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Effect of Ginsenosides Rb_1, Rg_1, Rh_1 and Re on Enzymes Content and Unscheduled DNA Synthesis of Cells *in Vitro*

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Using the cytochemical methods, these enzyme contents were determined with microspectrophotomer including Lactate dehydrogenase (LDH). Succinate dehydrogenase (SDH), Glucose-6-phosphate dehydrogenase (G6PDH), Glucose-6-phosphatase (G6Pase), Alkaline phosphatase (AKP), α-Naphlhyl acetate esterase (ANAE), Adenosine triphosphatase (ATP_{ase}). Acid phosphatase (ACP) and Monoamine oxidase (MAO) during in vitro of human fibroblasts. The results showed that these enzyme content of LDH, SDH, AKP, ANAE, G6PDH and ATP_{ase} were decreased significantly but G6Pase and ACP did not change, however MAO was increased significantly with aging in vitro. The results suggested that some enzyme content was not changed, others increased or decreased in human fibroblasts during aging in vitro. Rb_1, Rg_1, Re, Rh_1 and SRG were added to the culture medium of fibroblasts and Hela for 5 day's all ginsenosides concentrations of 5.0~0.5 μg/m*l* were used. The results showed that these ginsenosides increased content of PAS, G6Pase, G6PDH, LDH and Pyruvate oxidase (PO) and decreased content of MAO in old cultures but increased MAO content in young cultures. However all ginsenosides decreased these enzyme content of PAS, G6Pase, G6PDH, PO and LDH in Hela cells. The results suggested that all ginsenosides increased cellular metabolic rate in aging human fibroblasts but decreased cellular metabolic rate in cancer cell in varying degrees.

Using ^{14}C-TdR and H-TdR double labelled methods, mitomycin C (MMC) induced unscheduled DNA synthesis (UDS) was determined with a liquid scintillation counter in old and young cultures of human fibroblasts. These cultures were exposed to MMC at 1.0~10.0 μg/m*l* which damges DNA, and found that UDS was significantly increased in young cultures but UDS was slightly decreased in old cultures after 24 hour. The results suggested that it was much reduced UDS induced by MMC during aging in vitro of human fibroblasts. Rb_1, Rg_1, Re, Rh_1 and SRG increased significantly the MMC induced UDS in old cultures but all ginsenosides decreased the MMC-induced UDS in young cultures of fibroblasts and cancer clutures. No significant difference in UDS with all ginsenosides without MMC-induced was observed in old and young cultures of fibroblasts.

Studies on the Hypoglycemic Effect of Ginseng Glycopeptide

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The ginseng glycopeptide (GGP) isolated from the root of *Panax ginseng* C.A. Meyer was demonstra-

ted to decrease the levels of blood sugar and liver glycogen when injected intravenously to rats and mice at doses of 20~200 mg/kg without affecting total blood lipid. In addition, GGP was found to decrease various experimental hyperglycemias induced by injection of adrenaline, glucose, alloxan and streptozotocin. It was found that when blood sugar and hepatic glycogen were decreased, cAMP content and adenylate cyclase (AC) activity were enhanced. The further studies demonstrated that the decrease of blood sugar and liver glycogen induced by GGP were inhibited by pretreatmets with pentolamine and propranolol, respectively. Radioligand receptor assay showed that there is competitive binding to β-receptor of duck's erythrocyte membrane between GGP and [^{3}H] DHA in vitro, and its IC_{50} is 6.3×10^{-8} M. In additon, GGP at dose which cause decrease of blood sugar and glycogen inhibited LDH activity, and consequently produced decrease of lactic and increase of pyruvic acid. GGP was also found to stimulate SDH and CCO activities. On the above mentioned results, GGP's hypoglycemic mechanism may be made the following inference: First GGP as excitant agitated receptors and lead up to the enhancement of AC activity and cAMP level. The biological information was delivered into mitochondria and cytoplasm. and produced the enhancement of glycometabolosm and the decrease of liver glycogen.

The Effect and Mechenism of Ginsenoside Re on Hemopoiesis

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The effects of panax ginsenoside and ginsenoside Re on proliferation and differentiation of multi-stem cells of bone marrow in mice were observed by applying methods of colony forming unit-spleen (CFU-S) etc. The results showed that the multi-stem cells could be stimulated by panax ginsenoside and ginsenoside Re in vitro, especially the formation of erythrocyte colony and mixed colony of erythrocyte, granulocyte and macrophage was increased obviously. But it failed to stimulate the formation of granulocyte colony. Apparently we count the number of colony whatever underlying dissection microscope or using histochemical staining of HE, the number of spleen colony of experimental group of Re and panax ginsenoside is 1~2 times as the normal control group. It is supposed that ginsenoside is one of effective conponents of ginseng on hemopoiesis. Furthermore ginsenosied Re of panaxtriol group is basic functional unit on hemopoiesis. Further investigation indicates that mechenism of panax ginsenoside and ginsenoside Re on hemopoiesis is due to the way in which ginsenoside can stimulate the cells to scerete some cytokines related to hemopoiesis. Recently, our experiment proved that panax ginsenoside and ginsenoside Re could stimulate bone marrow stromal cell and lymphocyte to secrete hemopoietic factor (GM-CSF) and hemopoietic related factors (IL-3, IL-6, etc). The detailed mechinsm remains to be elucidated. The advanced study on this area has theoretical and practical importance.

Effects of Ginseng Root Saponins on Brain Neurotransmitters and Serum Corticosterone in Heat-Stressed Mice and Noise Stressed Mice

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The death rate, rectal temperature, and serum corticosterone increased, and the levels of brain 5-HT and NE decreased in mice exposed to 45℃ for 15 min.

Ginseng root saponins (GRS) ip 200 mg/kg reduced the death rate, prolonged the survival time, inhibited the rise of body temperature, the increase of serum corticosterone, and the decrease of brain 5-HT and NE in heat-stressed mice. Reserpine eliminated the hypothermia of GRS at room temperature and its inhibitory effect on hyperthermia under heatstress conditions. PCPA eliminated only the inhibition of GRS on hyperthermia under heatstress. The rectal temperature, serum corticosterone increased, and the brain Ach decreased in mice exposed to noise (50 Hz, 85～87 dB). GRS 50, 150 mg/kg ip inhibited the rise of body temperature, the increase of serum corticosterone, and the decrease of brain Ach.

Research of Interaction Mechanism of Ginsenoside-Rb_1 with Liposome DPPC

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How do the Rb_1 with DPPC membrane interact? Because Rb_1 is water resolving material, we think that the Rb_1 acts on polar head of DPPC, thus, influencing it's phase conversion temperature. In order to prove the assumption, we have studied as following:

Fig. 1 is a NMR spectrum of the DPPC. Peak C corresponds with basic group $N(CH_3)_3$ of polar head of the DPPC. After Rb_1 is added, twin-shoulder peaks became single shoulder peak of the C. Indeed, Rb_1 acted on polar head of the lipid molecule. It influenced conformation changes, reduced phase conversion temperature.

In order to examine aforesaid conclusion, we studied IR absorbing spectrum (Fig. 2) and Raman spectrum (Fig. 3) of the DPPC. It is indicated from Fig. 2, Rb_1 is added before and after, shape and seat of the peaks are unchanged basically. Now that Rb_1 unacts on hydrophobic part of the hydrocarbon chain of the DPPC. Since limiting by instrument, in Fig. 2. Infrared absorbing spectrum of polar head group of the lipid molecule is not obtained. Thus, we examine it by Raman spectrum. In Fig. 3, 714 cm^{-1} peak from C-N stretching out and drawing back oscillation of the polar head. 1294 cm^{-1} peak coming from tureing round oscillation of $-CH_2-$. Having little influence by surrounding, can be as inter standard. Rb_1 is added before and after, I_{714}/I_{1294} value varied from 0.72 to 0.41. Interaction of Rb_1 with polar head of the DPPC is proved. 2845 cm^{-1} peaks come from symmetric and unsmmetric stretching out and drawing back oscillation of C-H in $-CH_2-$, $^{+}Rb_1$ is added before and after I_{2880}/I_{2845}. Value are 1.007 and 1.002 respectively, not changing. The result agrees with infrared absorptive spectrum.

