

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 and2).



Figure (1) Root of *panax ginseng*



Figure (2) Leaves, flowers and root of *panax ginseng*

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*

ginseng has immuno-modulating activity by affecting the hypothalamic- pituitary- adrenal (HPA) axis (Blumenthal, 2003). *In vitro* experiments reveal enhanced natural killer (NK) cell activity and increased immune cell phagocytosis after ginsenoside exposure (Blumenthal, 2003). According to 1999 World Health Organization review, ginseng saponins “are thought to decrease serum prolactin, thereby increasing libido” in male impotence (WHO,1999).

The main active agents in *Panax ginseng* are ginsenosides, which are triterpene saponins. The majority of published research on the medicinal activity of *Panax ginseng* has focused on ginsenosides (Ernst, 2002). These are the compounds to which some ginseng products are now standardized. Research reviews postulate that extracts of *Panax ginseng* affect the hypothalamus-pituitary-adrenal axis and the immune system, which could account for many of the documented effects. Animal models and *in vitro* studies mentioned (Vogler *et al.*,1999) indicate that *Panax ginseng* enhances phagocytosis, natural killer cell activity, and the production of interferon; improves physical and mental performance in mice and rats; causes vasodilation; increases resistance to exogenous stress factors; and affects hypoglycemic activity.

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 caspase-activating 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 in epidemiological 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).
- 6-Efficacy of improving liver functions (Matsuda *et al.*, 1991).
- 7-Efficacy of adjusting blood pressure (Vuksan *et al.*, 2006)
- 8-Efficacy of improving female climacteric disorder (Ogita and Samugawa, 1994).
- 9-Efficacy of anti-fatigue and anti-stress (El-Kady *et al.* 2006).

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.

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