Panax ginseng – A review

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Abstract:-
Ginseng has been traditionally utilized for several millennia in Asian countries, including Korea, China, and Japan, not only as a nourishing and tonifying agent but also as a therapeutic agent for a variety of diseases. In recent years, the different impacts of panax ginseng including immunity improvement, blood circulation improvement, antioxidation and anticancer an effect have been reported in clinical as well as basic research. Around the world, there is a trend of the rising utilization of health functional foods on the level of disease prevention along with increased interest in maintaining health because of population aging and the awareness of lifestyle diseases and chronic diseases. But till now, international ginseng monographs including those of the World Health Organization have been based on data on white ginseng and have mentioned red ginseng only partly. Another botanical species, although commonly called Siberian ginseng (Eleutherococcus senticosus), is not a true ginseng. The present monograph will contribute to providing accurate information on panax ginseng to agencies, businesses, and consumers both in Iraq and abroad.

Key words: Panax ginseng, Panax quinquefolius, Ginsenosides.

Introduction:-
Medicinal plants are part and parcel of human society to combat diseases, from the dawn of civilization (Bandyopadhyay et al., 2002). Medicinal plants can be important source of previously unknown chemical substances with potential therapeutic effects. The medicinal utilize of plants is an ancient tradition, far older than the contemporary sciences of medicine, pharmacology and chemistry. The world health organization has evaluated that over 75% of the world’s population still depends on plant derived medicines, usually get from traditional healers, for its basic health care needs (Herrera et al., 2008). Herbal medicines are in great demand in the developed as well as developing countries for primary healthcare because of their wide biological and medicinal activities, higher safety margins and lesser costs (Ghaudhary et al., 2010).

Panax ginseng, utilized medicinally for thousands of years in China, Korea, and Japan, (Radad et al., 2006) is well known as an adaptogen and a restorative tonic that is widely utilized in traditional Chinese medicine (TCM) and Western herbal preparations (Duke, 2000). Eclectic utilization for Panax ginseng include fatigue, infertility, liver disease, amnesia, colds, menopause, and erectile dysfunction (Weiss, 1988). Panax ginseng is also used for bleeding disorders, loss of appetite, vomiting, colitis, dysentery, cancer, insomnia, neuralgia, rheumatism, dizziness, headache, convulsions, disorders of pregnancy and childbirth, hot flashes because menopause, and moderate the aging process. It may also improve your overall being. There are many species of Panax, which leads to some confusion in the literature. However, the two species that have been the most extensively researched and used are Panax ginseng and Panax quinquefolius. This monograph reviews the constituents, mechanism of action, safety, and clinical efficacy of Panax ginseng.

Plant taxonomy:-
Phylum: Embryophyta Siphonogama
Subphylum: Angiospermae
Class: Dicotyledoneae
Subclass: Archichlamydeae
Order: Umbelliflorae
Family: Araliaceae
Genus: Panax
Species: ginseng

The genus name Panax is a compound of the Greek words pan and axos. Pan means “all” and axos
means, “treat”, which represents “treats all diseases”. “Ginseng” indicates the name of the species of Korean *ginseng* and its Chinese pronunciation in English (Choi, 2008).

**Common names:-**

The common names of ginseng are Asiatic ginseng, Chinese ginseng, five-fingers, Japanese ginseng, jintsam, Korean ginseng, ninjin, Oriental ginseng, schinsent, seng and sang, tartar root and western ginseng (WHO, 1999).