Rb_1 acting on polar head of the lipid molecule of the DPPC is proved by experiment of NMR, IR and Raman spectra.

The Effect of Ginsenoside-Rb_1 on Human Red Cell Membrane's Protein

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The effect of a drug on an organism, at first is a action of the drug on biocell's membrane. Therefore, using interaction parameters of the drug with cell's membrane, research the characteristic of the drug.

The proteins in cell's membrane have important biology function. When cell aging or pathological changes of the function and confomation of membrane protein are accompanied generally. We investigated the action of Ginsenoside-Rb on HRCM protein, the result indicated that Rb_1 can increase the rate of α-helix of the membrane protein. Improving the function of cell's membrane.

Preparation of HRCM, cell's membranes of fresh red cells are broken by supersonic method, cell's substances flow out, taking the membranes, and inputed isotonic suspension, shaping ghost.

J-500c circular dichroism (CD). Concentration of the membrane protein in 90 μg/ml, concentration of Rb_1 is 20 μM, incubated at 37℃ one hour, the result as shown Fig.

By means of Chen and Yan method, pass through count of counter and given, when Rb_1 is not added into, content of α-helix protein is 61.3%, Rb_1 is added into, it changed to 67%, increased 5.7%.

Ginsenoside-Rb_1 can increase rate of α-helix of membrane protein, improving the function of cell's membrane, particularly aging cell.

Conformational Changes in Human Erythrocyte Membranes by Ginsenosides as Measured by Circular Dichroism

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The effect of 5 kinds of ginsenosides on human erythrocyte membranes (HEM) was studied by circular dichroism (CD). HEM were prepared by hemolysis, Ginsenosides Rb_2, Rc, Rd, Rc and Rg_1 were extracted from *Panax ginseng* C.A. Meyer and dissolved in ethanol. HEM containing ethanol to a 1 : 3 or less, ethanol : protein mass ratio were used as a model.

Fig. 1 is the percent changes in negative $[\theta]_{222}$ by the ginsenosides after the ginsenosides had been mixed vigorously with HEM and incubated at 20℃ for 5 hours. The percent change is defined as follows:

$$\frac{[\theta]_{222}-[\theta]_{222-\text{control}}}{[\theta]_{222-\text{control}}} \times 100 = \text{percent change}$$

Protein concentration＝1.66 mg/ml: Concentration of each ginsenoside＝2.4×10^{-4} M. The results indicate that the ginsenosides are membrane-ordering agents, which can increase the α-helix percentage of HEM proteins. Cell aging is accompanied by the decrease of α-helix percentage in HEM (Zeng *et al*, unpublished result). This membrane-ordering effect may be the key factor of the anti-aging function of ginsenosides. It is observed that the greater the solubility of the ginsenosides in water is, the greater the conformational change in HEM will be.

Fig. 2 is the time course of Re effect at 4℃. Protein concentration＝0.5 mg/ml; Concentrations of Rc are 5×10^{-7} M(－) and 1×10^{-6} M(···) HEM is estimated to be excess in both cases. It is evident that after 3 hours of addition of Rc, the percent changes are directly proportional to the concentration of Rc. That means Rc reaches it utmost point of the effect. It can be explained as caused by the poor solubility of Rc.

The relationship between the solubility of ginsenoside and its effectiveness, and the magnitude of CD change suggest that the conformational changes must be achieved mainly by ginsenosides acting on peripheral proteins of HEM.

Investigation of the Effect Ginsenoside Re on the Membrane Fluidity of the Transforming C_3H_{10} Cell

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Ginseng is a famous traditional Chinese medicine and has antitumor effect. Ginsenoside-Re is one of the main components. The fluidity of cell membrane plays an important role in cell's physiological characteristics. The membrane fluidity of tumor cell is much higher than that of normal cell. This is connected wih tumor cell's growth and metastasis. In this paper, we used fluorescence polar method to study the difference of membrane fluidity between normal and transforming C_3H_{10} cells and the effect of Re on the transforming C_3H_{10} cells and the effect of Re on the transforming cells.

In the experiments, cells were diluted in PBS (pH＝7.25), and Re was dissolved in DMSO (Dimethyl Sulfoxide). Added Re into the cell suspension, after 2 hours at 37℃, labeld the cell membrane with DPH, and measured the polar date on HITACH M850.

We found that (1). Re's effect on the tumor cells is connected with its concentration. The higher the concentration is, the larger the effect it has. The effect is about saturated near a concentration of 30 μg/ml. The EC_{50} of Re is about 10 μg/ml. (See Fig. 1) (2). When the concentration is 30 μg/ml, the work time is 2 hours, the statistical value is in Fig. 2.

From the results, we can find that the normal cell's fluidity is much smaller than that of the transforming cell, and the Re can decreased the membrane fluidity of tumor cell obviously. Since the membrane fluidity is connected with cell's characteristics, and it has important effect on tumor cell's growth, development and metastasis, Re's antitumor mechanism may be related to its effect on the membrane fluidity of tumor cells.

^{23}Na NMR Study of Interaction of Human Red Blood Cells (RBC) with Ginsenoside-Rb_1 and Re

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Ginseng is one of precious Chinese traditional medicine with many curative effects. Much work has been reported about Ginseng component analysis. It's pharmacology and clinical application. However, little has been done so far about the interaction of cells with Ginsenoside in terms of molecular biophysics. With the use of CD, IR, Raman technique and so on, Quan and Wang *et al* studied interaction of human RBC membrane with Ginsenoside-Rb_1, Re and so on, and obtained important results. In order to explore whether Ginsenoside could influence the functions of Na^+/K^+ pumps or not, we continued to study the interaction of intact human RBC with Ginsenoside-Rb_1, and Re, by using Na NMR techique.

Intracelluar and extracellular Na generally have almost same chemical shifts. In order to separate the resonance signal of intracellular Na^+ from that of extracellular Na^+, shift reagents should be added into the RBC suspension. In this work we use lanthnaide complexes M_3D_y (TTHA), $[M=NH_4^+, N^+(CH_3)_4^+]$ as the ^{23}Na shift reagents.

For the samples of isotonic RBC suspension contained 200 mM M_3D_y (TTHA), two ^{23}Na NMR resonances are resolved respectively with a separation of 7.0 ppm, as shown in Fig. 1(a) and 2(a). The stronger peak is from extracellular Na and its chemical shift varies with addition of shift reagent. The weaker one is due to intracellular Na^+ and it's resonance frequency is independent on shift reagent. Addition of Ginsenoside Rb_1 and Re, respectively to the RBC suspension, no change was observed for the intensity ratio of the intracelluar Na^+ signal to extracellular Na^+ signal, as shown in Fig. 1, 1B, 1C, 1D and in Fig. 2, 2B, 2C and 2D.

This observation suggests that Ginsenoside do not influence normal function of Na^+/K^+ pumps in the cell membrane. It is well known that Na^+/K^+ pumps play the role of maintaining the high transmembrane Na^+ and K^+ concentration gradients, which guarantees the normal transport process of cells. Therefore it is of great importance that Ginsenoside could do good for human body while do not influence the normal function of Na^+/K^+ pumps.

Studies on the Peculiarity and Pharmacologic Effect of Freshening Ginseng

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The peculiarity of freshening ginseng was studied. Its commodity rate was 98.33% and having the first quality after had been stored 12 months, compared to fresh ginseng the saponin content of freshing one only dropped 1.33%, much lower than that of 14.10% of ginseng dried by sun. The freshening ginseng can be wildly utilized in the fields of medicine, health protection, improve looks etc. being its high fresh rate, extraction and preparing its pharmacologic effect composition easies, mildew and month-easten prevention and long period for sell. The results of its pharmacologic effect on small white mice showed that freshening ginseng had extreme significant effects against oxygen deficiency and convulsions, significant effects against diuresis and fatigue. The statistical analysis indicated that there was no marked difference of pharmacologic effect between freshening ginseng and the fresh check one.

