Analysis of Application Cases of Ginseng Extract

Ginseng extract is a natural extract prepared from ginseng (Panax ginseng C. A. Mey.) from authentic producing areas such as Changbai Mountain, using modern extraction, separation and purification technologies (supercritical CO_2 extraction, bio-enzyme conversion, etc.), with ginsenosides, ginseng polysaccharides and ginseng peptides as the core active components. Its applications cover four major fields: medicine, health products, cosmetics and functional foods. Its core value stems from clear mechanism of action, sufficient evidence-based data and standardized production processes. This article first systematically analyzes its core mechanism of action, then combines typical cases in various fields, taking into account professionalism, systematicness and logic, and adopts segmented expression to improve reading experience.

Part 1: Core Mechanism of Action of Ginseng Extract

The core of the biological activity of ginseng extract lies in the synergistic effect of various active components it contains, among which ginsenosides (accounting for 3%-15% of the total extract), ginseng polysaccharides (5%-20%) and ginseng peptides (1%-5%) are the three core components. Each component has a clear mechanism of action and clear targets, which have been verified by in vitro cell experiments, animal experiments and clinical trials. The specific segmented analysis is as follows:

I. Ginsenosides: Core Active Components with Multi-Target Regulation of Physiological Functions

Ginsenosides are the most representative active components in ginseng extract. More than 80 subtypes (such as Rg1, Rb1, Rg3, Rh2, Compound K, etc.) have been isolated and identified. Different subtypes have significant differences in targets and synergistically exert multi-dimensional physiological effects. The core mechanisms and data are as follows:

1. Immune Regulation Mechanism

The core targets are NK cells, macrophages, T lymphocyte subsets ($CD4^+$, $CD8^+$) and cytokines (IL-2, IL-6, TNF-α), which mainly improve the state of immune deficiency by activating innate immunity and adaptive immunity.

In vitro experiments have confirmed that treating macrophages with 100μg/mL ginsenoside Rg1 for 48h can increase the phagocytosis rate of

macrophages by 58.3% and the secretion of TNF-α by 42.7%; clinical data show that oral administration of ginsenoside Rh2 (16.2% purity) for 30 days can increase the $CD4^+/CD8^+$ ratio of immunocompromised people from 0.87 to 1.23, close to the level of healthy people (1.2-1.8), and the content of immunoglobulin IgG is increased by 28.6%.

2. Anti-Inflammatory and Antioxidant Mechanisms

The main anti-inflammatory target is the NF-κB signaling pathway, which relieves chronic inflammation by inhibiting the release of inflammatory factors; the antioxidant effect mainly relies on scavenging free radicals and activating the antioxidant enzyme system to reduce oxidative stress damage.

Cell experiments show that ginsenoside Rd (50μg/mL) can inhibit the inflammatory response of RAW264.7 cells induced by lipopolysaccharide (LPS), reduce the secretion of IL-6 by 63.2% and the expression of NF-κB protein by 51.8%; in vivo experiments show that the compound ginsenoside extract (Rg1+Rb1) can increase the activity of SOD (superoxide dismutase) in the liver of aging mice by 39.4%, reduce the content of MDA (malondialdehyde) by 45.1%, and significantly reduce oxidative stress damage.

3. Adjuvant Anti-Tumor Mechanism

The core effects are inhibiting tumor proliferation, inducing tumor cell apoptosis, inhibiting tumor angiogenesis, and reversing tumor multidrug resistance. The main targets are VEGF (vascular endothelial growth factor), Bcl-2/Bax apoptosis pathway and P-gp protein.

In vitro cell experiments: Ginsenoside Rg3 (20μg/mL) has an inhibition rate of 61.3% on lung cancer A549 cells, which can reduce the expression of VEGF mRNA by 72.5% and inhibit tumor angiogenesis; treatment of liver cancer HepG2 cells with ginsenoside Rh2 (15μg/mL) for 72h results in an apoptosis rate of 48.7% and a 3.2-fold increase in the Bax/Bcl-2 ratio, significantly inducing tumor cell apoptosis; clinical data show that the combination of Rg3 and chemotherapy can reverse multidrug resistance, and the effective rate of chemotherapy is increased by more than 30%.

4. Cardiovascular and Cerebrovascular Protection Mechanism

It mainly expands blood vessels, improves myocardial ischemia, resists arrhythmia and protects vascular endothelium. The core targets are NO (nitric oxide) synthase, Ca^{2+} channels and vascular endothelial cells (VEC).

Animal experiments have confirmed that intravenous injection of ginsenoside Rg1 (10mg/kg) can increase the coronary blood flow of rats by

42.8% and reduce the myocardial ischemic area by 37.6%; clinical data show that oral administration of ginsenoside Rb1 (50mg per day) for 8 weeks can reduce the frequency of angina pectoris in patients with coronary heart disease by 65.0%, increase the NO content by 38.2%, and significantly improve vascular endothelial function.

5. Neuroprotective and Cognitive Improvement Mechanism

It inhibits neuronal apoptosis, promotes neurogenesis, improves synaptic plasticity, and reduces β-amyloid deposition. The targets are hippocampal neurons, Aβ protein and synaptic associated protein (SYP).

Animal experiments: Intragastric administration of ginsenoside Rb1 (20mg/kg) for 6 weeks can increase the expression of SYP protein in the hippocampus of AD model mice by 52.3% and reduce the deposition of $A\beta_{1-42}$ by 49.8%; clinical verification shows that after 6 months of taking Rb1 extract, the Mini-Mental State Examination (MMSE) score of patients with early AD is increased by 12.0%, and the error rate of memory test is decreased by 42.0%.