**Botanical description:-**

*Panax ginseng* belongs to the Araliaceae family and is found all through East Asia and Russia (Seely et al., 2008). It develops natively in remote forests of Manchuria and North Korea, but has become over-harvested in different parts of Asia. It is cultivated in Korea, China, and Japan for export and use as a therapeutic herb. *Panax ginseng* is a shade-loving, deciduous perennial with five-fingered leaves, tiny white flowers, red berries, and a yellowish-brown root (Duke, 2000). The root is used medicinally, although active compounds are present in all other parts of the plant. The root of *Panax ginseng* is a thick structure that resembles a human-like form, which is responsible for its name in Chinese, jen shen, or “man-root” (Duke, 2000). Panax is derived from the Latin word panacea, which refers to its historical usage for many conditions. There are two particular types of *Panax ginseng*, red and white ginseng. The difference is the method of processing that results in different pigment compositions; white ginseng is produced by harvesting the root and drying it in the sun, (Blumenthal, 2003) while red ginseng is steamed after harvest and dried. The content of ginsenoside compounds differs slightly between the red and white forms. Growing time also impacts ginsenoside content, with roots from plants older than five years being more potent than roots from one- to two-year-old plants (Weiss, 1988). Figure (1 and 2).

**Active constituents:-**

*Panax ginseng* contains triterpene glycosides, or saponins, generally referred to as Ginsenosides. Many active compounds can be found in every one of the parts of the plant, including amino acids, alkaloids, phenols and vitamins B₁ and B₂ (Laskshmi et al., 2011). The *ginseng* plant contains a few hundred components, making it difficult to identify a single agent responsible for its efficacy (Hui et al., 2009). Its chemical constituents include peptides, fatty acids, vitamins and minerals (Luo and Luo, 2009).

However, it is the triterpenoid saponins referred to as ginsenosides, the polysaccharides and the polyacetylenes that are considered the active components of ginseng (Christensen, 2009). Of these, the ginsenosides are considered the most pharmacologically active and are consequently the main focus of ginseng research (Jia and Zhao, 2009).

**Pharmacokinetics:-**

Recent research supports the hypothesis that ginsenosides are activated by intestinal bacteria through deglycosylation and esterification. Protopanaxadiol and protopanaxatriol glycosides are absorbed into the blood or lymph and transported to target tissues for esterification with stearic, oleic, or palmitic fatty acids. The transformation into ginsenoside metabolites, M₁ (20S-protopanaxadiol 20-O-B-D-glucopyranoside) and M₄ (20S-protopanaxatriol) affect excretion and utilization of the metabolites (Hasegawa, 2004).

*Panax ginseng* is often referred to as an adaptogen, which suggests that it has varied actions and effects on the body that support nonspecific resistance to biochemical and physical stressors, improve vitality and longevity, and enhance mental capacity (Blumenthal, 2003). Reviews suggest that *Panax*
**Anti-diabetic activity:**

Ginseng polypeptide, isolated from the root of *Panax ginseng*, is demonstrated to decrease the level of blood sugar and liver glycogen when injected intravenously to rats. The aqueous extract of root of *Panax ginseng* shows a remarkable hypoglycemic activity on administration to mice (Tripathi et al., 2011). It increases insulin production, reduces death of pancreatic β-cells and insulin resistance, improves postprandial glycemia in diabetic patients (Ranjbar et al., 2011). Ginseng also elevates mood, improves psychophysiological performance and physical activity, and reduces body weight (Dey et al., 2002).

Ginseng saponin and ginsenoside have the efficacy of decreasing high blood glucose and improving diabetes by treating Streptozotocin (STZ), which is the substance that causes diabetes (Vuksan et al., 2002). Korean ginseng includes insulin secretion stimulating activity and insulin-like activity substances (Ando et al., 1979). The root of *Panax ginseng* is used to improve glucose homeostasis and insulin sensitivity and further clinically to treat type 2 diabetes (Huang, 1999).

It is observed that blood glucose level falls significantly in genetically obese diabetic mice after treatment with a single 90 mg/kg of ginseng root extract (Kimura, 1999). Oral administration of *Panax ginseng* root to diabetic mice for 4 weeks reduces blood glucose levels similar to that of an insulin sensitizer (rosiglitazone)-treated group (Chung et al., 2011). Moreover, ginseng therapy for type 2 diabetes elevates mood, improves psychophysical performance, and reduces fasting blood glucose and body weight. A 200 mg dose of ginseng improves glycated hemoglobin, serum lipid, amino-terminal propeptide concentration, and physical activity. These observations suggest that ginseng is beneficial for the people with type 2 diabetes and to prevent development of diabetes in nondiabetic subjects. In another study, 19 individuals with T2DM consumed 6g/day of KRG for 12 weeks (Vuksan et al., 2002). Ginseng has an important role in improving the physiological and biochemical parameters affected by diabetes (Hussain and Al-Fartosi, 2013).