The Pharmacological Effection of The Rich Ge Ginseng

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The rich Ge ginseng contains germanium about 10^{-3}. It's pharmacological effection to compare with general ginseng is reported in this thesis.

1. The rich Ge ginseng (5 g/kg Ginseng, 5 mg/kg Ge) effect on antianoxia more significantly than general ginseng.
2. It can reduces the hyperglycemia caused by adrenaline.
3. It does'nt effect on the normal blood fat but reduces the hyperlipemia.
4. It can inhibits the multiplication of sarcoma S180. The ratio of anticancer (35.7%) is more than the general ginseng's (13.7%).
5. It can reduce the content of lipfuscin in the mice brain and improve the learning ability of mice to show it's antiaging effection.

Studies on Medicinal Products From *Panax Ginseng* Cell Culture

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This thesis shows the result obtained from the cell mass culture, both of suspension culture and simple-easy culture of *Panax ginseng*, it emphasizes on extracting and isolating polysaccharide substance and its physicochemical properties, pharmacological activities and the safety trial which was one of medicinal products produced by mass cell culture of P. ginseng. The result of this research, now, provided the basis for the industrialization of production and product development under present conditions in our country.

A Stduy on Pharmacology and Toxicology of Delayed Ageing Health Tea

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8902F Health Tea can obviously prolong the time of their climbing pole and sustained swimming after being perfused 3 g/kg and 6 g/kg to mice continuosly for 14 days. The experimental results suggest that the tea has an effect of anti-fatigue; can strengthen the power of mice to resist hypoxia under ordinary pressure and has no toxicity.

Biological Activity of Ginseng Stem-Leaf on Pheasant

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The ginseng stem-leaf is the stem and leaf of ginseng (*Panax ginseng* C. A. Mey). The 3% of them were added into the sample feed of pheasant (Phasianus Colchicus) (10 month ages, n=45, F=36, M=9) for 77 days from 20, April to 7, July. The pheasant control (10 month ages, n=45, F=36, M=9) without additon were keeping isolated state from the sample, We observed laying egg rate, pecking egg rate, fertilized rate and incubation rate during the period of their laying eggs. At the end of laying egg, we collected blood samples and determined biochemical indexes in serum (the content of total protein, serum albumin, glucose, calcium, phosphorus and each kind of serum globulin α, α, β, γ). Statistics analysis was by T test.

The results of determination and observation from the effection of ginseng stem-leaf on pheasants are as follows: (1) Increasing 13%, 20.4% and 17% of α, β, γ serum globulin, respectively ($P<0.05$). (2) Increasing 10.1% ($P<0.05$) and 14.8% ($P<0.01$) of phosphorus and calcium in serum, respectively. (3) The laying egg rate increased 12% ($P<0.05$) and pecking egg rate reduced to 10 times ($P<0.01$). (4) There is no significant differences in the amount of total protein and glucose between sample and control. (5) Increasing 5.1% ($P<0.50$) and 2.3 times ($P<0.01$) of fertilized egges and incubation rate, respectively.

These suggested that ginseng stem-leaf was of protisol effect to advance protein synthensis, improving absorbtion of organic and mineral substances. In the gaining internal consumption caused by increasing production, the level of protein and glucose in serum were maintained. In addition, sperm vitality of the male and incubation rate increased by the adding effection.

The conclusion we studied is that the ginseng stem-leaf is of high values for keeping pheasant. If it were spreaded to the field of poultry and the other animals, ginseng stem-leaf would be efficiently used and produced immense economic benefits. This needs to be studied further.

The Effection of Ginseng Saponin Rh_2 on Metabolism of Cancer Mice

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The invert substance from Ginseng saponins of stem and leaf show the chemical and physical property of Ginseng saponin Rh_2 and effection of anticancer. The thesis reports the effection of the Rh_2 on metabolism and it's correlated enzyme. The blood sugar and blood fat of S_{180} sacoma mice are lower than normal. The Rh_2 (15 mg/kg) can increase their blood sugar and blood fat as it inhibits the multiplication of sacoma. The Rh_2 (10 mg/kg, 20 mg/kg) inhibit the synthesis of DNA and RNA in cancer cell and accelerate it in bone marrow cell of mice with hepar cancer H_{22}. The synthesis of DNA and RNA in both cancer cell and bone marrow cell is inhibited when Rh_2 (30 mg/kg) is administrated to the cancer mice. The Rh_2 (10 mg/kg, 20 mg/kg) decrease the relative content of LDH in the cancer cell and increase it in bone marrow cell. The LDH in the serum of cancer mice is more than normal and it's isoenzyme spectrum is changed, the radio of LDH_1 is low and LDH_5 is high, Rh_2 (15 mg/kg) can decrease LDH as well as change LDH_1 and LDH_5 to be normal. LDH effects on the metabolism. The effections of Rh_2 on the LDH in different cell and in serum of cancer mice indicate the relation between the metabolism and it's correlated enzyme.

Chemical Properties and Anti-Tumor Activity of Polysaccharides from Roots of *Panax Ginseng*

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One glucan (GR-5N) and two acidic polysaccharides (GR-5AUL and GR-5AUH) were isolated from the roots of *Panax ginseng* C. A. Meyer. GR-5N was composed of Glc only but GR-5AUL and GR-5AUH were composed of GalA, Gal, Rha, Ara, mainly. The molecular weight of GR-5N, GR-5AUL and GR-5AUH were 25,000, 72,000 and 5,500, respectively, detected by H. P. L. C. with 0.2M NaCl as eluant. The molecual weight of GR-5AUL and GR-5AUH were increased to 760,000 and 42,000 if eluated with water in the H. P. L. C condition, indicated the two acidic polysaccharides from larger molecular in water. Glycosyl linkage analysis showed GR-5N has a 1→4 linkage main chain and was branched in the 6 position of the 1→4 Glc in the main chain. Its structure was samilar to amylopectin but GR-5AUL and GR-5AUH were pectic polysaccharides. GR-5N has anti-tumor activity. The ILS (increase in life span) of GR-5N was 46.8% when the dosage was 100 mg/kg/day.

Chemical and Biochemical Studies on Non-Saponin Constituents of Korean Ginseng

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There has been a general tendency to explain the traditional ginseng efficacy through the pharmacological and biochemical activities of ginsenosides. However, when we analyze the pharmacological and biological data on ginseng reported yet, we can easily arrive at the conclusion that most of the data on pharmacological and biological activities must have been obtained using impure ginsenoside samples, which should contain some non-saponin constituents as impurities. Based on the above background, the non-saponin constituents of ginseng were studied in our laboratory. Phenolic substances including Maltol, Vanillic Acid, Salicylic Acid, Ferrulic Acid and Caffeic acid and impure ginsenoside samples were found to show strong antioxidant and anti-fatigue activities, while pure ginsenosides were devoid of the activities. Maltol, one of antioxidant components in Korean red ginseng drew a special interest due to its very low pro-oxidant activity. The antioxidant activity of ginseng may be considered as scientific basis for the anti-aging activity which was described in traditional medicinal material book as "long-term medication of ginseng will improve bio-efficiency and extend life-span".

The lignan components, another non-saponin constituents, isolated from ginseng extract in our laboratory mayexplain the hepato-protective activity of ginseng which has been repeatedly claimed as one of the efficacies of ginsenosides. The β-carboline alkaloids isolated in our laboratory as one of the non-saponin constituents of ginseng may play some pharmacological activities which should also be investigated. Present talk will include chemistry and biochemical aspects of the non-saponin constituents of ginseng with special interests for the explanation of traditional ginseng efficacy on modern scientific basis.

Effect of *Panax ginseng* Saponin Fraction on Ethanol Metabolism in the Animal Body

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Ethanol is one of the favorite mood-altering dug and its psychic effects, both pleasant and unpleasant, are well known enough but what is less known is that alcohol is a toxic drug; its overconsumption taxes the body's economy, produced a number of pathological changes particularly in the liver and impairs biological functions. Present knowledge on alcohol metabolism showed that alcohol and its metabolite effects are reported directly linked to the first two products of its oxidation, hydrogen and acetaldehyde.

