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ADVANCING WOMEN'S HEALTH THROUGH NUTRACEUTICALS

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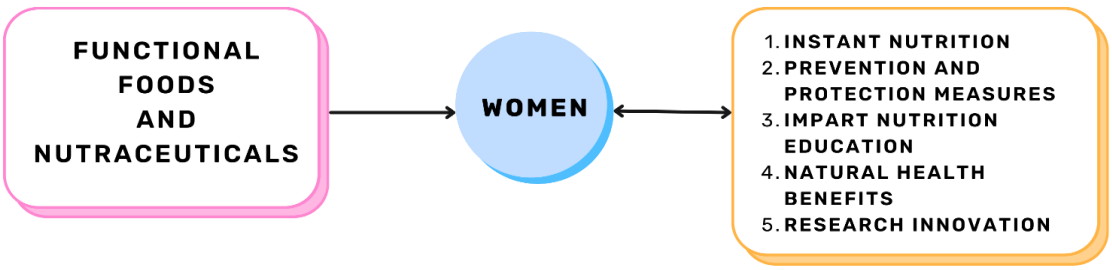
ABSTRACT

While healthy, balanced, and natural food meets the nutritional requirements of any healthy person, there are people, particularly women who need to be provided with supplements. Pregnant and lactating women, those with pre and post-menopause issues, and women with special dietary needs like sportswomen, models, etc., fall in this category. There is also a major issue of malnutrition endemic among the large section of society in which it is prevalent in social mores and custom affects women much more seriously compared to the menfolk. Due to various sociological and economic factors, the special nutritional needs of women cannot be adequately addressed by normal consumption habits, and nutraceuticals come as an effective solution to this problem. Though not acclaimed to the extent it deserves, the nutraceuticals do play a decisive role in combating many life-threatening diseases like Cardio Vascular Diseases, Obesity, Hypertension, Arthritis, etc., both as an thus, nutraceuticals serve as an effective prophylactic and a curative aid to the mainline treatment. The generally recognized benefits of a carefully calibrated regimen of nutraceuticals are general performance enhancement, stress relief, increase in memory, immunity boosting, etc., Considering that women shoulder more than their share of family responsibility, women stand to be the main beneficiaries of such health regimen, and in this sense, the nutraceuticals contribute to a considerable extent to the empowerment of women.[1,2]

KEYWORDS: Nutraceuticals, Functional Foods, Women's Health, Dietary Supplements, Bioactive Compounds, Phytochemicals, Antioxidants, Omega-3 Fatty Acids, Hormonal Balance, PCOS, Menopause, Preventive Healthcare, Immunomodulation.

1. INTRODUCTION

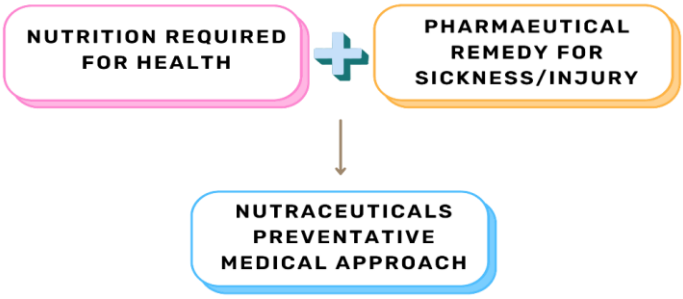
The term "nutraceutical" was coined in 1979 by Stephen De Felice and is defined as "a food or parts of food that provide medical or health benefits, including the prevention and treatment of disease".[1,2] Nutritional therapy is based on its motto as a complimentary therapy with nutraceuticals as food not only provides energy and nutrients but are also used as medicines. Nutraceuticals detoxify our bodies and restore our healthy digestion and dietary habits, too. Nutraceuticals are marketed in their concentrated forms as pills, capsules, powders and tinctures either as a single substance or as combination preparations.[3,5,6] A nutraceutical may be a naturally nutrient-rich food such as spirulina, garlic, soya or a specific component of a food like omega-3 oil from salmon. They are also known as medical foods, nutritional supplements and dietary supplements. Global demand for herbal and non-herbal extracts is growing consistently. Green tea for weight loss and cancer treatment while Ginkgo biloba for improvement of cognitive function, has been used widely as nutraceuticals.[5] The Nutraceutical market has been developed from past few years due to growing attention of researchers and sophisticated techniques for determination of qualitative and quantitative parameters. On the other hand, consumers are becoming frustrated with the high-cost, high-tech disease treatment approach in modern medicines. As a result, consumer demand is emerging for nutrition products that will provide complementary or alternative benefits.



1.2 Functional foods and Nutraceuticals for women

Concept of Nutraceuticals

Clinical test results are needed for animal tests and studies, as well as verification of their therapeutic effects, in pharmaceutical development. But regarding nutrition, there had not been any verification method for foods in the prevention of diseases in the past. In recent years, however, as food composition has been scientifically proved to cause lifestyle-related diseases and has become a social issue. The nutraceutical products are recognized and produce health benefits like alleviating the risk of cancer and heart disease and also to prevent or treat hypertension, high cholesterol, excessive weight, osteoporosis, diabetes, arthritis, macular degeneration leading to irreversible blindness, cataracts, menopausal symptoms, insomnia, diminished memory and concentration, digestive upsets, and constipation, not to mention headaches; other products are touted as cures for thinning hair, lack of confidence, poor complexion, varicose veins, alcoholism, depression, and lethargy. The concept of Nutraceuticals has started to be acknowledged as one of the measures for preventing such diseases.[4,6,7]



1.3 Classification of Nutraceuticals

a) Traditional

- Chemical constituents, Nutrients, Herbals, Phytochemicals
- Probiotic organisms
- Nutraceutical enzymes

b) Non-traditional

- Fortified Nutraceuticals
- Recombinant Nutraceuticals

c) Substance with established nutritional functions:

- Vitamins, Minerals, Amino acids, Fatty acids.

d) Herbs or Botanical products

e) Reagents derived from other sources:

f) Functional foods

g) Probiotics and Prebiotics:

h) Polyunsaturated fatty acids (PUFA):

i) Anti-oxidant vitamins:

j) Polyphenols:

k) Spices:[5, 6]

TRADITIONAL NUTRACEUTICALS

When we talk about traditional nutraceuticals, we're basically looking at foods in their rawest, most honest form. These are items that haven't been messed with by industrial processing. Because they stay exactly how nature made them, their biological structure remains intact. This is a big deal because it means the "bioactive compounds" inside stay powerful and ready to help our bodies.

Take lycopene as a prime example. You'll find this heavy-hitting antioxidant in things like:

a. Tomatoes and pink grapefruit

b. Guava, papaya, and watermelon

It's not just for show, either. Research shows that lycopene is a serious player in preventing diseases. It's been linked to lower risks of leukemia and several cancers, including prostate, bladder, and cervical cancer. All that protection essentially comes down to the natural strength of that one antioxidant.[86,87]

Non-Traditional Nutraceuticals

When we look at non-traditional nutraceuticals, we are moving into the world of "enhanced" nutrition. These aren't just whole foods; they are products that have been intentionally boosted with specific nutrients or functional ingredients to better support our long-term health and vitality.

A standout example of this is β-carotene. You'll find this compound in abundance within vibrant orange produce like carrots, tangerines, and oranges. As a precursor to Vitamin A, it acts as a high-powered antioxidant that does a lot of heavy lifting for our bodies:

c. **Neutralizes free radicals** to prevent cellular damage.
d. **Protects our eyes**, specifically shielding the cornea from the harmful effects of UV radiation.
e. **Functions as a natural shield** due to its anti-inflammatory and anti-carcinogenic properties.[45]

Non-traditional nutraceuticals can be further classified into two main categories:

Fortified Nutraceuticals: These involve enriching foods with essential micronutrients such as vitamins and minerals to enhance their nutritional profile. For example, milk fortified with cholecalciferol (vitamin D3) is commonly used to help manage vitamin D deficiency.

Recombinant Nutraceuticals: Foods included under this category are usually developed using modern biotechnological techniques such as genetic modification and fermentation. These methods are mainly applied to improve the availability of nutrients in food or to introduce components that provide additional health benefits. Such approaches help in enhancing the nutritional quality of food without changing its basic dietary role.

An example of this type of nutraceutical is gold kiwifruit, which has been modified to naturally contain higher amounts of vitamin C along with carotenoids and lutein. These nutrients are known to support antioxidant defence and help protect body cells from oxidative stress. Similarly, bioactive compounds such as lutein and zeaxanthin are commonly present in foods like corn, avocado, egg yolk, and spinach. These compounds have been associated with antioxidant activity and are believed to contribute to protective effects against certain types of cancer, along with supporting eye and tissue health.