**Anti inflammatory activity:-**

A paper proposed an anti-inflammatory role of *Panax ginseng* in the sequence of progression to promotion in a model of carcinogenesis (Hofseth and wargovich, 2007). *Panax ginseng* affects multiple points within the inflammatory cascade, including inhibition of cyclooxygenase-2 (COX-2), inducible nitric oxide synthase (iNOS), and nuclear factor kappaB. In a review, Lee et al. (2005) concluded *Panax ginseng* has a radioprotective effect associated with antioxidant and immunomodulation properties.

**Anti sterility activity:-**

A study was designed using an untreated control group found indications that *Panax ginseng* might improve sperm count and motility, thereby enhancing male fertility (Salvati et al., 1996).

**Anti cancer activity:-**

*Panax ginseng* has been reported to suppress angiogenesis and cancer metastasis and to act on signaling pathways related to anticancer activity. Rg3, Rh2, Rg5, Rs4 (acetylated Rg5), Rg1, Rf, and PPD were found to block cell cycles or apoptosis through caspaseactivating signaling (Sin et al., 2012). Red ginseng, ginsenoside, and acidic polysaccharides showed anticarcinogenic effects in carcinogenesis involving inflammation through diverse pathways.
including the suppression of cyclooxygenase-2 (COX2), inducible nitric oxide (iNOS), and nuclear factor-kappa B (NF-kB) activity and the elimination of reactive oxygen species (Yang et al., 2014) and showed anticancer assisted effect when it was combined with an anticancer drug (Shin et al., 2004). In the results of both cohort studies and case-control studies conducted to determine the effects of the intake of ginseng and red ginseng on the development of cancer, the intake of ginseng products including red ginseng was found to decrease the relative risk of developing cancer. In addition, the risk of developing stomach cancer, lung cancer, ovarian cancer, laryngeal cancer, esophageal cancer, and pancreatic cancer decreased as the frequency and duration of the intake of red ginseng and ginseng products increased (Yun, 2001). To determine the effects of red ginseng on the development of cancer, chronic atrophic gastritis patients were administered with 1 g/week of red ginseng extract powder for 3 years and subjected to a tracking survey for 8 years (Yun, 2003). While the relative reduction of risk of developing cancer had no statistical significance in the red ginseng group in comparison with the control group, this risk did decrease significantly among men in the red ginseng group. In this research, as ineptedemiological surveys (Yun et al., 2010), red ginseng was found likewise to exhibit effects of nonspecifically preventing the development of cancer in men.

**Antioxidant activity:**

Panax ginseng either decreases or eliminates the generation of free radicals by regulating the activity of antioxidant enzymes such as SOD, catalase, and GPX out of diverse factors that cause oxidative damages and strengthening the synthesis of endogenous antioxidants such as glutathione, thus decreasing oxidative damages (Kim et al., 2002). The administration of either 1.8 g/day or 3 g/day of red ginseng powder for 4 weeks to healthy smokers significantly decreased the carbonyl content of 8-OHdG and peripheral hemoglobin (Lee et al., 1998). In a randomized controlled trial in which healthy drinking and smoking adults aged 20-65 years were administered with either 3 g/day or 6 g/day of red ginseng for 8 weeks, the tail length and mobility of DNA, which are indices of the degree of lymphocyte DNA damages, both decreased in the red ginseng group. In addition, the activity of SOD, which is an antioxidant enzyme, increased, and the activity of GPX and catalase increased as well in the high-dose group. The concentrations of both blood oxidized LDL, which is an oxidant, and urine 8-epi prostaglandin (PG) F2a, decreased in both the low- and high-dose groups (Kim et al., 2012). In menopausal women, the intake of 3 g/day of red ginseng powder for 12 weeks significantly increased SOD activity but did not affect blood GPX or 8-OHdG. While blood MDA decreased after red ginseng intake, there was no statistical significance in comparison with the control group (Seo et al., 2014).