Acetaldehyde is produced during ethanol metabolism and is known to be oxidized mainly by aldehyde dehydrogenase (ALDH) but is also oxidized by catalase and microsomal ethanol oxidizing system (MEOS). ALDH activity was found mainly in the mitochondrial fraction but a significant ALDH activity was also present in microsomal fraction. A small ALDH activity was in the cytosol fraction.

In the factual scene, when ginseng extract was administered to an animal following the medication of ethanol, there had been reports that the consumption rate of ethanol speeds up. We found that there was optimum concentration of the ginseng saponins for the maximum activity of enzymes such

as ADH, ALDH, MEOS respectively.

Wistar rats (150～200 g, male) were given freely with 12% ethanol (Control) and/or 12% ethanol containing 0.1% ginseng saponin (Test) instead of water for 6 days and the liver was analyzed. Liver homogenate was used for ADH, ALDH, and MEOS assay. ALDH activities of both control and test group were lower than that of normal group but test ALDH was less inhibited than control. ADH activities of both control and test were slightly higher than that of normal group. We know that ADH activity is usually stimulated by ethanol feeding at initial stage but our previous data showed that it became gradually steady after prolonged ethanol feeding. MEOS activities of both control and test group were much higher than that of normal group. MEOS enzymes are inducible but the activity of test group was greatly higher than that of control.

Electron microscopic observation showed that the hepatic cell of control group was significantly damaged. Mitochondria were swollen and disrupted severely. The rough endoplasmic reticulum were dilated and vesiculated and smooth endoplasmic reticulum were proliferated. Peroxisomes were increased in number and prominant golgi apparatus were seen, and pyknosis occurred and large fat droplets were seen. However, hepatocytes of test group showed that swollen or desrupted mitochondria were not seen, and dilated or vesiculated RER were very few.

Ethanol containing [$^{1\,14}$C] ethanol (5 μCi) was injected to the above three groups. And, 30 min later, the distribution of radioactivity of hepatic lipids was investigated. Radioactivity of hepatic lipids of both control and test group was higher than that of normal group, but that of test group was much lower than that of control. Analysis of individual lipids such as phospholipids, cholesterol, fatty acid and triglycerides showed that the phospholipid biosynthesis of ethanol fed groups was significantly impaired and fatty acid and triglycerides biosynthesis were greatly stimulated. However, the saponin prevented the phospholipid biosynthesis depression and triglyceride biosynthesis.

It seemed that the ginseng saponin might stimulate ADH, ALDH and MEOS in accelerating ethanol oxidation and acetaldehyde removal from the tissue and excess hydrogen can be shunt more quickly into lipid biosynthesis.

Study on Several Pharmacological Reaction of Insamside-Re (Ginsengside-Re)

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The effects on cardia, potential of cell membrane and sex function of Insamside-Re (Ginsenoside-Re) seperated from Insam (Ginseng) radix of 6 years were studied. The melting point 201～203℃ and the optical rotation-0.98 of Insamside-Re (Ginsenoside-Re) was used for experimentation. The volume of coronary circulation in cardia seperated from warm blood animal was determined by Langerdorf method.

Insamside (Ginsenoside-Re) increased the volume of coronary circulation and ATP and that the glycogen of cardia muscle remarkable and the biosynthetic rate of ATP to 140%, after the sample was continuously given to rat for 7～10 days. The weight of sex organ of infant animal was significantly increased and the number of sperm and the amount of gonadotropic remarkably. The safety potential of smooth muscle cell of vessel and L-cell was enhanced clearly. The registibility of experimental animal on several negative factors was increased. But the wood fiber was not appeared in main roots of the wild Insam (Ginseng). The content of saponin in wild Insam (Ginseng) was one and half times

than that of the cultivated Insam (Ginseng) collected from plant of 6～7 years. On the other hand, the pharmacological activities of the wild Insam (Ginseng) were higher than that of the cultivated Insan (Ginseng). The wild Insam (Ginseng) was strongly active in the prolongation of swimming time of mice, and gradually decreased the lipid peroxide content in rat serum induced by radiation injury. The results proved in a scientific manner that the wild Insam (Ginseng) may have higher tonic efficacy than the cultivated Insam (Ginseng) using from old times.

Regulation of Protein Phosphorylation by Ginsenoside Rb_1 on CCl_4-Induced Liver Injury of Rat

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All of the cellular responses are mediated via protein phosphorylation. In the present study, we found out the ginsenoside Rb_1 (G-Rb_1) from Korean red ginseng regulate protein kinase activity in liver homogenates from male Sprague Dawley rat received by intraperitoneal injection of CCl_4 (0.35 ml/kg B.W.) or G-Rb_1 (10 mg/kg B.W.) plus CCl_4 (0.35 ml/kg B.W.). The homogenates were incubated for 5 min at 25℃ with 2 μCi of ATP-gamma-^{32}P. Among protein phosphorylated, two major protein bands identified on sodium dodecyl sulphate-polyacrylamide gel (10%, 1.5 mm) appeared to undergo CCl_4 and G-Rb_1-mediated phosphorylation. Liver homogenates from CCl_4-treated rat exhibited significant phosphorylation of proteins with molecular masses at 118- and 34 kda, While those of liver homogenates from G-Rb_1 or G-Rb_1/CCl_4-treated rat were kept equal to control level, it is inferred that these phosphorylated-proteins seem to be liver injury factor (LIF) and G-Rb_1 has a regulatory function of LIF. On the basis of the effects of specific protein kinase inhibitors such as H-7 and W-7, G-Rb_1 seems to regulate protein kinase shaving some similarities to tumor promotor, protein kinase C and calcium/calmodulin-dependent protein kinase. In addition to, it will be described for lipid metabolism and glucose metabolism interrelating with metabolic diabetes mellitus. These results suggest ginsenoside Rb_1 seems to protect both liver injury and metabolic diabetes modulating protein (118 kDa and 34 kDa) phosphorylation.

Note: H-7, 1-(5-isoquinolinysulfonyl)-2-methyl piperazine
W-7, N-6(6-aminohexyl)-5-chloro-1-naphthalene sulfonamide

A Study on the Antitumor Activity of *Panax ginseng*

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Panax ginseng has been extensively used in the traditional oriental medicine as a restorative, tonic and prophylactic agent. Recently, several reports regarding to anticancer effects of *Panax ginseng* has been accumulated. These studies emphasized the fact that anticancer activities might be due to a glycoside group called ginsenoside or panax saponin which has a water soluble characteristic.

However, the authors and collaborators demonstrated that a highly lipid soluble component in extract of *Panax ginseng* roots contains a considerable cytotoxic activities against murine leukemic cells (L1210, P388) and human cancer cells (HRT-18, HT-29, HCT-48).

Each cell-line was cultured in medium containing serial concentrations of the crude Gx or 7 : 3

Gx *in vitro*. A highly lipid soluble compound in the extract of *Panax ginseng* root was cytocidal to murine leukemic cells and human colon and rectal cancer *in vitro*. In the meantime, ginseng saponin derivatives did not have cytotoxic effects at its corresponding concentration. The growth rates of the cancer cells in medium containing ginseng extracts were inhibited gradually to a significant degree roughly in proportion to the increase of the extract concentration. The cytotoxic activity of 7 : 3 Gx was about 3 times more potent than that of crude Gx, one unit of cytotoxic activity against L1210 cells being equivalent to 2.54 μg and 0.88 μg for the crude Gx and 7 : 3 Gx, respectively. The Rf value of the active compound on silica-gel thin layer chromatography with petroleum-ether/ethyl ether/acetic acid mixture (90 : 10 : 1, v/v/v) as a developing solvent was 0.23. While, the Panaxydol and Panaxynol as active compounds were purified from petroleum-ether extract of *Panax ginseng* root by Dr. Ahn and Kim, and author fount that the one unit of cytotoxic activity of the Panaxydol and Panaxynol against L1210 cells being equivalent to 0.26 μg and 0.39 μg, respectively.