Substances with Established Nutritional Functions

Vitamins are basic nutrients that the body needs to function properly on a daily basis. They are directly involved in processes such as metabolism, immunity, and growth. When the intake of essential vitamins is inadequate, the effects usually become visible in the form of specific deficiency symptoms. Because of this reason, many nutraceutical products and health-supporting foods are enriched with commonly required vitamins such as A, B-complex, C, D, and E.

Plant-based foods remain one of the primary sources of vitamins in the human diet. With the progress made in plant biotechnology, it has become possible to improve the vitamin content of certain crops in a natural and controlled manner. This helps in increasing the nutritional value of foods without changing the way they are consumed. Apart from vitamins, minerals such as calcium, zinc, iron, manganese, and magnesium are also essential, as they support important body functions including bone strength, enzyme activity, and immune defence.

Mineral deficiencies are still widely observed, particularly deficiencies of calcium, zinc, and iron. These problems are more common in developing regions and among sensitive groups such as infants and young children. Lack of these minerals may result in poor immunity, delayed growth, and developmental issues. Therefore, improving the mineral content of plant-based foods through dietary planning or food fortification can serve as a practical approach to enhance overall nutritional health at a larger scale.[36]

Herbs and Botanical Products

Herbs and botanical products have been used for many generations as part of traditional healing practices. People have relied on these natural substances mainly in the form of extracts, powders, or concentrated preparations to support health and to manage different health problems, whether short-term or long-lasting. Their continued use reflects the trust built over time in their therapeutic value.

Traditional medical systems such as Ayurveda, which originated in India and is one of the oldest holistic healing systems, strongly emphasize the use of medicinal plants for maintaining overall health and preventing disease. Scientific studies now support many of these traditional practices by showing that herbs contain bioactive compounds with important nutraceutical properties. These compounds are known to provide antioxidant, anti-inflammatory, and antimicrobial benefits, which contribute to the body's natural defence mechanisms.

Even in modern times, botanical ingredients remain widely used in nutraceutical formulations. Their popularity lies in the fact that they offer a natural and time-tested approach to wellness. When used appropriately, herbal nutraceuticals can help support health and work alongside conventional medical treatments without replacing them.[69,77]

Reagents Derived from Other Sources Glucosamine and Chondroitin:

Glucosamine is something the body needs to keep joints working properly. It supports the cartilage, which acts like a cushion between the bones and helps joints move smoothly. Most glucosamine supplements are prepared from animal sources such as bovine or calf cartilage, and they are widely used in several European countries, especially by people dealing with joint discomfort or osteoarthritis.

One commonly used form is glucosamine sulfate. It helps the joints by improving the quality of the fluid present inside them, making movement less stiff and more comfortable. Many people report that regular use helps them move more easily over time. Glucosamine is usually sold as either hydrochloride or sulfate, and both are known to help reduce joint inflammation.

Often, glucosamine is taken along with chondroitin. Chondroitin is another natural substance found in cartilage and helps it stay strong and flexible. When these two are used together, they tend to work better in supporting joint comfort and improving mobility than when used alone.[38,39]

Flavonoids

Flavonoids are natural substances present in many fruits, vegetables, and plant-based foods. Because of their health-supporting properties, they are commonly included in functional foods and nutraceutical products. One of the main reasons flavonoids are valued is their strong antioxidant activity, which helps protect body cells from damage caused by everyday stress and environmental factors.

Apart from their antioxidant role, flavonoids also help the body by reducing inflammation and limiting the growth of harmful microorganisms. They support the proper functioning of different organs by protecting the liver, helping in blood sugar regulation, and maintaining digestive health. Their contribution to heart health is particularly important, as they help improve blood circulation and reduce the chances of fat and plaque buildup in blood vessels.

Flavonoids are also known to support brain health and may help lower the risk of certain chronic conditions when consumed regularly as part of a balanced diet. By helping blood vessels relax and reducing the risk of abnormal clot formation, these compounds further support cardiovascular function. Due to these multiple benefits, flavonoids are considered an important group of bioactive compounds in nutraceuticals and functional foods.[88]

Dietary Supplements and Fibers

Dietary supplements are things people take when they feel their regular food is not enough for their body. These products are used mainly to support health or to cover nutritional gaps. They can contain vitamins, minerals, plant-based ingredients, or extracts from foods and herbs. Many people use supplements to feel active, stay healthy, improve immunity, or support their daily lifestyle.

Fiber supplements are very important for digestion. Fiber helps the stomach and intestines work properly and keeps bowel movements regular. Foods like brown rice, oats, bananas, dry beans, and other legumes naturally contain fiber and are good for gut health. Taking enough fiber, either from food or supplements, helps digestion and reduces the chances of digestive problems in the long run.

Phytochemicals

Phytochemicals are natural substances found in plants that help support good health. These compounds are commonly used in nutraceutical products because they can positively affect many functions in the body. Some phytochemicals help control blood sugar levels and improve how the body uses insulin, which makes them useful in managing conditions like diabetes. Although many phytochemicals have been discovered so far, only a small number of them have been studied in detail.

Mushrooms are a good example of foods that contain important bioactive compounds. They are not only nutritious but also known for their medicinal benefits. Compounds present in mushrooms have been found to support immunity and show antioxidant and antiviral effects. One such compound, called lentinan, is known to strengthen immune responses and has shown potential benefits in supporting treatment for infections, including certain viral diseases.

Functional Foods

Functional foods are dietary components that go beyond basic nutrition to offer additional health benefits, contributing to the prevention of disease and promotion of overall well-being. These foods are rich in essential nutrients required for growth, maintenance, and development, and they often include categories such as cereals, legumes, and fermented foods.

Whole grains like rice, wheat, corn, millets, sorghum, and buckwheat have been associated with a reduced risk of coronary heart disease, certain cancers, and high blood pressure. Similarly, legumes such as kidney beans, chickpeas, lentils, and soybeans have demonstrated antioxidant and cardioprotective properties, potentially lowering the risk of cardiovascular diseases and managing diabetes.[100]

Chocolate, particularly dark chocolate, is also recognized as a functional food due to its rich content of proteins, iron, magnesium, calcium, and riboflavin. It exhibits antioxidant, anti-inflammatory, and heart-protective effects. Citrus fruits serve as another valuable example, known for their therapeutic properties, including anticancer, antiviral, and immune-boosting effects.

Fermented milk products like yogurt are widely regarded as functional foods because of their ability to support digestive health. Yogurt is also linked with immune modulation and may play a preventive role against gastrointestinal infections and atherosclerosis. Furthermore, it is often recommended for individuals with lactose intolerance due to its easy digestibility.

Probiotics and Prebiotics

Probiotics are live microorganisms, often referred to as "good bacteria," that provide numerous health benefits when consumed in adequate amounts. These beneficial microbes help maintain a healthy balance in the gut microbiota, improve digestive health, and enhance immune function.

Prebiotics, on the other hand, are non-digestible food components—commonly fibers or specific oligosaccharides—that selectively stimulate the growth and activity of beneficial bacteria in the colon. They serve as food for probiotics, helping to optimize gut health and nutrient absorption. A notable example is inulin, a type of prebiotic fiber that, upon hydrolysis, produces beneficial compounds such as fructo-oligosaccharides and galacto-oligosaccharides.

Together, probiotics and prebiotics support a healthier gastrointestinal environment and are often included in dietary strategies aimed at enhancing overall wellness.[82,83]

Polyunsaturated Fatty Acids (PUFAs)

Polyunsaturated fatty acids (PUFAs) are essential fats that include omega-3 (n-3) and omega-6 (n-6) fatty acids. These fats differ based on the position of the first double bond in their chemical structure. As the human body cannot synthesize them, they must be obtained through the diet.

PUFAs are crucial for maintaining cell membrane integrity, regulating inflammation, and supporting brain and heart health.[8,9,96]

Omega-3 fatty acids, in particular, have been shown to reduce the risk of chronic diseases, including cardiovascular conditions and inflammatory disorders. One of their key functions is to combat oxidative stress by neutralizing free radicals—unstable molecules that can damage cells and accelerate aging.

Antioxidants play a vital role in defending cells against free radical damage. The human body uses both internally produced (endogenous) and externally sourced (exogenous) antioxidants to counteract this damage. These substances help stabilize or neutralize free radicals, thus maintaining cellular health and preventing disease progression. A balanced intake of PUFAs and antioxidant-rich foods is essential for long-term health and disease prevention.[8,9,96]

Polyphenols

Polyphenols are naturally occurring phytochemicals found abundantly in plant-based foods such as fruits, vegetables, whole grains, legumes, tea, coffee, cocoa, and wine. With over 8,000 identified polyphenolic compounds—including

phenolic acids and flavonoids—polyphenols are known for their antioxidant properties and their role as secondary metabolites that help plants defend themselves against ultraviolet radiation, oxidative stress, and microbial attacks.

Based on their structural characteristics, polyphenols can be classified into various groups. One major group is phenolic acids, which make up nearly one-third of all polyphenols. These are typically categorized into:
Hydroxybenzoic acids: Examples include protocatechuic acid, gallic acid, and p-hydroxybenzoic acid.

