two to three days before the onset of menstruation and continued consistently until the second day of menstruation. [36]
- **Possible Side Effects:** Extended utilization of *N. sativa* extract, containing phytoestrogens, has the potential to decrease testosterone levels overtime, resulting in a negative feedback effect on luteinizing hormone. [33]
- **Results:** The seeds of *N.sativa* demonstrated a range of beneficial effects in the treatment of various ailments, encompassing inflammatory and autoimmune disorders, along with metabolic syndrome and thus it is effective in treatment of dysmenorrhea. [37]

#### 4. Vitexagnus-Castus (chaste tree)

- **Introduction:** The chaste tree belongs to family Lamiaceae, is a shrub tree with a height of 3 to 6m in the Mediterranean region, this plant thrives in its natural habitat along riverbank and sea costs. The plants also found in flora of Pakistan.(5) The fruits of this plant hold significant value within traditional medicinal practices across various countries. They are extensively employed for alleviating symptoms associated with premenstrual syndrome (PMS), enhancing the psychoemotional well-being of women, and promoting regularity in the menstrual cycle. Moreover, these fruits serve as a vital ingredient in the production of medicinal formulations. With a rich history dating back over 2500 years, this plant has been utilized in ancient Greece, Rome and Egypt, showcasing its diverse applications in addressing various gynecological issues. [38, 39]
- **Chemistry and Pharmacology:** The fruits of the chaste tree plant contain a secondary metabolites, including terpenoids (which form the essential oil), flavonoids, irinoids, and phenol carboxylic acid. Through the utilization of chromatographic and spectral techniques, researchers have identified over 60 different substances within these fruits. Among these compounds, flavonoids and irinoids are particularly abundant and prominent in terms of their quantities and concentrations within the chaste tree fruits. The chaste tree exhibits a wide range of beneficial effects, including prevention of oxidative stress, hypolipidemic action, antidiabetic properties, antioxidant activity, modulation of hormones, opiodergic effects, as well as anti-inflammatory and anti-nociceptive actions. [40]
- **Effect on Hormones System:** A recent study conducted that the certain flavanoids, namely apigenin, penduletin, and vitexin, possess estrogenic properties. These compounds specifically bind to the  $\beta$ -estrogen receptors. Chase tree fruit may have additional beneficial effects in treating the problems related to menstruation, the presence of linoleic acid help in activating the expression of  $\beta$ -estrogen receptor gene. It has been reported that chase tree fruit displace the estrogen from both  $\alpha$  and  $\beta$  estrogen receptors. [38]
- **Anti Inflammatory Effect:** Vitex agnus castus has shown comparable effectiveness to mefenamic acid in reducing the severity of dysmenorrheal pain in women who have reproductive tract congenital anomalies. Additionally, Vitex may provide various other advantages, including relieving headaches and enhancing gastrointestinal symptoms. [41]
- **Antinociceptive Activity:** The activity of relieving pain by the Vitex tree fruit carried out by the inhibition of COX-1 and COX-2 enzymes. This inhibition subsequently leads to a reduction in the production of pain mediators such as prostaglandins, histamine, serotonin and bradykinin. [42]
- **Antioxidant Activity:** The constituents of it have the potential to interact with dopaminergic antagonists and display both progestrogenic and estrogenic activities. [40]

- **Dose:** In a clinical trial, the extract of Chate tree Ze 440 in dry form use at a daily dosage of 20 mg. there is no adverse effect reported on discontinuation of drug.
- **Result:** Further investigation is needed to explore the synergistic interactions and mechanisms by which the individual chemical compound in Vitex exerts their pharmacological effects. The extensive range of pharmacological activities exhibited by the compounds, as well as the potent pharmacological activity of the entire extract, highlight the importance of studying Vitex for its potential in regulating female reproductive system. [38]