The survival times of mice inoculated with S-180 were extended about 1.5 to 2 times by the 7 : 3 Gx treatment compared with their control group. The significantly decreased hemoglobin values of rats after inoculation with Walker 256 were recovered to normal range by oral administration of the crude Gx. The synthetic levels of protein, DNA and RNA in human colon and rectal cancer were significantly diminished by treatment with the crude Gx, which can explain a part of the origin of its anticancer activity.

Studies on Chemical Constituents Panax Seng and Structure-Activity Relationship of Anti-Arrhythmic Action of Ginsenosides

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In recent year, systematic studies on chemical constituents of the roots, rhizomes, stems, leaves, flower-buds and fruits of *Panax ginseng* cultivated in China have been carried out in onr laboratory. Forty-four compounds were isolated and identified, including thirty-five known constituents. They are ginsenoside-Rb_1 (1), -Rb_2 (2), -Rc (3), -Rd (4), -Re (5), 20 (S)-Rg_3 (6), 20 (R)-Rg_3 (7), 20 (S)-Rh_2 (8), 20 (S)-protopanaxatriol (9), 20 (R)-protopanaxatriol (10), 20 (R)-protopanaxadiol (11), 20 (S)-propanaxadiol (12), ginsenoside-Rf (13), -Rg_1 (14), 20 (S)-Rg_2 (15), 20 (R)-Rg_2 (16), 20 (S)-Rg_3 (17), 20 (R)-Rg_3 (18), 20 (S)-Rh_1 (19), 20 (R)-Rh_1 (20), panasenoside (21), panaxynol (22), kaempferol (23), trifolin (24), panasenoside (25), β-sitosterol (26), daucosterine (27), malonyl-ginsenoside-Rb_1 (28), nonaconsane (29), tripalmitin (30), lindein (31), palmitic acid (32), α,γ-di-palmitin (33), ginsenoside-Ro (34) and adnosine (35), respectively.

Nine new compounds were identified as ginsenoside-Rb_3 (36), ginsenoside-F4 (37), ginsenoside-RAo (38), ginsenoside-La (39), 20 (R)-ginsenoside-Rb_2 (40), 25-hydroxyl-protopanaxatriol (41), 25-hydroxyl-ginsenoside-Rg_2 (42), 2-methyl-4-pyranone-3-O-β-D-glucoside (43), and ginsenoglucolipid (44) by means of spectral analysis (MS, ^{1}H-NMR, ^{13}C-NMR, 2D-NMR) and chemical methods.

Anti-arrhythmic activities of the major ginsenosides were studied. The structures of ginsenosides and their anti-arrhythmic activities were proved to have structure-activity relationship as follows:

1. The relationship between structure types of aglucones and their intensities of activity: PPT type glycosides>OA type glycosides>PPD type glycosides.

2. The relationship between the number of sugar molecules and itensities of activity: glycosides with three sugars>glycosides with two sugars>glycosides with one sugars.

Ginsenoside-Re was shown to be the strongest anti-arrhythmic compounds among the saponin tested. The results showed that the anti-arrythmic action of Re was as potent as lidocaine, but its toxicity was only 1/10 of it.

A Comparative Study of Some Histological Characters, Saponin Content and Pharmacological Activities in The Wild and The Cultivated Insam (Ginseng)

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The wild Insam (Ginseng) collected from wild plants has been used in traditional medicine since 4,000 years ago. From about thousands years before the cultivation of *Panax ginseng* has been developed in our country. The cultivated Insam (Ginseng) has been commonly collected from cultivated plant of 6~7 years. The object of the study was to classify difference between the wild and the cultivated Insam (Ginseng). When the grown year the of cultivated plants increases from one year to 7 years the amount of resin canal in transverse section of main root and the saponin content of root increase. In particular, the increasing rate of saponin content of roots from 2~3 years to 3~4 years was significantly higher than that of roots from 5~6 years to 6~7 years. But a group of wood fiber with lignification was partially formed from the upper part of main roots of 4 years. Therefore, the groups of wood fiber usually existed in the upper part main roots of 6~7 years. This data was recommended to breeder and cultivater that the cultivated period of this plant should be such as to diminish from 6~7 years to 4~5 years.

We obtained the following data through several experimentation mentioned above.

Insamside-Re (Ginsenoside-Re) has remarkable cardio tonic action and it depends on the increasing of the volume of coronary circulation and the strengthening of biosynthetic of ATP, etc. Insameside-Re (Ginsenoside-Re) makes the cell metabolism vigorously and maintains the homeostasis of cell in the high level by activating the sex function and raising the safety potential of cell membrane, etc.

Influence of Maltol on the Permeability of Sheep Ghost Membranes and Liposomes Composed of Lipid Extracted from Sheep Ghost

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Maltol is a soluble extract from ginseng. Some investigators studied the effect of maltol on the

lipid peroxidation and found that it has antioxidant action as a free radical scavengers. Thus, maltol was suggested to be antiaging agent. In this paper, we have studied the effects of maltol on the fluidity and permeability of sheep ghost membranes and liposomes composed of lipid extracted from sheep ghost, by fluorescence technique. At first, ghosts were resealed in the calcein-containing solution. Calcein is a highly quenched fluorescent dye, its fluorescence will increase dramarically after leakage from inside liposomes. The ghosts or liposomes were incubated for some interval at 37℃ in the presence or absence of maltol, then the fluorescence was determined. The results were shown in Table 1.

Effect of maltol on the leakage of calcein from sheep ghosts.

Maltol/lipid (mol/mol)	0.25 : 1	0.5 : 1	1 : 1
Incubation time at 37℃	4.5 h	3.0 h	2.0 h
Leakage increase	35%	42%	20%

The effect of maltol on the leakage of calcein from liposomes composed of sheep ghost lipids was also studied. When liposomes were incubated with maltol at 37℃ for 25 hours, at molar ratio 1 : 1 of the drug to lipid, the leakage of calcein was increased 41% compared to the liposomes without incubation with the drugs.

The results mentioned above indicated obviously; (1) the presence of maltol can increase the permeability of biomembranes and artificial membranes, (2) the fact that extent for maltol to increase ghost membrane and artificial liposomes suggests that maltol interact not only with membrane lipids, membrane proteins were involved also. In order to gain insight into the action of the drug on the membrane proteins, we investigated at room temperature for a week in the presence or absence of maltol (2.0 mg/ml). The DTNB [5,5′ Dithiobis (2-nitrobenzoic acid)] was added, and the absorbances at 412 nm were determined. The results showed that the absorbance of sample in presence of maltol is lower than that in the absence of the drug. This suggests maltol may decrease the exposure of sulfhydryl group during incubation at room temperature, and thus stabilize the conformation of membrane proteins.

The Effection of "Ginseng Life Source" On Anticancer

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"Ginseng Life Source" is the tonic made of some materia medica and natural substance.

Our researches show it can prolong the living time of mice with the ascites of EAC, hepar cancer H_{22} and cervices cancer U_{14}. It not only inhibits the multiplication of sarcoma and cell of ascites cancer but also decreases the ratio of living cell/died cell and divided ratio in ascites. The results indicate the "Ginseng Life Source" inhibits the division of cancer cell to effect on anticancer.

"Ginseng Life Source" inhibits the synthesis of DNA and RNA in cancer cell but accelerates in bone marrow cell.

The immunization of the mice with cervicesis cancer is depressed. "Ginseng Life Source" can improve it. The cancer mice are fed with Ft207 of subliminal dose and "Ginseng Life Source" The significant effection of anticancer is found. "Ginseng Life Source" makes the dose of Ft207 to decrease so that

the side-effect of Ft207 is reduced. "Ginseng Life Source" decreases the relative content of SDH and LDH in cancer cell and increases it in bone marrow cell. "Ginseng Life Source" can decrease content of LDH in serum of cancer mice and make the isoenzyme spectrum of LDH to be normal. "Ginseng Life Source" not only is a effective agent of anticancer but also is a synergist with chemical therapeutic agent. It inhibits the cancer cell but doesn't damage the normal cell.