Hydroxycinnamic acids: This group includes caffeic acid, ferulic acid, chlorogenic acid, sinapic acid, and coumaric acid.

Foods rich in these compounds include berries, apples, pears, cherries, kiwi, chicory, and coffee. Due to their potent antioxidant and anti-inflammatory activities, polyphenols are of particular interest in promoting health and preventing chronic diseases such as cardiovascular disorders, neurodegenerative conditions, and certain cancers.[88]

Spices

Spices are aromatic plant-derived substances, used either whole or ground, that primarily serve to enhance the flavor, aroma, and color of foods rather than contribute nutritional value. These natural additives are rich in volatile oils and oleoresins, which are responsible for their characteristic taste and smell.

The health-promoting effects of spices stem from their bioactive compounds, many of which possess antioxidant, anti-inflammatory, antimicrobial, and neuroprotective properties. For instance, spices such as turmeric, black pepper, red chili, ginger, garlic, coriander, saffron, cinnamon, and rosemary have been shown to support cognitive function and offer protective effects against neurodegenerative diseases. Furthermore, spices contribute economically by serving as important exports for producing countries, and their wide applications across industries underscore their value beyond the kitchen.[88,89]

Table1: Types of women health with their nutraceuticals.[8–35, 41–56]

Sr. No.	Types of Health Problems	Subtype with useful Nutraceuticals
1.	**Reproductive Health**	• **Fertility Problem:** Omega-3-fatty acids, Folic acid, Vitamin (B12,C,D) • **Meno-Pause:** Black cohosh, Soy-isoflavones, Red clover
2.	**Gynecologic Conditions**	• **PCOS:** Myo-inositol, Berberine, Vitamin-D • **Fibroids:** Green tea extract (EGCG), Curcumin, Vitamin D3
3.	**Hormonal Health**	• **Thyroid Disorder:** Carnitine, Melatonin, Selenium • **Estrogen/ Progesterone Balance**: Flaxseed, Maca root, Chasteberry

4.	**Mental Health**	• **Depression:** 5-Hydroxytryptophan (5-HTP) Omega-3-fatty acid S-adenosyl-L-methionine (SAM-e) • **Postpartum Disorder:** Omega-3-fatty acid, Collagen, Vitamin-D • **Migraine:** Riboflavin, Coenzyme Q10, Magnesium
5.	**Nutrition & Lifestyle**	• **Obesity:** Green Tea Extract, Chitosan, Glucomannan • **Iron Deficiency Anemia:** Vitamin B12, Ferrous sulfate, Ferrous gluconate
6.	**Cancer**	• **Breast Cancer:** Resveratrol, Sulforaphane, Beta-carotene • **Cervical Cancer:** Gingerol, Curcumin, Vitamins (A,C,D,E)

1. Reproductive Health

1.1 Fertility Problem

1.1.1 Omega-3-fatty acids

- **Sources of Omega-3-fatty acids**
- EPA & DHA Sources: Salmon, Mackerel, Anchovies, Sardines.
- Plant sources of ALA: Flaxseeds, Chia seeds, Walnuts, Mustard oil, Canola oil.
- DHA-Fortified foods: Fortified-Eggs, Milk, Yogurt, Breads.
- Other natural Sources: Seaweed, Leafy Green vegetables, soybeans & Kidney beans.

- **Mechanism of action of Omega-3-fatty acids Anti-inflammatory effects**

EPA & DHA reduce inflammation by down-regulating inflammatory pathways. For instance, in pregnant women, omega-3 supplementation lowers placental and maternal inflammatory markers such as IL-6, IL-8, and TNF-α.These fatty acids also help block Toll-like receptor 4 (TLR4) signaling in placental and adipose tissue.

Modulation of prostaglandin synthesis

In cells of the uterine lining, substances such as DHA and EPA help reduce inflammation. During inflammatory conditions, these compounds lower the production of certain prostaglandins that are usually linked with pain and inflammation. By doing so, they help maintain a healthier balance inside the uterus.

DHA and EPA also reduce the activity of enzymes that are responsible for producing inflammatory prostaglandins. As a result, the body shifts toward producing prostaglandins that cause less inflammation. This action helps control inflammatory responses and supports better uterine health, especially during conditions associated with inflammation.

Modulation of metabolic and oxidative stress pathways

If a pregnant person has metabolic issues like gestational diabetes, omega-3s can really help out. These good fats help the cells in the placenta work better. They do this by cutting down on stress in the cells and helping the placenta handle fats more efficiently. This makes things healthier for both mom and baby.

Because omega-3s help the placenta do its job right, they might also reduce the risk of other pregnancy problems. Keeping things balanced in the placenta cells is super helpful, especially when metabolic issues are in the picture.[8,9,10]

❖ **Marketed Products of Omega-3 Fatty Acids:**

- **Nordic Naturals Ultimate Omega®**
  - High-strength EPA and DHA supplement
  - Used to support fertility and hormonal health

- **NOW® Ultra Omega-3**
  - Concentrated fish oil formulation
  - Supports reproductive and cardiovascular health

1.1.2 Folic acid

- **Sources of Folic acid**
- **Food sources:** fruits, vegetables, Legumes, whole grains.
- **Animal Food sources**: Eggs, Liver, Fish.
- **Fortified Foods:** Bread, Nutrition bars, Breakfast cereals.
- **Supplements:** Multivitamins, Prenatal vitamins.

- **Mechanism of action of Folic acid:**

Conversion to Active Form

Folic acid → converted in the liver → Tetrahydrofolate (THF).THF is the active form that actually works inside the body.

One-Carbon Transfer (Main Role)

THF carries one-carbon units (small chemical pieces).These pieces are needed for making DNA and certain amino acids. Think of THF as a delivery truck carrying "carbon bricks" for building new cells.

DNA Synthesis (Most Important Action)

THF helps convert: dUMP → dTMP. This step is needed for making thymidine, a key DNA base. THF helps build purines (A & G bases) → needed to make DNA and RNA.[11,12]

❖ **Marketed Products of Folic Acid:**

- **Folvite®**
  - Pure folic acid tablet
  - Commonly prescribed for women planning pregnancy
- **Fol 5®**
  - Standard folic acid supplement
  - Used for fertility support and pregnancy care

1.1.3 Vitamin B12

- **Sources of Vitamin B12**
- Natural Animal Sources: Seafood, Meat & Organ Meats, Eggs, Dairy Products.
- Fortified Foods: Soy milk, energy bars, nutritional yeast.
- Supplements: Oral tablets, Sublingual tablets, Injections.

- **Mechanism of action of Vitamin B12**

Methionine Synthase Reaction (DNA & Nerve Function) Form: Methylcobalamin

Location: Cytoplasm Vitamin B12 helps convert:

Homocysteine → Methionine Why is this important?

Methionine forms SAM (S-adenosylmethionine), the "universal methyl donor." SAM is needed for:

Making DNA, Maintaining myelin sheath (protective covering of nerves), Producing neurotransmitters

Methylmalonyl-CoA Mutase Reaction (Fat & Energy Metabolism) Form: Adenosylcobalamin

Location: Mitochondria What happens?

Vitamin B12 converts:

Methylmalonyl-CoA → Succinyl-CoA Why is this important?

Succinyl-CoA enters the TCAcycle, helping produce energy, Prevents accumulation of methylmalonic acid, which damages nerve.[13,36,37]

❖ **Marketed Products of Vitamins (B12, C and D):**

- **Neurobion®**
  - Vitamin B-complex supplement containing B12
  - Supports reproductive and nerve health
- **Limcee®**
  - Vitamin C supplement
  - Enhances antioxidant protection

1.2 Meno-pause

1.2.1 Black cohosh

- **Sources of Black Cohosh**
- Natural plant sources: Eastern United States, Southern Canada.
- Herbal Drug Source: Triterpene glycosides, Phenolic compounds, Alkaloids.
- Nutraceutical and Supplement Source: Standardize dry extracts.

- **Mechanism of Action: Modulation of Neurotransmitters**

Black cohosh primarily acts on the central nervous system rather than directly on estrogen receptors. It influences neurotransmitters such as:

- Serotonin
- Dopamin
- Norepinephrine

By stabilizing these neurotransmitters, black cohosh helps regulate the hypothalamic thermoregulatory center, which reduces hot flashes and night sweats.

Selective Estrogen-Like Activity

Unlike hormone replacement therapy, black cohosh does not significantly increase estrogen levels. Instead, its triterpene glycosides exhibit selective estrogen-like activity, meaning:

- They mildly mimic estrogen effects in the brain
- They do not strongly stimulate breast or uterine tissues

This makes black cohosh relatively safer for women who cannot take estrogen.

Effect on Luteinizing Hormone (LH)

Black cohosh may help reduce elevated luteinizing hormone (LH) levels, which rise during menopause.
Lowering LH levels contributes to the reduction of vasomotor symptoms such as hot flashes.