### III. FOOD FOR INFERTILITY

1. **Introduction:** Infertility is a medical disorder that is characterized by inability to conceive a child or a pregnancy to full term. Infertility may be of two types: primary infertility, which is described as situation in which a couple has never been able to conceive a child, and secondary infertility, in which a couple has previously carried a child to term but is now unable to conceive. [39]
2. **Factors Contributing Infertility:** Infertility can be caused by a number of different factors, some of which include the following:
  - **Age:** advanced maternal age (usually above 35) and advanced paternal age can both reduce fertility and increase the chance of infertility due to variables such as falling egg and sperm quality. Maternal fertility normally starts to decline around the age of 35, while paternal fertility begins to decline around the age of 50.
  - **Female Factors:** These can include hormonal imbalances, ovulation problems, and fallopian tubes, obstructed anatomical abnormalities in the reproductive organs and age-related loss in fertility, or certain underlying medical diseases.
  - **Male Factors:** Infertility in men can be caused by several factors, including hormonal imbalances, anatomical abnormalities, and specific medical diseases that impact sperm production or delivery, a low sperm count, poor sperm motility or morphology.
  - **Lifestyle Choices:** such as smoking, excessive alcohol use, and obesity, certain medical problems such as polycystic ovary syndrome and endometriosis, genetic abnormalities, and certain drugs or treatments such as chemotherapy can also contribute to infertility.
  - **Infections of the Reproductive Organs:** especially sexually transmitted infections (STIs), can cause inflammation, scarring, and damage that can have an impact on a couple's ability to have children.
  - **Genetic Factors:** Infertility can be caused by genetic factors such as genetic abnormalities or chromosomal problems, and these factors can affect both males and females. [40]

**3. Therapies that Improve Reproductive Health:** Infertility is a complicated medical issue that can have a wide range of underlying reasons, and it almost always need the involvement of medical professionals. Considering this, following are some natural therapies that could improve reproductive health:

- **Balanced Diet:** It is quite important to eat healthily to preserve both general health and fertility. Maintaining a balanced, nutrient-dense diet that consists of an abundance of fruits, vegetables, whole grains, lean meats, and healthy fats should be your primary focus. There is some evidence that suggests that meals high in antioxidants, such as berries, leafy greens, and nuts, may be especially advantageous for reproductive health.
- **Herbal Supplements:** The use of certain herbal supplements to enhance reproductive health has a long history. Maca root, evening primrose oil, red raspberry leaf, and chasteberry are a few examples of these types of supplements.
- Acupuncture is a traditional Chinese medicine that includes putting very tiny needles into precise places on the body all throughout the body. It is thought to assist in the regulation of hormone levels, the improvement of blood flow to the reproductive organs, and the reduction of stress.
- **The Management of Stress** is important because chronic stress may have a deleterious influence on fertility. It is possible that engaging in stress-relieving activities like meditation, yoga, exercises involving deep breathing, or therapy would be useful in regulating one's levels of stress.
- **Exercise on a regular basis:** Keeping an exercise regimen that is both modest and consistent will help to improve general health and may have a favorable influence on fertility. However, exercise that is either too light or too strenuous might have the opposite impact, so it is essential to find a happy medium.
- **Controlling One's Weight:** achieving and sustaining a healthy weight is essential for fertility. Conditions related to being either overweight or underweight might influence hormone levels and cause ovulation to be disrupted. [41, 42]
- **Prevalence:** Infertility is a substantial problem on a worldwide scale. According to estimates provided by the World Health Organization (WHO), infertility affects roughly 15 percent of all married couples across the world. This number represents a large chunk of the total population of the world.
- **Variations at the Regional Level:** Infertility rates might differ from area to region. The prevalence of infertility can be affected by a variety of factors, including but not limited to socioeconomic situations, cultural norms, access to treatment, and population demographics. Some nations with older populations or countries with a high incidence of sexually transmitted infections (STIs) and reproductive health difficulties have been found to have higher rates of infertility.

- **Developing Nations:** Infertility can have a more significant impact in developing nations due to a number of circumstances, including restricted access to healthcare services, poor reproductive health infrastructure, and problems in both the pricing and availability of fertility therapies. The global trend of women delaying childbirth adds to a rise in the prevalence of infertility, which in turn contributes to an aging population.