Some Biochemical Effect of Korean Ginseng

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A considerable amount of evidence which showed the beneficial effects of Korean ginseng based on more scientific concepts and methodology has been accumulated. However such multifarious pharmacological actions of Korean ginseng makes it possible to suggest some common factors through which effects of ginseng might be mediated. In this communication, the effects of ginseng saponins on prostagrandins synthesis will be presented.

The production of prostaglandins (PGE2, PGF2, TxB2, 6-keto-PGF1) from [3H]-arachidonic acid was determined with various enzyme sources such as rabbit kidney microsome, bovine arotic microsome and human platelet homogenate. The Ginseng saponins reduced the formation of TxB2, but increased the formation of 6-keto-PGF1 dose dependently. However the total amount of cyclo-oxygenase products from arachidonic acid did not show any significant changes in the presence of Ginseng saponins. And the inhibitory effect of imidazole on TxB2 production was potentiated by ginsenosides and the inhibitory effect of tranylcypromine on production of 6-keto PGF1 was almost completely reversed by ginsenosides. These results suggest that the Ginseng saponins affect the PG synthesis in the divergent biosynthetic pathways of prostaglandins from endoperoxide.

The Effect of The Volatile Oil of The Ginseng on The Tumor Cells

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The volatile oil of the ginseng (GVO) were extracted by Jilin university from the parts of ginseng growthing above the earth's surface (stem, leaves and flower bud). The compounds were determined by the analytical method of GC/MS and most of them are sesqeterpenes. We made the research of GVO on the antitumor effect, via two paths *in vivo* and *in vitro*. No research in this field has so far been reported in the world. The GVO are waste materials of ginseng and its value is very cheap, it can be made into perfume or medicine. The comprehensive utilization of ginseng has both practical value and economic significance. The SGC-803 gastric carcinoma cells and murine liver carcinoma

ascites cells *in vitro* were treated with GVO (5.5 μg/m*l* and 11 μg/m*l*). The growth of the cancer cells was inhibited. The numbers of the dead cells increased. $^{14}CO_2$ radiation intensity of the cancer cells declined determining with liquid scintillation. The cancer morphology had been remarkably damaged with phase contrast microscopy and fluorescence microscopy, however nearly no damage in normal fibroblasts. The contents of the cytochemical components (PAS, SDH, DNA) in single cell were decreased by means of measurement with microspectrophotometer and the morphology displayed by cytochemistry stain had been injuried obviously. Inject GVO (2 mg, 5 mg, 6.6 mg, 7.8 mg, 8.8 mg, 13.2 mg and 19.8 mg) into the abdominal carities of S-180 and EAC ascitic cancer mice, once per day for 2.5 or 10 days. Oral administration GVO (0.5 g/kg and 1 g/kg), once per day for 10 days. There was also a group of the combination of chinese traditional and western medicine (cytoxan 40 mg/kg), once every second day, 5 times in all. In control group the normal saline would be given. The experimental results suggested: between 8.8 mg and 19.8 mg the animals didn't like moving or eating very much and would die among the first to the fourth day. In the 5 mg and 7.5 mg group there was also certain toxicity. 2 mg-test-group, the numbers of living animals increased, the living time was longer and T/C reached to 115%. In oral adminastration experimental (GVO test group), the activation and spirit in animals were better than those of the control group. The ascitic content decreased, especially in chinese traditional and western medicine group. The other indexes didn't change obviously. This study discussed the mechanisms of antitumor action of GVO. In might be the result of composite factors; the main composition sesqueterpenes inhibited the metabolism of nucleic acid, glucose and enzyme, etc. in the cancer cells and the activation of the cancer cells was declined and the cancer's growth became slower and this drug also had the effect of killing cells directly. We would go on researching into this subject in the further.

Effects of *Panax ginseng* (Kaesong) on the Major Endocrine Glands

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Since an efficacious component was seperated from *Panax ginseng* in 1854, numerous data have been accumulated on its ingredients and efficiences including effects on the endocrine glands.

Still, we have been as yet unable to find any data on its effects on the endocrine glands aged different years. Under such situation, we gave pulverized ginseng in the dose of 0.8 g per weight (kg) to rats of different month ages (prepuberty, maturity, agedness), the method of administration being that the pills kneated from pulverized ginseng with wheat flour were given before morning feed once a day. After ginseng was given for 1, 2, 3 and 7 days, we observed the number and morphology of thyroid-stimulating cells in the hypophysis: the number of follicles, morphology of follicular epithelia, dyeing degree of the collid in the thyroid gland: the state of distribution of graunles of Vitamin C, and situation of siunsoids in the adrenal gland.

The results are as follows: The functional enhancement of thyroid-stimulating cells in the anterior lobe of hypophysis expressed by increase in the number, enlargement in size, diminution in the number and dyeing degree of secretory granules was more readily revealed according as animals are younger. The functional enhancement of thyroid gland indicated by increase in the number of thyroid follicles, modification of ollicular epithelial cells, diminution of colloid and its dyeability began to be recognizable

already on the day after one-day feed, and were most noticeable on the day after three-days feed in younger animals, while it began to on the day after three-days feed and were most pronounced on the day after seven-days feed in more aged animals. The functional enhancement of adrenal conted shown by diminution of granules of vitamin C and enlargement of sinusoids is more rapidly manifested according as animals are younger, and is more slowly manifested according as they are more aged.

The Effect of Ginseng Saponins on cAMP and cGMP in Plasma and Liver's Kupffer Cells

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Many scholars think that cAMP and cGMP are closely related to syndromes of traditional Chinese medical science. We use traditional Chinese medicine of anti-"YAn Xu" and Ginseng Saponins to treat "Yang Xu" rats at the same time. As a result it shows that both of them can obviously improve cAMP of "yang Xu" rats and CA/CG is going up. Pathology reactions prove that Ginseng Saponins can effectively increase quantities of Liver's Kupffer cells of "yang Xu" rats.

Studies on The Transforming Mechanism of Amino Acid Components in The Course of Ginseng Processing

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The transforming mechanism of amino acid components in the course of ginseng processing is reported. And the structure of some new compounds formed in the course of ginseng processing is identified through spectrum analysis. The amino acid components in fresh ginseng take the following chemical changes during drying and steam heating:

1. Glutamic and pyroglutamic acid, all contained in fresh ginseng, have a relationship of decrease and increase in different ginseng product, when fresh ginseng is processed for dried and Dail ginseng (processed with the method of being soaked in boiling water for about 5 minutes and then dried), the content of pyoglutamic acid decreases and that of glutamic acid increases slightly. When red ginseng is prepared from fresh ginseng, the content of glutamic acid decreases and that of pyroglutamic acid increases. The transformation of pyroglutamic acid from glutamic acid is carried out successively under the thermo-conditions of red ginseng processed. But when the water solution of purified pyrolutamic acid is placed for a long time under a moist conditions, pyroglutamic acid dehydrates into glutamic acid. These results all certify that the difference of ginseng processing skill can determine the direction of two-reaction-way of pyroglutamic and glutamic acid.

2. Dencichine contains highly in fresh ginseng. In the course of heating and drying for preparation of red ginseng, it is degradated to be 2,3-diamino-propylaldehyde carboxylic acid. Thus the toxicity of red ginseng decreases.

3. In the course of red processing, the other amino acid omponents in fresh ginseng parly take Maillard reaction with maltose to produce Amadori compound. After dehydrating and molecular rearrangement, maltol and its sapogenin derivatives are formed.

The Role of Ginseng Drying in The Harvest and Post-Harvest Production System for American Ginseng

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American ginseng (*Panax quinquefolium* L.) is a prized horicultural crop that is widely used in Asia Pacific countries for medicinal and pharmaceutical purpose. As a consequence of the value of the American ginseng root, production in North America has now expanded well beyond the native range of the plant in eastern North America. Over the past ten years, a ginseng industry has begun in the province of British Columbia, Canada and the interest in the crop and the area under planting has grown very rapidly.