Anti-Inflammatory and Analgesic Action

The phenolic compounds present in black cohosh exhibit anti-inflammatory effects, which:

- Reduce muscle and joint pain
- Improve overall physical discomfort in menopause

Mild Sedative and Anxiolytic Effect

By acting on the CNS, black cohosh produces a calming effect, helping relieve:

- Anxiety
- Irritability
- Sleep disturbances[20,79]

❖ **Marketed Products of Black Cohosh:**

- **Remifemin®**
  - Standardized black cohosh extract
  - Widely used for menopausal symptom relief
- **Nature's Way Black Cohosh®**
  - Herbal supplement
  - Supports hormonal balance during menopause

1.2.2 Soy Iso-Flavones

- **Sources of Soy Iso-Flavones**
- Whole Soy Foods: Soy milk, Tofu, Miso, Tempeh,Soybeans,Soy flour.
- Soybean-Primary Source: Soy Iso-flavones include: Genistein,Daidztein,Glycitein.
- Processed Soy Products: Soy protein isolate, soy protein concentrate,Textured soy protein.

- **Mechanism of Action**

Soy isoflavones are plant-derived phytoestrogens that show mild estrogen-like effects in the human body. Their action depends on hormonal status and target tissue.

Selective Binding to Estrogen Receptors

Soy isoflavones such as genistein and daidzein have a chemical structure similar to estrogen. They bind preferentially to estrogen receptor-β (ER-β) rather than ER-α.

- In low-estrogen states (e.g., menopause), they produce mild estrogenic effects
- In high-estrogen states, they act as weak anti-estrogens by competing with endogenous estrogen

Regulation of Gonadotropin Secretion

Isoflavones influence the hypothalamic–pituitary axis, leading to:

- Reduced secretion of luteinizing hormone (LH)
- Improved hormonal balance

This contributes to the reduction of hot flashes and night sweats.

Antioxidant Activity

Soy isoflavones possess antioxidant properties:

- They neutralize free radicals
- Protect cells from oxidative stress

This action supports cardiovascular health and slows age-related cellular damage.[21,22,76,78]

❖ **Marketed Products of Soy Isoflavones:**

- **Estroven®**

– Contains soy isoflavones

– Used for menopause symptom management

- **Solgar Soy Isoflavones®**

– Standardized isoflavone supplement

– Supports hormonal health

1.2.3 Red Clover

- **Sources of Red Clover**
- Natural plant sources: Europe, Asia, North America.
- Herbal Drug Source
- Nutraceutical and Supplement Source

- **Mechanism of Action of Red Clover**

(1) Estrogen-Like Effects

Red clover contains phytoestrogens that bind to estrogen receptors and help compensate for declining estrogen levels during menopause. This helps reduce hot flashes and improve overall hormonal balance.

(2) Support of Bone and Cardiovascular Health

Red clover isoflavones support bone mineral density and improve lipid metabolism. These effects help reduce the risk of osteoporosis and cardiovascular complications in post-menopausal women.[23,24]

❖ **Marketed Products of Red Clover**

- **Promensil®**

– Red clover isoflavone extract

– Commonly used for menopausal symptom relief

- **NOW® Red Clover**

– Herbal supplement

– Supports hormonal and cardiovascular health

2. Gynaecologic Conditions

2.1 PCOS: (Polycystic ovary syndrome)

2.1.1 Myo-inositol:

- **Sources of Myo-inositol**
- Almonds
- Sesame seeds
- Orange
- Muskmelon
- Oats

- **Mechanism of action of Myo-inositol**

(1). Improvement of insulin Sensitivity

- PCOS is frequently associated with insulin resistance, a condition in which the body's cells do not respond effectively to insulin.
- This leads to elevated insulin levels, which can worsen hormonal imbalance.
- Myo-inositol functions as a key component of intracellular signalling pathways that help cells respond to insulin.
- By enhancing insulin sensitivity, it allows glucose to be utilized more efficiently, lowering blood glucose levels and reducing the need for excessive insulin secretion.

(2). Regulation of Menstrual Cycles

- By addressing both insulin resistance and elevated androgen levels, myo-inositol supports the restoration of normal ovarian activity.
- Improved hormonal balance can lead to more regular ovulation and menstrual cycles, thereby enhancing fertility potential in women with POCOS.[14,15,16]

- **Marketed product of Myo-inositol:**
- **Ovasitol®**

– Contains Myo-inositol and D-chiro-inositol

– Commonly used for PCOS and hormonal balance

- **Inofolic®**

– Myo-inositol with folic acid

– Widely prescribed for women with PCOS and fertility concerns

2.1.2 Berberine

- **Sources of berberine**
- Goldenseal
- Barberry
- Oregon grape
- Tree turmeric
- Chinese goldthread

- **Mechanism of action of Berberine**

(1) Reducing high androgen levels

- In PCOS, some women have high levels of androgens (male hormones), which can cause symptoms like excess hair growth and acne.
- Berberine may help lower these androgen levels through various actions in the body.

(2) Improving lipid (fat) levels

- Berberine can help improve cholesterol and fat levels in women with PCOS.
- Specifically, it may help lower "bad" LDL cholesterol and triglycerides while boosting "good" HDL cholesterol.[17]

- **Marketed product of Berberine:**
- **Thorne Berberine**
  - Contains pure berberine
  - Supports healthy blood sugar and metabolic function

- **Nutricost Berberine**
  - High-strength berberine supplement
  - Used for insulin sensitivity and lipid support

2.1.3 Vitamin D

- **Sources of Vitamin D**
- Oily fish
- Red meat
- Egg yolk

- **Mechanism of action of Vitamin D: (1).Modulating androgen production**

Vitamin D can also influence androgen synthesis in the ovaries.By potentially lowering testosterone levels ,it may help counteract hyperandrogenism

- One of the hallmark features of PCOS that contributes to irregular cycles and infertility.

(2) Promoting folliculogenesis

- Vitamin D supports the development and maturation of ovarian follicles, which may improve menstrual regularity and enhance fertility outcomes in women affected by PCOS.[18, 19, 29, 30]

- **Marketed product of Vitamin-D**
- Nature Made Vitamin D3
- Solgar Vitamin D3

2.2 FIBROIDS

2.2.1 Green Tea

- **Source of Green Tea**
- It is made from the Camellia sinensis plant.
- Dried leaves and leaf buds are used
- Including black and oolong teas.
- It is prepared by steaming and pan-frying the camellia sinensis leaves and then drying them.

- **Mechanism of Action**

(1) Slowing Down Fibroid Growth

- EGCG may help inhibit the growth of fibroid tumour cells by affecting the pathways involved in cell division and signalling.

(2) Reducing Fibroid-Related Proteins

- Studies show that EGCG can lower the levels of fibronectin and CTGF proteins. These proteins contribute to the formation of the extracellular matrix in fibroids and are often found in higher amounts in women with fibroids.

(3) Limiting Excessive Tissue Growth

- EGCG may help prevent the excessive growth of connective tissue, a key feature of fibroids.[31,32]

❖ **Marketed product Green Tea**

- Nature's Bounty Green Tea Extract Solaray Green Tea Leaf Extract

2.2.2 Curcumin

- **Sources of curcumin**
- It is naturally occurring ring chemical compound, is primarily sourced from turmeric (Curcuma longa), a rhizomatous herbaceous perennial plant belonging to the ginger family.
- Curcumin is a major component of the curcuminoid complex found in turmeric, along with demethoxycurcumin and cyclocurcumin.

- **Mechanism of Action**

(1) Slowing Down Fibroid Growth

- Curcumin may help reduce the growth of fibroid cells. This could mean slowing down or even reversing the growth of fibroids.

(2) Encouraging Natural Cell Death

- Curcumin might trigger a natural process in fibroid cells that leads to their death, which could help shrink fibroids.

(3) Reducing Fibroid Structure Build-up

- Curcumin may help reduce the production of certain components (like fibronectin) that contribute to the size and structure of fibroids.[33]

❖ **Marketed product of Curcumin:**

- **Solgar Full Spectrum Curcumin**

– Well-known brand with curcumin and turmeric bioactives

- **Doctor's Best Curcumin with C3 Complex®**

– Combines curcumin extract with formulation for better absorption

2.2.3 Vitamin D3

- **Sources of Vitamin D3**
- Fatty fish
- Egg yolks
- Mushrooms
- Tofu
- Yogurt

- **Mechanism of Action of Vitamin D3**

(1) Regulation of Fibroid Cell Proliferation

Vitamin D3 inhibits fibroid cell growth by regulating genes involved in cell proliferation and apoptosis. Deficiency of vitamin D3 has been linked to increased risk of uterine fibroids.