#### 4. Mechanisms of Infertility in Women

- **Ovulation Disorders:** Inconsistent or nonexistent periods of ovulation might make it challenging to conceive a child. The hormonal control of ovulation can be thrown off kilter by medical conditions such as polycystic ovarian syndrome (PCOS) and hypothalamus dysfunction.
- **Blockage of the Fallopian Tubes:** If the fallopian tubes are blocked or damaged in any way, either the sperm will not be able to reach the egg or the fertilized egg will not be able to implant in the uterus. There are a few conditions that can lead to tubal obstruction, including pelvic inflammatory disease (PID), endometriosis, prior pelvic operations, and anatomical abnormalities.
- **Uterine Abnormalities** Implantation or the development of a healthy pregnancy can be hampered by structural abnormalities of the uterus, such as uterine fibroids, polyps, or congenital deformities.
- **Endometriosis** is a disorder in which tissue that lines the uterus that is known as the endometrium starts to develop outside of the uterus. Endometriosis can be one of the causes of infertility. It may result due to inflammation, scarring, and adhesions due to this condition.
- **Hormonal Imbalances:** Imbalance in hormones such as follicle-stimulating hormone (FSH), luteinizing hormone (LH), estrogen, and progesterone can all cause disturbances in the menstrual cycle, ovulation, and implantation processes.
- **Age-related Factors:** As women age, there is a natural drop in the quality and amount of eggs, which can decrease fertility and elevate the chance of chromosomal abnormalities.

#### 5. Mechanisms of infertility in Men:

- **Sperm Disorders:** The most common cause of male infertility is with either with the generation of sperm, its motility (movement), or its morphology (form). The inability of sperm to reach the egg and fertilize it can occur due to low sperm count (oligospermia), poor sperm motility (asthenospermia), or faulty sperm morphology (teratospermia).
- **Varicocele** is a disorder that is characterized by swollen veins in the scrotum. This condition can cause an increase in testicular temperature and can hinder the production of sperms.

- **Hormonal Imbalances:** Hormonal imbalances, such as those involving testosterone, follicle-stimulating hormone (FSH), or luteinizing hormone (LH), can impact on the generation and quality of sperms.
- **Genetic Anomalies:** Infertility in men can be caused by genetic anomalies such as chromosomal diseases (like Klinefelter syndrome) or single gene mutations, which can be inherited.
- **Testicular Factors:** Testicular factors include damage to the testicles, testicular cancer, undescended testicles (cryptorchidism), and testicular infection (orchitis), each of them can affect sperm production and function.
- **Ejaculatory Disorders:** Infertility can occur due to the conditions that impair ejaculation, such as retrograde ejaculation a condition in which the sperm enters the bladder rather than being release is one of the examples. [43]

#### IV. FOODS FOR THE MANAGEMENT OF INFERTILITY

##### 1. Vitex

- **Introduction:** Vitex, also known as chasteberry, botanical name is **Vitex agnus-castus**, belongs to the family Verbenaceae is a herb that has been traditionally used for the treatment of various hormonal conditions, including infertility. Vitex is a shrub native to the Mediterranean region and Central Asia. The ripe berries of the Vitex plant are used in herbal preparations. There are many species of vitex, but agnus castus is the one usually used in herbalmedicine.It has a long history of use in traditional medicine, particularly in Europe, for a range of female reproductive disorders.It consists of glycosides "**agnuside**" and "**casticin**" which impact on the hormonal balance in the body particularly in relation to the reproductive system and on fertility. It is available in the form of capsules or tablets, tinctures or grounded to add to the food. The berries can be soaked in hot water and drunk as a tea.
- **Hormonal Regulation:** Vitex have an impact on the hormonal system, especially in regulating the balance between progesterone and estrogen. It influences on the hypothalamus and pituitary glands modulate the secretion of hormones regulating the menstrual cycle, such as follicle-stimulating hormone (FSH) and luteinizing hormone (LH).
- **Progesterone Support:** Vitex is often used to promote progesterone production and address luteal phase defects. It influences the release of LH, which triggers the release of an egg from the ovary and the subsequent formation of the corpus luteum, which fabricate progesterone.
- **Prolactin Regulation:** Vitex also affects the hormone prolactin, which is involved in lactation. It has an inhibitory effect on prolactin secretion, which can be beneficial where elevated prolactin levels contribute to infertility.