With this rapid technological expansion and industry development in British Columbia (in a period less than ten years compared to the eastern North America industry age of approximately one hyndred years), attention is now moving away from field production issues and more emphasis is being directed to enhancements in American ginseng drying, storage and processing. There is a dearth of knowledge on these aspects even though they are crucial to market share and international competitiveness, it has been recognized, that as a consequence of the international marketplace and its associated competition, mechanization will play a key role in the reduction of production costs. Further, efforts to improve mechanization dictates the application of a systems approach to improve the efficiency of the harvest and post-harvest production system. This system includes crop digging, pre-washing cold storage, washing, drying and post-drying storage. The research to date has focussed on drying and storage issues and has resulted in the design of a new dryer system for ginseng.

As commercial dryers are unsuitable for detailed research investigation, four scale model research dryers were built and operated for research purposes. The results are applicable to a wide range of dryer designs. The research dryers were used to examine the role of dryer management (using size sorted and unsorted root), dryer loading rates, dryer airflow rates and pre-drying cold storage on ginseng drying rates and ginseng root quality. From the dryer management experiment, there are distinct advantage to size sorting root. With the largest root closest to the heating source in the dryer, each tray in the dryer is found to dry at a similar rate. If unsorted root is used in the dryer, efficiency is increased if the trays are rotated rather than left in fixed positions. The loading rate experiment clearly illustrates that increased loading rates above those currently used in commercial dryers are possible without a sacrifice in quality, in the experiments, the maximum loading rates were not reached. This has significant implications on the potential efficiency of commercial dryers to increase their loading rates without quality sacrifice provided dryer design and management factors are properly addressed. There is some evidence that a minor reduction in drying time is possible with increased airflow rates. This may prove to be more significant as loading rates are further increased. Pre-drying cold storage is a most significant tool for the producer for managing dryer operations. Over a period

of six weeks, no discernable decrease in quality was found as a consequence of cold storage. Further, the moisture loss and the associated root surface changes (loss of surface soil in storage for example) provide new challenges for root quality management.

Studies on the Transforming Mechanism of Pyroglutamic Acid in the Course of Ginseng Processing

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1. Pyroglutamic acid was first extracted, isolated and identified from Chinese red ginseng with a different advanced technique from the data that foreign researchers had reported, and its some chemical characters were also studied.

2. It was found with improved liquid chromatography that fresh, white, Dali ginseng (Prepared with fresh ginseng being soaked in boiling water for 5 minutes or so and then dried) and red ginseng contained a different quantity of pyroglutamic acid. The result showed that the content of pyroglutamic acid in fresh ginseng was the highest and the order of the contents in various processed ginseng products from high to low was: red ginseng>Dali ginseng>white ginseng, the order of that in different parts of red ginseng was: fine root>rhizome>lateral root>principal root. The content of pyroglutamic acid in red ginseng completely with fine root was also higher than that without lateral and fine root.

3. With the method of quantity analysis *in vivo* and chemical transformation *in vitro* combined to reveal the transforming mechanism of glutamic and pyroglutamic acid in the course of ginseng processing. As the fresh ginseng was processed, pyroglutamic acid was hydrated into glutamic acid largely. In the course of red ginseng was prepared, glutamic acid was cyclodehydrated into pyroglutamic acid, it was easy for pyroglutamic acid to take a reaction of ring openning and difficult for glutamic acid to cycle. During ginseng processing, these were transformed in two reverse direction, the thermal conditions of the processing determined the direction of the transformation, and the time of steam heating determined the quantity of pyroglutamic acid content in processed ginseng.

Influence of Technical Parameters of Steaming Ginseng on Quality of Red Ginseng Production

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Technical Parameters of steaming Ginseng: Temperature inter pressure, speed of dropping temperature pH value, containing moisture in it, Cellulose content Surface condition and so on, decide Quality of red Ginseng production.

Influence of steaming Ginseng on Colour: When other condition is not Changed, changing temperature, measuring red Ginseng Colour, obtained figure as following:

Temperature

The colour of the Ginseng is deeper with increasing of the steaming temperature. The colour of Ginseng change from brown red to black when the temperature T>105℃. When T<90℃, the colour change to light pink. The influence of temperature on colour is very sensitive.

On the increase of containing moisture in fresh Ginseng, steaming temperature also should increase. Steaming temperature should increase 1℃, every increasing 2%, moisture in it.

Experiment indicated steaming temperature should increase 1℃, every increasing 2% content of cellulose in Ginseng.

Steaming Ginseng Pressure has important influence on quality of red Ginseng, When pressure is increased, the red Ginseng sensitivity decreased Pressure is decreased the of yellow skin increased.

pH value has also important influence on quality, when pH<6, the colour of red Ginseng is bright less, light sweet smell, and cellulose is broken, when pH=7 or a little>7, the red Ginseng had well quality, that has luster, thick sweet so on. Simultaneously, can decrease remaining poison of agriculture drugs, nitric acid radical and sub nitric acid radical and sub nitric acid radical.

Far-Infrared Drying Method with Negative Pressure of Ginseng

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The drying purpose of Ginseng is to remove surplus moisture in it. Ability of the molecules-H_2O absorbing infrared ray is strong, in 0.25～2.5 μ, 2.5～4 μ, 5～8 μ spectra ranges. In 4.6～6.5 μ, 7～8 μ ranges, it is agreed with water molecules absorbing bands. We think a common heating source for steaming and drying Ginseng is economical.

Using superficial temperature of the heater is about (100°～130°) C. Wavelength of emitting peak Value λ_{max} is 7.2 μm. Spectral energy distribution of the grey-body is given by Plank law.

Infrared emissions nearby λ_{max} is absorbed by superficial water molecule of the Ginseng, that is matching absorption. Infrared emission in other regions enters into Ginseng tissue, and water molecules in the absorptive all energy is larger than matching absorption. It is very advantageous to dry inside of Ginseng and for it's gelatins, reaching same drying speed inside and outside. Such dried Ginseng, surface has not trench, is bright, and emerged translucent.

The purpose of using negative pressure can produce pressure gradient from inside to surface in Ginseng, Lifting drying efficiency, Particularly, when containing moisture in Ginseng approaches the standard of the production, the effect negative pressure is very obvious.

We designed an infrared emission source, area 8×2. 5 M^2, irradiance homogeneity>95%, used to in producing.

The Manufacture of Jilin Dali Ginseng

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"Jilin Dali Ginseng" is produced through the latest technology. The technology different from the others lies in changing the method of boiling in water into that of steaning in a steamer. The remarkable effect of ginseng being produced in this way depends on the temperature, time and presure in the steamer, and the time and pressure depends on the temperature.

The thesis details the selection of raw material, the operating process and parameter of steaming, drying and drying in the sun, and also compares the various medicinal elements and the content of JIlin Dali Ginseng and Japanese Ginseng. The quality of Jilin Dali Ginseng is better than that of the traditional ginseng. Labour productivity is increased and the production cost is reduced. Besides, Jilin Dali Ginseng can also be produced by machine.

Content Change of Saponins and All Sugar After Fresh Ginseng Processing

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**The First Ginseng Processing Plant Jing Yu Countary JiLin Province*

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The content of saponins and all sugar were analysed comparativey in fresh ginseng and dried ginseng and red ginseng from the same producing area and same grade. The results showed that the contents of saponins and all sugar had taken place change and come down, the contents of monosaccharides and oligosaccharides were rising, but the contents of polysaccharides were down after fresh ginseng were processed into dried ginseng and red ginseng. This thesis analysed comparatively the these cause of change.

Studies of The Original Group of Panax on Chemical and Numerical Taxonomy

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Through our systematic investigation on the chemical components in panax original group (*Panax ginseng, Panax quinquefolium* and *Panax notoginseng*) and summarization of recent research advance in the chemistry of panax plants, we defined the interspecies characteristic components and pointed for the first time the characteristic component group for the original group with the theory and methods of plant chemical taxonomy.

According to plant biochemical metabolic theory, we explained the biochemical pathways of the characteristic components and determined their initiation and progression.

We carried out the cladistic classification on the original group of panax and discussed the evolutionary relationship with the applying of the maximum synchronous methods in the chemical and numerical Taxonomy and the synthesizing the plant morphological, anatomical, geological, and cytological cha-

racters.