(2) Anti-fibrotic and Hormonal Regulation

Vitamin D3 reduces fibrosis and helps regulate estrogen and progesterone signaling pathways. This contributes to reduced fibroid growth and improved uterine health.[34,35]

❖ **Marketed product of Vitamin-D3**

- **Solgar Vitamin D3**

– Premium brand

– Softgels or veggies capsules

- **Carlson Labs Vitamin D3**

– Known for liquid drops (good for kids/adults)

3. Hormonal health

3.1 Thyroid Disorder

3.1.1 carnitine

- Sources of Carnitine
- Red meat
- Poultry
- Fish

- Avocado
- Dairy products

- **Mechanism of action of carnitine**

(1) Fatty acid transport

- Long-chain fatty acids(LCFAs)are too large to cross the mitochondrial membrane on their own.
- Carnitine binds to these fatty acids, forming a compound called acyl carnitine.
- This acyl carnitine can cross into the mitochondria.
- Once inside, the fatty acid is transferred back to coenzyme A(CoA) for further metabolism, and carnitine is freed to transport more fatty acids.

(2) Energy production

- Inside the mitochondria-the cell's energy factories-long-chain fatty acid(LCFAs) are broken down through a process called beta-oxidation.
- This breakdown produces adenosine triphosphate(ATP), the main source of energy for the body.
- The energy generated is vital for numerous cellular functions, such as muscle contraction, never signalling, and maintaining a healthy metabolic rate.

(3) Carnitine in nutraceutical

- L-carnitine is a widely used dietary supplement, often promoted for its potential to improve energy production, enhance athletic performance, and assist with weight management.
- Although the body can make its own carnitine, supplementation may be helpful in certain situation-such as during periods of intense physical activity, recovery from illness, or in people with metabolic disorders.[57,58]

- **Marketed product of carnitine**
- **Nutricost L-Carnitine**

– High-potency option

– Supports workout recovery and energy use

- **Doctor's Best L-Carnitine Fumarate**

– Combines L-Carnitine with fumarate for performance support

3.1.2 Melatonin

- **Sources of melatonin**
- Nuts
- Fish
- Eggs
- Fruits
- Vegetable
- Mushrooms
- Cereals

- **Mechanism of action melatonin**

(1) Modulation of TSH

- Melatonin appears to influence thyroid function through several complementary mechanisms.
- One important action is its ability to modulate thyroid-stimulating hormone (TSH).
- By acting as a natural antagonist to TSH, melatonin may help reduce overstimulation of the thyroid gland, which is particularly relevant in conditions such as hyperthyroidism.

(2) Regulation of Thyroid Hormone secretion

- Melatonin has been shown to play a role in the regulation of thyroid hormone secretion.
- It may affect the expression of genes responsible for thyroid hormone synthesis, thereby influencing the overall balance of circulating thyroid hormones.

(3) Antioxidant Effect

- Beyond its direct endocrine effects, melatonin also provides protection at the cellular level through its antioxidant properties.
- By reducing oxidative stress within the thyroid gland, melatonin may help prevent or lessen thyroid dysfunction, since oxidative damage is known to contribute to the development and progression of thyroid disease.[51,52,80,81]

❖ **Marketed product of Melatonin**

- **Nature's Bounty Melatonin**

– Trusted daily sleep support option

– Often available in gummies or tablets

- **Solgar Melatonin**

– Premium supplement brand

– Gentle formula for restful sleep

3.1.3 Selenium

- **Sources of selenium**
- Brazil nuts
- Seafood
- Meat & Poultry
- Eggs
- Certain grains

- **Mechanism of action selenium (1)Selenoprotein Formation**
- Selenium is an essential component of selenoproteins. These proteins carry out a wide range of cellular activities, with more than 25 different types identified in human tissues, each performing a specific function.

(2) Antioxidant Protection

- Some selenoproteins, such as glutathione peroxidases, act as powerful antioxidants.
- They help neutralize harmful free radicals and shield cells from oxidative stress, reducing the risk of cellular damage.

(3) Thyroid Hormone Regulation

- Another group of selenoproteins, including deiodinase enzymes, help activate and deactivate thyroid hormones.
- This regulation is essential for maintaining healthy metabolism and supporting overall physiological balance.[53,54,65,66]

❖ **Marketed product of selenium**

- **Solgar Selenium 200 µg**

– Trusted brand with high potency

– Widely used for thyroid and immune health

- **Nature's Bounty Selenium**

– Available in easy-to-take softgels

– Helps maintain antioxidant balance

3.2 ESTROGEN/PROGESTERONE BALANCE

3.2.1 Flaxseed

- **Sources of Flaxseed**
- Linum usitatissimum L. plant, a versatile plant historically valued for both its fiber and oil-yielding seeds.
- Omega-3 Fatty Acids
- Ligands
- Fiber
- Protein

- **Mechanism of action Flaxseed**

(1) Lignans and Their Estrogenic/Anti-Estrogenic Actions

- Flaxseed lignans, once metabolized by gut bacteria into compounds such as enterodiol and enterolactone, resemble the natural structure of estrogen. Because of this similarity, they are able to bind to estrogen receptors in the body.
- Their action, however, depends on the hormonal environment. When estrogen levels are low, such as during menopause, lignans may provide mild estrogen-like activity.
- In contrast, when estrogen levels are high, they can act as anti-estrogens by competing with stronger natural estrogens for receptor binding.
- This dual role helps explain their potential in maintaining hormonal balance.

(2) Modulation of Estrogen Metabolism

- Flaxseed lignans appear to influence the enzymes that regulate estrogen metabolism, thereby shifting the balance of estrogen breakdown products.
- Evidence indicates that they may promote the formation of 2-hydroxyestrone, a weaker estrogen metabolite, instead of 16α-hydroxyestrone, which is more biologically active and has been associated with an increased risk of hormone-dependent conditions such as breast cancer.
- This shift toward less potent estrogen metabolites is thought to contribute to the protective role of flaxseed in hormone-related disorders.

(3) Impact on Progesterone Levels

- Emerging evidence suggests that flaxseed lignans may also influence progesterone regulation.
- In women with polycystic ovary syndrome (PCOS), flaxseed supplementation has been linked to an increase in progesterone levels, which could support menstrual cycle regulation and reproductive health.[71,72,98]

❖ **Marketed product of Flaxseed**

- **Barlean's Organic Lignan Flax Oil**

– High in alpha-linolenic acid (ALA)

– Often used for heart and hormone support

- **Relax-a-Mama Flaxseed Oil**

– Popular product for women's health

– Provides natural omega-3s

3.2.2 Maca root

- **Sources of Maca root**
- Lepidium meyenii
- Geographic Origin: It is native to the Andes Mountains in Peru, adapted to harsh conditions such as high altitudes, strong UV rays, and cold, windy weather.
- Botanical Family: Maca is a member of the cruciferous family, similar to broccoli and cabbage.

- **Mechanism of action Maca root**

(1) Hormonal Regulation

- Flaxseed lignans also seem to affect the way estrogen is processed inside the body. They work by influencing certain enzymes that decide how estrogen is broken down. Because of this action, the body tends to produce more of a weaker form of estrogen instead of the stronger one.
- Research suggests that flaxseed lignans encourage the formation of **2-hydroxyestrone**, which has milder effects in the body. At the same time, they reduce the production of **16*α*-hydroxyestrone**, a stronger form of estrogen that has been linked with a higher risk of hormone-related problems, including breast cancer.
- This natural shift toward less active estrogen forms is believed to be one of the reasons flaxseed is considered beneficial for hormonal health. By helping balance estrogen activity, flaxseed lignans may support protection against hormone-dependent disorders.

(2) Adaptogenic Properties

- Maca is often described as an adaptogen, which simply means that it helps the body handle different kinds of stress. This stress can be physical, mental, or even emotional. Instead of targeting one specific problem, maca works by supporting the body's ability to adjust and stay balanced during challenging situations.
- Adaptogens like maca help the body regain balance when it is affected by tiredness, anxiety, or everyday environmental stress. By supporting energy levels and helping the body respond better to stress, maca may improve overall vitality. Regular use is believed to help people feel more stable, energetic, and better equipped to maintain long-term health and well-being.

(3) Endocannabinoid System Modulation

- Maca contains a group of unique compounds known as macamides, which share structural similarity with anandamide, an important endocannabinoid in the human body.
- Because of this resemblance, macamides are thought to influence the endocannabinoid system (ECS), a regulatory network involved in mood, stress response, pain perception, and overall homeostasis.[73,74]

❖ **Marketed product of Maca root**

- **The Maca Team Maca Powder**

– Organic maca root powder

– Simple, whole-food maca form

- **Navitas Organics Maca Powder**

– Popular superfood brand

– Used for energy & stamina

3.2.3 Chasteberry

- **Sources of Chasteberry**
- Extracts of Chasteberry may be prepared from the herb's leaves , steam, flowers and seeds.
- Chasteberry, also known as Vitex agnus-castus or chaste tree, is primarily sourced from the dried ripe fruits of the chaste tree.
- This flowering shrub is native to the Mediterranean region and Central Asia, according to the National Center for Complementary and Integrative Health (NCCIH)

- **Mechanism of action Chasteberry**

(1) Dopaminergic Properties

- Chasteberry, which is also called *Vitex agnus-castus*, is a plant that is often used to help with women's reproductive health. It mainly works by influencing the pituitary gland, which controls many hormones in the body. Because of this action, chasteberry can indirectly affect the menstrual cycle.
- One important way chasteberry works is by acting on dopamine-related pathways. When it interacts with dopamine receptors, it helps control how much prolactin the body releases. High prolactin levels are commonly linked with problems like irregular periods and difficulty in conceiving. By helping keep prolactin levels under control, chasteberry may support more regular menstrual cycles and improve overall hormonal balance.