- **Menstrual Cycle Regulation:** Vitex is used to support regular menstrual cycles by promoting hormonal balance. It can alleviate symptoms of premenstrual syndrome (PMS), such as breast tenderness, bloating, and mood swings.
- **Potential Benefits:** Vitex have various positive effects on female fertility, such as regulating menstrual cycles, addressing luteal phase defects, and improving progesterone levels. It improves skin health for those with Acne Vulgaris and Post-gestatory acne (acne as a result of taking oral birth control). It is found to be useful for minimizing uterine cysts growing within the smooth muscle of the uterus.
- **Dose:**  
**Capsules: 900-1,000mg a day, Tincture: 60-90 drops a day.** Vitex starts producing its effects within 10 days, but complete advantages may be achieved till 6 months or longer as it is making fundamental changes in the delicate chemistry of the body it may require some time. Since it is a harmonizing and nourishing herb it works behind the scenes to restore balance for long term in a gentle way. It should be taken once a day in the morning on an empty stomach (half an hour before breakfast). It comes in many forms, including loose herbs, capsules, tea, tincture, and powdered herb, but capsules and tincture offer the most consistent results since it is trouble free to control the dosage and convenient to ingest.
- **Possible Side Effects:** Side effects include stomach upset, itchy skin with mild rash, headache, increased acne, heavy menstrual flow
- **Contra Indications:** The herb should be avoided while nursing and during pregnancy. Interaction with other medications including oral contraceptives and birth control pills it may cause them to become ineffective. It may not be safe under certain other conditions, such as Parkinson disease and cancers that are hormone sensitive, such as breast cancer and uterine cancer. [44]

## 2. Gokshura

- **Introduction: Tribulus terrestris**, commonly known as puncturevine or Gokshura, is an herb that has been used in traditional medicine systems, particularly in Ayurveda and Traditional Chinese Medicine (TCM). Gokshura belongs to the **Zygophyllaceae** family is a small, flowering plant that is native to Asia, Europe, and Africa. It has spiky fruits that contain sharp spines, giving rise to its common name "puncturevine". It has a long history of use in traditional medicine systems including male sexual health, fertility, and general well-being. It contains various active compounds, such as saponins, flavonoids, alkaloids, and steroidal glycosides. These primary bioactive components are responsible for its potential activity particularly the saponin, **protodioscin**.
- **Effect on Testosterone:** Tribulus terrestris has been traditionally used for its potential to increase testosterone production. Testosterone is an important hormone involved in male reproductive health, including sperm production and libido.

- **Effect on Male Fertility:** It has antioxidant properties that can protect sperm cells from oxidative damage. It may have a positive impact on male fertility by increasing sperm count, motility, and morphology. Its main constituent, protodioscin, improves DHEA levels in males. Men with erectile dysfunction have low levels of DHEA. Studies show that protodioscin, extracted from Tribulus, enhances natural DHEA levels needed for proper erection.
- **Effect on Female Fertility:** Tribulus is a potent, over-all fertility tonic for females and an ovarian stimulant, making it an excellent choice for PCOS patients. It is notably effective for women with PCOS who do not ovulate. This herb is also excellent for assisting women with menstrual irregularities and regulating the menstrual cycle as a whole.
- **Anti-sperm Antibodies:** Anti-sperm antibodies are produced in the body as a result of the body having an immune response against semen. This can happen to both men and women as well. The antibodies that are triggered during the immune response start to kill the sperm because the body identifies them as foreign invaders. Increased numbers of anti-sperm antibodies in women can make it difficult for the sperm to reach the egg, and/or to fertilize the egg. The heightened immune response also affects conception.
- **Other Potential Benefits:** Apart from male fertility, Tribulus terrestris has been traditionally used for various other purposes, such as enhancing libido, managing erectile dysfunction, improving urinary tract health, and supporting overall vitality.
- **Dose:** Capsules: 500mg a day to start can be increased up to 1500mg a day as required. Liquid Extract or tincture can be taken 3-5 ml, 2 times a day. For men it has shown best results when used all month long, for 3-6 months consistently because it takes 46-72 days for an immature sperm to mature before ejaculation. For women it is required to take all month long and for women with irregular ovulation timing or an ovulatory cycle, Tribulus has been shown best results when used from day 5-14 of the menstrual cycle, not past ovulation.
- **Possible Side Effects:** No side effects have been reported with long-term use, except for gastrointestinal upset in some patients after 6 months of consistent use.
- **Contra Indications:** The drug should be avoided during pregnancy or by women who are attempting to conceive should use the herb before ovulation period only. It contributes to cholestasis when indicated during pregnancy. It is a liver disease in which the normal flow of bile from the gall bladder is impacted due to raised levels of pregnancy hormones. It occurs during pregnancy only. The gall bladder holds bile produced by the liver, aiding in the breakdown and digestion. Cholestasis affects this function down, which may cause bile acids to empty into the blood stream. While it has also shown a low level of survival rate of offspring when indicated during the course of pregnancy therefore it should be avoided. [45]