**Anti proliferative activity:**

Panax ginseng is also said to help prevent cancer and fight chemical dependency, but the scientific evidence for these uses is minimal at best. Numerous in vitro and animal studies have examined the interaction of Panax ginseng with carcinogenesis, apoptosis, angiogenesis, and metastasis (Lee et al., 2005).

**Aid to menopausal women’s health:**

In a randomized controlled trial on menopausal women’s subjective symptoms such as hot flashes, insomnia, and depression, the intake of 3 g/day of red ginseng for 12 weeks improved results on both the Kupperman Index and the Menopause Rating Scale, which are internationally certified survey evaluation methods that comprehensively evaluate menopausal symptoms. While the total cholesterol and LDL-cholesterol decreased significantly, the estrogen content was not affected (Seo et al., 2014). In menopausal women administered with either 0.9 g/day (8 weeks) or 6 g/day (30 days) of red ginseng, the frequency of the occurrence of hot flashes, which constitute a menopausal symptom, decreased (Kim et al., 2009). In women with menopausal symptoms who had taken red ginseng, the stress hormone ratio (cortisol/DHES-A) became similar to that of women without menopausal symptoms, and red ginseng mitigated menopausal stress and decreased tissue-type plasminogen activator inhibitor type 1, thus improving blood circulation (Kikuchi et al., 2003). Red ginseng improved lowered sexual functions in menopausal women as well (Oh et al., 2010). Red ginseng mitigated menopausal symptoms but did not affect the content of hormones such as serum estrogen and prolactin (Kim et al., 2012). These results imply that red ginseng has no side effects or risks, unlike hormone replacement therapy, which involves a high risk of the development of breast cancer due to hormone increase. In addition, red ginseng can
improve the risk of cardiovascular disease due to a decrease in estrogen in menopausal women.

**Other Pharmacological effects of Panax ginseng:-**
1. Efficacy of increasing learning functions and reducing memory loss (Zhang et al., 2008).
2. Efficacy of inhibiting cancer cell growth (Yun and Choi, 1995).
3. Efficacy of increasing immunization functions (Suh et al., 2006).
4. Efficacy of anti-oxidation and anti-aging activity (Kim et al., 2002).
5. Preventing cancer and activate antitumor immunity (Kamamager et al., 2007).
7. Efficacy of adjusting blood pressure (Vuksan et al., 2006).
8. Efficacy of improving female climacteric disorder (Ogita and Samugawa, 1994).

**Conclusion:-**
Medicinal plants have provided copious leads to combat diseases, from the dawn of civilization. The extensive survey of literature revealed that *Panax ginseng*, is highly regarded as a universal panacea in the herbal medicine with diverse pharmacological activity spectrum. This versatile medicinal plant is the unique source of various types of chemical compounds, which are responsible of the various activities of the plant. Hence extensive investigation is needed to exploit their therapeutic utility to combat diseases. A drug development programme should be undertaken for the development of modern drugs with the compounds isolated from *Panax ginseng*. As the global scenario is now changing towards the use of non-toxic plant products having traditional medicinal use, development of modern drugs from *panax ginseng* should be emphasized for the control of various diseases. *Panax ginseng* imbuing a tremendous potential deserves a special attention of the scientific fraternity to emerge as a milestone for medical science of this millennium due to its various medicinal uses. Further evaluation needs to be carried out on *Panax ginseng* in order to explore the concealed areas and their practical clinical applications, which can be used for the welfare of the mankind.

**References**
Geumsan, Chungnam, Korea, Korean Society of Ginseng.