(2) Regulation of Hormones

- In addition to prolactin control, chasteberry also plays a role in balancing other reproductive hormones.
- It has been shown to influence the release of luteinizing hormone (LH) and follicle-stimulating hormone (FSH), both of which are essential for ovulation and overall reproductive health.

(3) Progesterone Support

- Another important mechanism involves progesterone support.
- Through its effects on the pituitary gland, chasteberry may contribute to increased progesterone production.
- Adequate progesterone levels are vital for maintaining a regular menstrual cycle and for supporting fertility.[75]

❖ **Marketed product of Chasteberry**

- **Nature's Way Vitex Fruit**
- **Solaray Vitex**

4.1 Depression

4.1.1 5- Hydroxy -tryptophan

- **Sources of 5-HTP**
- Griffonia Simplicifolia Seeds
- Meat
- Fish
- Eggs
- Dairy Products

- **Mechanism of action 5-HTP**

(1) Serotonin production

- 5-Hydroxytryptophan (5-HTP) serves as a precursor to serotonin, a key neurotransmitter involved in regulating mood, sleep, and emotional well-being.
- After ingestion, 5-HTP is converted into serotonin in the brain, which can help relieve symptoms of depression, anxiety, and insomnia.

(2) Mood Regulation

- One major function of 5-HTP is serotonin production, which plays a central role in improving mental health and emotional stability.
- By enhancing serotonin levels, 5-HTP contributes to mood regulation, reducing feelings of depression and anxiety.

(3) Anxiety Relief

- The increase in serotonergic activity helps reduce stress and anxiety, promoting a calming effect on the nervous system.[46]

❖ **Marketed product of 5-HTP**

- **Natrol 5-HTP**

– Well-known sleep support product

– Often used for relaxation and mood balance

- **Doctor's Best 5-HTP**

– Standardized 5-HTP formula

– Helps support serotonin levels naturally

4.1.2 Omega-3-Fatty acid

- **Sources of Omega-3-Fatty acid**
- Fish and seafood
- Nuts and seeds

- Plant oils
- Eggs
- Yogurt
- Milk

- **Mechanism of action Omega-3-Fatty**

(1) Anti-inflammatory effects

- Chronic inflammation is often associated with depressive disorders.
- Omega-3 fatty acids help reduce inflammation in the brain by decreasing the production of inflammatory signaling molecules such as prostaglandins and promoting the synthesis of pro-resolving lipid mediators like resolvins and protectins.
- These actions can lower neuroinflammation, which is considered a contributing factor in depression.

(2) Neurotransmitter modulation

- Omega-3s can affect the activity of key neurotransmitters such as serotonin and dopamine, which play central roles in mood regulation.
- They enhance serotonin release and improve receptor function by maintaining the flexibility of neuronal membranes.
- Additionally, DHA may support GABAergic activity, improving receptor binding and reducing desensitization, which helps in stress regulation and calming the nervous system.

(3) Neuroplasticity

- Omega-3 fatty acids promote neuroplasticity, the brain's ability to form new neural connections.
- By influencing cell signaling pathways and maintaining membrane structure, they help the brain adapt to stress and respond to environmental changes, which is vital for mental health and cognitive resilience.

(4) Cell membrane function:

- Omega-3s contribute to membrane fluidity and elasticity, ensuring proper function of proteins such as receptors and ion channels.
- This structural support is essential for effective neurotransmission and overall neuronal health.[9, 96]

❖ **Marketed product of Omega-3-Fatty acid**

- **Nordic Naturals Ultimate Omega**

– Very popular high-potency fish oil

– Supports heart, brain, and immune health

❖ **Carlson Labs The Very Finest Fish Oil**

– Trusted for purity and freshness

– Available in liquid and softgel form

4.1.3 S-Adenosyl L-Methionine

- **Sources of SAMe**
- Eggs
- Fish
- Meat

- **Mechanism of action SAMEe**

(1) Boosting Brain Chemicals

- SAMe helps the body produce important brain chemicals like serotonin and dopamine.
- These chemicals are often out of balance in people dealing with depression, and by supporting their production, SAMe can help ease depressive symptoms.

(2) Supporting Healthy Brain Function

- SAMe acts as a helper in methylation processes, which are crucial for keeping brain chemicals in check and maintaining overall brain health.

(3) Helping with Depression

- Research suggests that SAMe has benefits similar to some traditional antidepressants but with potentially fewer side effects.
- It works by boosting brain chemical production, supporting healthy brain processes, and promoting a more positive mood.[47,48]

❖ **Marketed product of S-Adenosyl L-Methionine**

- Doctor's Best SAMe
- Jarrow Formulas SAMe

4.2 Postpartum Disorder

4.2.1 Omega-3-Fatty acid

- **Sources of Omega-3-Fatty acid**
- Fish oil
- Algal oil
- Flaxseed
- Chia seeds
- Walnuts

- **Mechanism of action Omega-3-Fatty acid**

(1) Reducing Inflammation

- Omega-3s, especially EPA, are believed to help reduce inflammation in the brain.
- This is significant because inflammation is thought to play a role in the development of depression.

2. Neuroplasticity

- Omega-3s can affect brain cells, helping the brain adapt and change. This adaptability might lead to better mood management.

3. Improved Cell Membrane Function

- Omega-3s are important for cell membranes. They help keep these membranes fluid and flexible, which affects how brain cells communicate and how neurotransmitters work.[8,10]

❖ **Marketed product of Omega-3-Fatty acid**

- **Nature Made Fish Oil**

– Commonly found in retail pharmacies

- **Viva Naturals Omega-3 Fish Oil**

– High EPA/DHA concentration

4.2.2 Collegen

- **Sources of collegen**
- Bone Broth
- Meat
- Fish
- Eggs
- Poultry
- Soy
- Zinc(found in shellfish, legumes,etc)
- Vitamin C (found in citrus fruits, berries,etc)

- **Mechanism of action Collagen**

(1) Tissue Repair

- Collagen is important for rebuilding and strengthening tissues like skin, muscles, and the pelvic floor.
- Pregnancy and childbirth can affect these areas, and collagen helps in their repair.

(2) Hair and Nails Health

- Many new moms experience hair loss or brittle nails after delivery.
- Taking collagen supplements might help improve hair and nail health, making them stronger and promoting growth.

(3) Skin Elasticity

- Collagen can help improve skin elasticity. This is especially helpful for reducing the appearance of stretch marks, a common concern for many moms after pregnancy.[55,56]

❖ **Marketed product of collagen**

- **Vital Proteins Collagen Peptides**

– Very popular everyday collagen powder

– Supports skin elasticity, hair, nails, and joints

- **NeoCell Super Collagen**

– Includes types 1 & 3 collagen

– Often recommended for skin and connective tissue

4.2.3 Vitamin D

- **Sources of Vitamin D**
- Sunlight
- Fatty fish
- Eggs yolks
- Milk
- Cereals

- **Mechanism of action Vitamin D**

(1) Neurotransmitter Synthesis

- Vitamin D helps in making neurotransmitters like serotonin, which affects mood. Low levels of Vitamin D might lead to less serotonin, possibly causing symptoms of depression.

(2) Neuroprotection and Anti-inflammatory Effects

- Vitamin D protects brain cells and reduces inflammation in the brain, which can be linked to depression.

(3) Modulation of the Hypothalamic-Pituitary-Adrenal(HPA) Axis

- The body's stress response system, known as the Hypothalamic-Pituitary-Adrenal (HPA) axis, plays a big role in how we handle stress. When this system isn't working right, it can lead to depression.
- Some research suggests that vitamin D could help regulate this stress response system, potentially improving mood.

(4) Vitamin D and Postpartum Depression

- Researchers have been looking into whether there's a link between vitamin D levels during pregnancy and the risk of postpartum depression.
- Some studies show that low levels of vitamin D might increase the risk of postpartum depression, but other studies haven't found the same connection.
- More research is needed to understand if taking vitamin D supplements during pregnancy could help prevent or lessen postpartum depression.[63,64]

❖ **Marketed product of Vitamin D**

- **Solgar Vitamin D**

– Premium brand

– Helps support overall vitality

- **Carlson Labs Vitamin D**

- Often available in liquid drops or tablets

4.3 Migraine

4.3.1 Riboflavin

- **Sources of Riboflavin**
- Milk
- Yogurt
- Cheese
- Meat
- Almond nuts
- Green vegetables (broccoli, spinach)
- Mushroom

- **Mechanism of action Riboflavin**

(1) Mitochondrial Function

- Riboflavin is vital for converting the food we eat into energy, especially within the mitochondria of our cells.