### 3. Maca

- **Introduction: Maca**, is also known as **Lepidium meyenii**, is a root or vegetable that belongs to the family **Brassicaceae** which is native to the altitudes of the Andes Mountains in Peru and has been used for centuries as both a food source and a medicinal plant. Macaenes and macamides are unique bioactive compounds found in Maca, they are believed to contribute to the potential health benefits associated with it. It comes in different colors, including yellow, red, and black. Each color variety is believed to have slightly different properties. It is rich in various nutrients, including carbohydrates, proteins, fiber, vitamin B, vitamin C, and vitamin E, minerals such as calcium, potassium, iron, and zinc and essential fatty acids.
- **Hormonal Balance:** Maca supports hormonal balance, particularly in women. It exerts its effects by acting on the hypothalamus and pituitary glands helps to regulate the production and balance of various hormones. [46]
- **Effects on Female Fertility:** Maca have positive effects on female fertility it improves menstrual regularities, supports ovulation, and enhances reproductive hormone levels. It also alleviates certain symptoms related with hormonal imbalances that may be mood swings and hot flashes.
- **Effects on Male Fertility:** Maca also has potential effects on male fertility. It improves sperm production, sperm motility, and sperm quality. It enhances healthy testosterone levels and provides antioxidant protection to sperm cells.
- **Other Potential Benefits:** It have other potential benefits, including enhanced energy levels, improved libido, increased stamina, and improved mood. It is also assumed that Meca also have positive effects on cognitive function and bone health.
- **Adaptogenic Properties:** Maca is characterized as adaptogen, a substance that aids the body to adapt to stress and promotes overall well-being. It supports the body's ability to cope with physical, environmental and mental stress.
- **Dose:** The recommended dose is 1,500 to 3,000 milligrams (mg) per day for root powder. It can be divided into two to three doses over a day. It is suggested to start with a lower dose and gradually increase it over the time, based on individual tolerance and response.
- **Possible Side Effects:** Maca is generally considered safe for most individuals when consumed in moderate amounts as a food or dietary supplement. Although, some individuals may experience some adverse effects that may be digestive issues, insomnia or changes in mood.
- **Contra Indications:** Individuals with conditions which include ovarian cancer, breast cancer, endometriosis, uterine fibroids or uterine cancer should use it with caution and consult a healthcare professional before using. It contains compounds called glucosinolates, which can influence thyroid function.

Rarely, some individuals may have allergies to maca. If they are allergic to other cruciferous vegetables such as broccoli, cabbage, or kale, there is a possibility of cross-reactivity and allergic reactions.

It is generally recommended to avoid maca during pregnancy and lactation to be on the side of caution. Maca may interact with certain medications, particularly those that are hormone-related or impact the endocrine system.

While all these herbs have long history of traditional use and shows promising potential for supporting hormonal balance and fertility, further research is needed to fully understand its mechanisms of action, establish optimal dosages, and evaluate its long-term safety. It is recommended to consult with a healthcare professional before considering the use of any herbal remedy for infertility or related purposes. [47,48, 49, 50]

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