1. The Original Panax group has coexisting characteristic chemical components: (1) Non-protein amino acid-dencichine; (2) Abnormal organic acid-o-benzene dicarboxylic acid. (3) Mainly contant of sesquiterpenes in the volatile oils-coexisting 5 types of sesqiterpenes, namely elemenes, cadinenes, gurjunenes, muurolenes and guaienes. (4) Mainly contant of tetracyclic triterpene saponines-coexisting ginsenoside-Rb_1, -Rb_2, -Rb_3, -Rc, -Re, -Rg_1, -Rg_2, -Rg_3, -Rh_1, and malonyl-ginsenoside-Rb_1.

2. 14 generally recognized characters relating to evolution were selected and the cladistic classification was operated. According to the maximum syncoefficients, the cladogram of the Original Panax Group was established. *Panax ginseng* and *Panax notoginseng* have the closest common forebear, CTU4. *Panax ginseng* evolved 3 steps at characters of No. 1 (stiplus), No. 9 (micromolecule short-chain (C_6～C_{10}) fatty acid and No. 14 (oleanic acid-type saponines) while *Panax notoginseng* evolved 6 steps at No. 2 (mode of stylus), No. 3 (mode of flower composition), No. 4 (distribution of bristle on leaf vein), No. 8 (distribution of sealevel), No. 11 (chain sesqueterpenes) and No. 13 (contant of Panaxatriol saponines). *Panax quinquefolium* and the initiative ginseng (CTU4) had the same forebear (CTU5). *Panax quinquifolium* evolved further at No. 1 and No. 14.

On Panax Origin and Evolution

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Panax is a small genus in Araliaceae. Its discontinuous, intercontinental distribution indicated its ancidentness. On the basis of the plate theory of the earth and the data of the earth history, the origin time of Panax should not be in Third period and should lately be in Cretaceous period, and the origin place of Panax should be on the ancient land of north China in the east parts of *Laurasia ancient* land. The Panax plants continuously spread in the suitable growth place on *Laurasia ancient* land and then got into North America before its separating from *Laurasia ancient* land. It is impossible that Panax plants in North America and Asia spread across the land bridge on the Bering channel. Panax plants have few species because of their genetic conservatism. The formation of the genetic conservation is due to the following causes: the aspects of ecology, of the growth of Panax plants, on hiche, of intermittent differentiation, and of often cross-pollination. the species evolution of Panax results from the genetic accumulation of divergence, adaption, and natural selection. And the genetic accumulation resulted from the geographic isolation caused by the earth plate movement, topographic features change, transgression, etc. and the adaptation and natural selection emerged in the course of the habitat move caused by climatic zone move. *Panax quinquefolium* and *P. trifolium* evolved in North America, *Panax ginseng, P. zingiberensis, P. pseudo-ginseng, P. pseudo-ginseng* var. *notoginseng, P. pseudo-ginseng* var. *bipinnatifidus, P. pseudo-ginseng* var. *japonicus*, etc. evolved in Asia. Man activities also exert a great influence on the distribution and evolution of Panax plants.

The Historical Process of Ginseng Farming in China

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The cultivation of ginseng (*Panax ginseng*) in China began with 2rd-4th centuries. The earliest ginseng garden was 'Nan Ji Yuan' of Zi-Tuan mountain in Shang-dang.

The main cultivation pattern of the ginseng before the Ming dynasty was transplanting wild ginseng. At first, the wild ginseng was transplanted to one place to carry out artificial cultivation without destroying its ecological environment in the primeval forest. The medicinal herbs gardens run by the authorities rose in the Sui-Tang dynasties, the ginseng cultivation was moved from the forest to the herbs gardness.

There was the record on reproducting the ginseng by seeds in the Ming dynasty.

Up to the Qing dynasty, the economic activities of the ginseng in China were transferred to the Northeast. There was transplanting wild ginseng seedlings in the early part of the Qing dynasty. The Qing government always adopted a policy of strictly forbiding the transplant of the wild ginseng seedlings in order to ensure the quality of the authorities-run ginsengs. Up to the 7th year of Guang Xu (in 1881), the Qing government declared a relaxation of the transplanting wild ginseng seedlings and levied a tax on the ginseng as on other herbs. Thus, the ban of binding the ginseng farming for more than 200 years was thoroughly lifted.

The ginseng seed-reproduction which was a little later than the transplanting wild ginseng seedlings made the ginseng farming in China get into a new stage. The cultivated area of the ginseng was gradually enlarged; up to the 23rd year of Jia Qing in the Qing dynasty (in 1818), Tou-Dao-Gou of Jilin province, etc. had three larger ginseng farms. The late period of Guang Xu, the authorities-run and industry-commerce capital invested ginseng farming emerged in Jilin province, and at the time there were ginseng farms managed by the local authorities in Dun-hua County.

In the period of the Republic of China, the ginseng farming had a quite rapid development. The ginseng yield in the Northeast was up to more than 750 thousand kilograms in 1929.

In the period of Japanese invading and occupying, the ginseng farms in the Northeast suffered from serious wreck. In 1948, the ginseng yield in the Northeast was less than 14 thousand kilograms.

In the modern times, the ginseng farming in China has rapidly developed, and the cultivation area of ginseng and its total yield have all occupied first place in the world.

The Histrical Outline of Chinese Medicinal Ginseng

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This article demonstrates that China is the first country of applying ginseng throughout the world according to Chinese medical literature. By means of surveying of areas distribution we identified the main areas of Chinese ginseng production during various periods, It was in Ji Zhou, Tan Zhou, Qi Zhou, Wei Zhou, Xin Zhou, Liao Zhou, Bing Zhou etc.; it has been in the Nouth of Hebei province, Liaoning province, Jilin province and the East of Heilongjiang province during modern times, The author uses the names as marks to discribe the districted graph of places of production of Chinese ginseng from Tang to Qing Dynasty and proposes that the first producers of ginseng throughout the world during ancient times are both China and Korea.

By means of analysing the formulations contained ginseng on "Treatise on Exogenous Febrile Diseases", "Thousand Golden Prescription for Emergencies", "Supplement to Thousand Golden Prescription",

"Newly Revised Canon of Materia-Tang", "Chong Xiou Zheng He Jieng Shi Zheng Lei Bei Yong Ben Chao", "Effective Prescription for Generations", "Compendium of Materia Medica", "Supplement to Coperdium of Materia Medica" and "Chinese Medical Science Dictionary" (preparation fraction), we demonstrate the long history and the general laws of clinical application on Chinese application of ginseng.

This article sharply criticizes the falsity that the Shang tang ginseng is Radix Codonopsis Pilosula and criticizes the doubt about the *Panax ginseng* C.A. Meyer of Chinese applicated during ancient times is not real ginseng of Araliaceae.

The Research of the Medical History of Ginseng

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It is acknowledged by all the world that China is the birthplace of ginseng. But people have different opinions on the time of the medical history of ginseng: According to my study on the inscriptions on the bronze ware, I consider that the medical history of ginseng is more than 3000 years. The following four characters in the first figure can prove this.

The first symbol in the first figure is a toten. Except the two arrows, the other part of it indicates a container for hunting arrows. Later the symbol developed into the character "服".

The sencond character in the first figure is the character "  ". I consider it a pictorgraphic character. The horizontal stroke in the middle is the surface of the ground: the upper part of it is the seeds of ginseng and the lower part of it is root. It is the main body of a ginseng with a man shape. The ancient people thought that the ginseng with a man shape was the best one. There are many records in aicient bookds.

Some variant forms of "" in the inscriptions on the bronze ware is without the horizontal stroke, and there is "  " in front of some of them, as in figure two. "" can be explained as the fibrous roots. The ancient Chinese thought that "" (three) was a large number. The predecescors thought that "" was the shape of shining rays. But it is not proper, because man is not a shining object. In fact, the character, "" is a pictographic character which shows the object with the shape, just like a fossil.

Existence decides consciousness. If there was the pictograph character "", there must existed the real Jinseng. The third and the forth characters in the firsl figure is a person's name in Shang Dinasly. So we can see that the Chinese people started to use ginseng in Yinshang times 3000 years ago.