(2) Energy Production

- Some research suggests that problems with how mitochondria work might be linked to migraines.
- Taking Riboflavin supplements could help improve the efficiency of energy production in cells, potentially reducing migraine triggers.

(3) Reducing Brain Inflammation

- By helping mitochondria function properly, riboflavin may lower inflammation in the brain, which is thought to play a role in causing migraines.

(4) Fighting Oxidative Stress

- Riboflavin helps our body's natural defenses against oxidative stress, which is also linked to migraines.[59]

❖ **Marketed product of Riboflavin**

- **Solgar Vitamin B2 (Riboflavin)**

– Trusted quality supplement brand
– Good for daily vitamin B2 support

- **Nature's Way Riboflavin**

– Simple daily B2 tab or capsule
– Supports normal energy release from food

4.3.2 Coenzyme Q10

- **Sources of Coenzyme Q10**
- Meat
- Fish
- Grains

- **Mechanism of action Coenzyme Q10**

(1) Mitochondrial Function and Energy Production

- CoQ10 plays a crucial role in the electron transport chain in mitochondria, which is essential for generating energy (ATP) within cells.
- Migraines may be linked to mitochondrial dysfunction. CoQ10 supplementation may help improve mitochondrial function and energy production in the brain.
- By supporting mitochondrial function, CoQ10 may help reduce the frequency and duration of migraine attacks.

(2) Antioxidant Properties

- CoQ10 acts as an antioxidant, neutralizing free radicals and reducing oxidative stress.
- Oxidative stress is believed to play a role in the development of migraines.
- By reducing oxidative stress, CoQ10 may help prevent or reduce the severity of migraine attacks.

(3) Anti-inflammatory Effects

- CoQ10 might also possess anti-inflammatory properties that could play a supportive role in managing migraines.
- Research suggests that inflammation is a contributing factor in the development of migraines.
- By potentially reducing inflammation, CoQ10 may help ease the symptoms associated with migraines.[60,61,62]

❖ **Marketed product of Coenzyme Q10**

- Qunol Ultra CoQ10
- Solgar CoQ10

4.3.3 Magnesium

- **Sources of Magnesium**
- Dark Leafy Greens (spinach , kale)
- Nuts & seeds (Almond, pumpkin, sunflower)
- Legumes (Black bean ,chickpeas, lentils)
- Fish(Salmon and mackerel)
- Avocado
- Dark Chocolate

- **Mechanism of action Magnesium**

(1) Cortical Spreading Depression (CSD)

- Magnesium is vital for the proper functioning of NMDA receptors in the brain.
- By influencing these receptors, magnesium may help stop a wave of brain activity known as Cortical Spreading Depression (CSD), which is thought to trigger migraines.

(2) Neurotransmitter Modulation

- Magnesium affects the release of important brain chemicals like glutamate, which plays a part in sending pain signals.
- By modulating these chemicals, magnesium could help in controlling pain.

(3) Vascular regulation

- Magnesium helps regulate blood flow by affecting certain channels in blood vessels.
- This regulation could impact the widening of blood vessels that happens during a migraine.

(4) Platelet Aggregation

- Magnesium helps prevent platelets from clumping too much—a process that has been connected to the development of migraines.[49,50]

❖ **Marketed Products of Magnesium**

- **Nature Made Magnesium®**

– Magnesium supplement

– Supports muscle, nerve, and metabolic health

- **NOW® Magnesium**

– Available as magnesium citrate or oxide

– Used for relaxation, hormonal balance, and general wellness

5. Nutrition & Lifestyle

5.1 Obesity

5.1.1 Green Tea Extract

- **Sources of Green Tea Extract**
- Leaves of *Camellia sinensis*
- Green tea beverages
- Standardized green tea extracts (rich in EGCG)

- **Mechanism of Action of Green Tea Extract**

(1) Enhancement of Fat Oxidation:

Green tea extract, particularly epigallocatechin gallate (EGCG), increases thermogenesis and fat oxidation. It stimulates metabolic rate and helps in the breakdown of stored fats, thereby contributing to weight reduction.

(2) Regulation of Lipid Metabolism

EGCG reduces lipid absorption and inhibits adipocyte (fat cell) proliferation. Its antioxidant properties also help reduce inflammation associated with obesity.[31,32]

❖ **Marketed Products of Green Tea Extract**

- NOW® Green Tea Extract
- Nature’s Bounty Green Tea Extract

5.1.2 Chitosan

- **Sources of Chitosan**
- Derived from chitin found in shells of crustaceans such as shrimp and crab

- **Mechanism of Action of Chitosan**

(1) Reduction of Fat Absorption

Chitosan binds to dietary fats in the gastrointestinal tract, forming complexes that are not absorbed by the body. This leads to reduced fat uptake and calorie intake.

(2) Support of Weight Management

By decreasing fat absorption and promoting satiety, chitosan supports weight loss and helps improve lipid profiles in obese individuals.[33]

❖ **Marketed Products of Chitosan**

- NOW® Chitosan
- Nature's Way Chitosan

5.1.3 Glucomannan

- **Sources of Glucomannan**
- Root of *Amorphophallus konjac* (Konjac plant)

- **Mechanism of Action of Glucomannan**

(1) Appetite Suppression

Glucomannan is a soluble dietary fiber that absorbs water and expands in the stomach, producing a feeling of fullness and reducing appetite.

(2) Improvement of Lipid and Glucose Metabolism

It slows gastric emptying and carbohydrate absorption, helping regulate blood glucose levels and reduce cholesterol, thereby supporting weight management.[34,35]

❖ **Marketed Products of Glucomannan**

- Nature Made Glucomannan
- NOW® Glucomannan

5.2 Iron Deficiency Anemia

5.2.1 Vitamin B12

- **Sources of Vitamin B12**
- Meat, fish, eggs
- Milk and dairy products
- Vitamin supplements

- **Mechanism of Action of Vitamin B12**

(1) Red Blood Cell Formation

Vitamin B12 is essential for DNA synthesis and red blood cell production. Deficiency leads to impaired erythropoiesis and anemia.

(2) Support of Hematological Health

Adequate vitamin B12 levels improve hemoglobin synthesis and prevent megaloblastic anemia.[36,37]

❖ **Marketed Products of Vitamin B12**

- Neurobion®
- Becosules®

5.2.2 Ferrous Sulfate

- **Sources of Ferrous Sulfate**
- Synthetic iron salt used in supplements and fortified foods

- **Mechanism of Action of Ferrous Sulfate**

(1) Iron Supplementation

Ferrous sulfate provides elemental iron required for hemoglobin synthesis and oxygen transport.

(2) Correction of Iron Deficiency

It replenishes depleted iron stores, improves hemoglobin levels, and corrects iron deficiency anemia.[38]

❖ **Marketed Products of Ferrous Sulfate**

- Feosol®
- Fefol®

5.2.3 Ferrous Gluconate

- **Sources of Ferrous Gluconate**
- Iron salt derived from gluconic acid

- **Mechanism of Action of Ferrous Gluconate**

(1) Improved Iron Absorption

Ferrous gluconate provides iron in a form that is better tolerated and absorbed, especially in individuals sensitive to other iron salts.

(2) Enhancement of Hemoglobin Levels

It supports hemoglobin synthesis and improves oxygen-carrying capacity of blood.[39,40]

❖ **Marketed Products of Ferrous Gluconate:**

- Floradix® Iron Tablets
- Fergon®

6. CANCER

The mediterranean diet is a dietary pattern rich in nutraceutical foods. It emphasizes high consumption of fruits, vegetables, wholegrains, legumes, olive oil, nuts and seed moderate intake of fish poultry dairy and wine and low consumption of red meat, sweet, and processes food. The Mediterranean diet is associated with reduced oxidative stress and inflammation, inhibition of carcinogenesis, and protective effects against chronic diseases.

❖ **STAGES OF CANCER**

- Stage 1: Uncontrolled cell growth with near normal structure. (Hyperplasia)
- Stage 2: Abnormal cell changes and increased growth (dysplasia).
- Stage 3: Highly irregular, poorly differentiated cells spreading locally (anaplasia).
- Stage 4: Cancer spreads to distant parts of the body through the blood or lymphatic system (Metastasis).

❖ **Risk Factors**

- Age: cancer risk increases with age.
- Tobacco: causes lung, mouth, oesophagus, bladder and pancreatic cancers.
- Alcohol: increases risk of throat, liver, breast and bowel cancers; causes DNA damage and oxidative stress.
- Radiation: UV-rays, X-rays and radon can induce skin and other cancers.
- Chemical carcinogens: industrial mutagens damage DNA and promote cancer.
- Occupational exposure: industrial chemicals and pollution increase risk.

6.1 Breast Cancer

Breast cancer is the most common cancer in women worldwide and a leading cause of cancer related deaths. According to WHO (2020) 2.3million women were diagnosed and 685,000 deaths were reported globally. Breast cancer is a heterogeneous disease.

6.1.1 RESVERATROL

The Nutraceutical resveratrol commonly found in plant based foods, show promising anti-cancer potential. It is well absorbed in the intestine but has low bioavailability due to rapid metabolism. Despite this limitation, evidence suggests resveratrol plays a role in preventing or delaying chronic disease such as cardiovascular disorder, diabetes, and cancer through anti- oxidant and anti-inflammatory mechanisms. Despite this limitation, evidence suggests resveratrol plays a role in preventing or delaying chronic disease such as cardiovascular disorders, diabetes, and cancer through anti-oxidant and anti-inflammatory

- **Sources of Resveratrol**
- Red grape & red wine
- Dark chocolate
- Pistachios
- Walnuts
- Plums
- Berries
- Peanuts

Effects of resveratrol

- Resveratrol a natural compound, has shown promising anti-cancer effect in breast cancer cells. It inhibits the growth of cancer stem cells, reduce tumour formation and induces autophagy, process where cells self-destruct. RES also supress the beta catenin pathway, which is often overactive.
- Resveratrol can significantly limit the growth of breast cancer stem cells derived from MCF-7 and SUM159 cell lines. It has been shown to decrease the formation of mammospheres, which are cell clusters associated with

tumour initiation and progression in both cell culture experiments and animal models. It stimulates autophagic activity within the atmosphere. This effect has been demonstrated by elevated expression of key autophagy markers, including LC3-II, Beclin-1 and Atg7 as well as by the accumulation of LC3 positive puncta. Additionally, resveratrol interferes with the WNT/ beta-catenin signalling pathway, a major regulator of cancer cell survival and self-renewal.

- **Mechanism of Action of Resveratrol**

(1) Inhibition of Cancer Cell Proliferation

Resveratrol inhibits the growth of breast cancer cells by suppressing cell cycle progression and inducing apoptosis. It interferes with signaling pathways involved in cancer cell survival, including the Wnt/β-catenin pathway.

(2) Antioxidant and Anti-inflammatory Activity

Resveratrol reduces oxidative stress and inflammation, both of which contribute to cancer progression. It also induces autophagy in cancer cells, promoting self-destruction of abnormal cells.[41,42,94,95]

❖ **Marketed Products of Resveratrol**

- NOW® Resveratrol
- Doctor's Best Resveratrol

6.1.2 Sulforaphane

- **Sources of Sulforaphane**
- Broccoli sprouts
- Broccoli
- Cabbage
- Cauliflower

- **Mechanism of Action of Sulforaphane**

(1) Activation of Detoxification Enzymes

Sulforaphane induces phase II detoxification enzymes, which help eliminate carcinogens and protect cells from DNA damage.

(2) Suppression of Tumor Growth

Sulforaphane inhibits cancer stem cell growth and induces apoptosis. It also suppresses histone deacetylase (HDAC) activity, leading to inhibition of tumor progression.[43,44,91,92,93]

❖ **Marketed Products of Sulforaphane**

- Avmacol®
- BroccoMax®

6.1.3 Beta-Carotene

- **Sources of Beta-Carotene**
- carrot
- Sweet potatoes

- Pumpkin
- Mango
- Papaya
- Broccoli

- **Mechanism of Action of Beta-Carotene**

(1) Antioxidant Protection

Beta-carotene acts as a powerful antioxidant, neutralizing free radicals and reducing oxidative damage to breast tissue cells.

(2) Regulation of Cell Growth

Beta-carotene is converted into vitamin A in the body, which helps regulate cell differentiation and inhibits uncontrolled cell proliferation associated with cancer development.[45]

❖ **Marketed Products of Beta-Carotene:**

- Nature Made Beta-Carotene
- Solgar Beta-Carotene

6.2 Cervical Cancer

Cervical cancer is a gynecological malignancy that arises from the epithelial cells of the cervix and is strongly associated with persistent infection by high-risk human papillomavirus (HPV), particularly HPV-16 and HPV-18. Nutraceuticals and dietary antioxidants play a supportive role in the prevention and management of cervical cancer by reducing oxidative stress, modulating inflammatory pathways, and inhibiting abnormal cell proliferation.[88,100]

6.2.1 Gingerol

- **Sources of Gingerol**
- Fresh ginger (Zingiber officinale)
- Dried ginger powder
- Ginger extracts
- Ginger tea

- **Mechanism of Action of Gingerol**

Gingerol, the major bioactive compound present in ginger, exhibits strong anti-inflammatory, antioxidant, and anticancer properties. In cervical cancer cells, gingerol inhibits cell proliferation by inducing apoptosis through mitochondrial pathways. It suppresses nuclear factor-kappa B (NF-κB) activation, thereby reducing inflammation-driven cancer progression. Gingerol also interferes with cell cycle regulation and inhibits angiogenesis, limiting tumor growth and spread.[88]

❖ **Marketed Products of Gingerol**

- Himalaya® Ginger Capsules
- Organic India® Ginger Extract
- Nature Made® Ginger Root

6.2.2 Curcumin

- **Sources of Curcumin**
- Turmeric (Curcuma longa)
- Turmeric powder
- Curcumin-enriched extracts[89,90]

- **Mechanism of Action of Curcumin**

Curcumin is a polyphenolic compound with well-documented anticancer activity. In cervical cancer, curcumin inhibits tumor cell growth by suppressing oncogenic signaling pathways such as NF-κB, STAT3, and AP-1. It promotes apoptosis by activating caspase-dependent pathways and downregulates HPV oncoproteins E6 and E7, which are responsible for p53 and retinoblastoma protein degradation. This leads to restoration of tumor suppressor functions and inhibition of cervical cancer progression.[88,89,90]

❖ **Marketed Products of Curcumin**

- Curcumin C3 Complex®
- Himalaya® Curcumin
- Patanjali® Curcumin Capsules

6.2.3 Vitamins (A, C, D, and E)

- **Sources of Vitamins**
- **Vitamin A:** Carrots, sweet potatoes, spinach, liver
- **Vitamin C:** Citrus fruits, guava, strawberries, bell peppers
- **Vitamin D:** Sunlight exposure, fortified milk, egg yolk,
- **Vitamin E:** Almonds, sunflower seeds, wheat germ oil[100]

- **Mechanism of Action of Vitamins**

Vitamins A, C, D, and E play a protective role against cervical cancer through multiple mechanisms. Vitamin A regulates epithelial cell differentiation and prevents abnormal cervical cell growth.

Vitamin C acts as a potent antioxidant, protecting DNA from oxidative damage and enhancing immune responses against HPV infection. Vitamin D modulates immune function and inhibits uncontrolled cell proliferation by regulating gene expression involved in cell cycle control. Vitamin E protects cell membranes from lipid peroxidation and reduces oxidative stress, thereby lowering the risk of malignant transformation of cervical epithelial cells.[45,63,64,88]

❖ **Marketed Products of Vitamins**

- Becosules® Capsules (Vitamin A, C, E)
- Limcee® Vitamin C Tablets
- Calcirol® Vitamin D3
- Evion® Vitamin E Capsules

CONCLUSION

Functional foods and nutraceuticals have emerged as an important supportive approach in promoting women's health across different life stages. From adolescence to menopause and beyond, women experience unique physiological and hormonal changes that increase the risk of conditions such as fertility disorders, PCOS, menopause-related symptoms, obesity, anemia, fibroids, and breast cancer. Nutraceuticals derived from natural sources—including vitamins, minerals, fatty acids, phytochemicals, and botanical extracts—offer targeted health benefits with improved safety and tolerability compared to conventional pharmacological therapies.

The present article highlights the role of key nutraceuticals such as omega-3 fatty acids, myo-inositol, berberine, phytoestrogens, antioxidants, and micronutrients in managing gynecological and metabolic disorders. These compounds act through well-defined mechanisms including regulation of insulin sensitivity, modulation of hormonal balance, reduction of oxidative stress, anti-inflammatory activity, and inhibition of abnormal cell proliferation. Scientific evidence from published studies supports their effectiveness in improving reproductive health, alleviating menopausal symptoms, enhancing nutritional status, and reducing the risk of chronic diseases in women.

In addition, the availability of well-formulated marketed nutraceutical products has made these interventions more accessible and practical for routine use. When combined with appropriate dietary habits and lifestyle modifications, nutraceuticals can significantly contribute to preventive healthcare and overall well-being in women. However, rational selection, proper dosage, and evidence-based use are essential to maximize their benefits. Further clinical research and long-term studies will help strengthen their role as an integral component of women-centered healthcare strategies.

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