II. Ginseng Polysaccharides: Auxiliary Active Components for Enhancing Immunity and Metabolic Regulation

Ginseng polysaccharides are water-soluble components mainly composed of monosaccharides such as glucose, galactose and arabinose. Their core effects focus on immune regulation, hematopoietic function protection and glycolipid metabolic regulation. The mechanisms and data are as follows:

1. Immune Enhancement:

Ginseng polysaccharides (concentration 200μg/mL) can activate the activity of NK cells, increase their killing rate by 67.2%, and promote the proliferation of T lymphocytes, increasing the proportion of $CD4^+$T cells by 35.0%, which is suitable for people with immunodeficiency and chronic inflammation;

2. Hematopoietic Protection:

Animal experiments show that intragastric administration of ginseng polysaccharides (50mg/kg) can increase the proliferation rate of bone marrow hematopoietic stem cells in mice with chemoradiotherapy-induced damage by 58.5%, and increase the number of white blood cells from 2.3×10^9/L to 4.8×10^9/L, significantly reducing the side effect of hematopoietic suppression caused by chemoradiotherapy;

3. Glycolipid Regulation:

Clinical data show that oral administration of ginseng polysaccharides (100mg per day) for 12 weeks can reduce the fasting blood glucose of patients with type 2 diabetes by 18.3%, triglyceride (TG) by 22.7%, and increase insulin sensitivity by 31.5%.

III. Ginseng Peptides: Small-Molecule Active Components with High Absorption and Functional Supplement

Ginseng peptides are small-molecule peptides (molecular weight <1000Da) prepared by enzymatic hydrolysis, with an absorption rate of more than 90% (much higher than ginsenosides and polysaccharides). Their core functions are nutritional supplement, anti-fatigue and tissue repair. The mechanisms are as follows:

1. Anti-Fatigue:

Ginseng peptides can activate mitochondrial ATP synthase, increase cell energy supply efficiency by 18.0%, and enhance the activity of lactate dehydrogenase, reducing the content of blood lactic acid after exercise by 27.0%, thus relieving physical and mental fatigue;

2. Tissue Repair:

Small-molecule peptides can be directly absorbed by cells, promote the proliferation of skin fibroblasts and hepatocytes, and accelerate wound healing and postoperative recovery. In vitro experiments show that ginseng peptides (100μg/mL) can increase the proliferation rate of fibroblasts by 45.3%;

3. Nutritional Supplement:

It contains essential amino acids (such as lysine and leucine), which can supplement body nutrition and improve the state of malnutrition and postoperative debility. It can be absorbed by the intestines 15 minutes after oral administration, with a bioavailability of more than 92%.

IV. Synergistic Mechanism of Components

The overall activity of ginseng extract is not the effect of a single component, but the synergistic effect of the three core components: ginsenosides dominate multi-target physiological regulation, ginseng polysaccharides enhance immunity and hematopoietic protection, and ginseng peptides improve absorption efficiency and supplement nutrition. The synergistic effect of the three can increase the overall activity

by 30%-50%. For example: the combination of ginsenoside Rg3 and ginseng polysaccharides can increase the tumor inhibition rate from 61.3% to 78.5%; the combination of ginsenoside Rg1 and ginseng peptides can increase the anti-fatigue effect by 42.0%, which is significantly better than a single component.

Part 2: Analysis of Application Cases of Ginseng Extract in Various Fields (Combined with Mechanism + Accurate Data)

Based on the above core mechanisms of action, ginseng extract has formed large-scale and standardized applications in four major fields: medicine, health products, cosmetics and functional foods. The following combines typical cases to analyze its application scenarios, product development, mechanism implementation and clinical/market effects, highlighting professionalism and practicality.

I. Pharmaceutical Field: Precision Targeting and Clinical Evidence (Core Dependent on Ginsenosides + Polysaccharides)

Applications in the pharmaceutical field are mainly high-purity single-component or compound preparations, focusing on three directions: adjuvant tumor therapy, cardiovascular and cerebrovascular first aid, and immune regulation. They strictly follow the national drug approval standards, with sufficient clinical data and clear mechanisms.

1. Adjuvant Anti-Tumor Therapy: Ginsenoside Rg3/Rh2 Preparations

▲ Core Basis:

The synergistic effect of ginsenoside Rg3 (inhibiting tumor angiogenesis and reversing multidrug resistance) and Rh2 (inducing tumor cell apoptosis and enhancing immunity), combined with ginseng polysaccharides to strengthen immune reconstruction and reduce the toxic and side effects of chemoradiotherapy.

▲ Typical Case 1: Shenyi Capsules

⊙ Core Components: 20(R)-ginsenoside Rg3 (single active component), purity ⩾95%, containing 10mg Rg3 per capsule;

⊙ Application Scenarios: Adjuvant treatment of radiotherapy and chemotherapy for primary lung cancer and liver cancer, included in the national medical insurance catalog;

⊙ Clinical Data: Combined with chemotherapy in the treatment of advanced lung cancer, the median survival period was extended from 8.2

months to 10.5 months (an extension of 2.3 months), the Karnofsky Performance Status (KPS) score was increased from 65 to 91 (an increase of 40%), and the incidence of chemotherapy-induced nausea and vomiting was reduced by 58.7%;

⊙ Mechanism Implementation: By inhibiting the VEGF pathway, it reduces tumor angiogenesis, activates the activity of NK cells to enhance the body's anti-tumor immunity, reverses the multidrug resistance of chemotherapeutic drugs, and achieves the triple effects of "tumor inhibition + toxicity reduction + efficacy enhancement".

▲ Typical Case 2: Jinxing Capsules

⊙ Core Components: High-purity ginsenoside Rh2 (≥16.2%), combined with a small amount of ginseng polysaccharides (5%);

⊙ Application Scenarios: Postoperative recovery of tumor patients, immune protection during radiotherapy and chemotherapy, relieving side effects such as leukopenia and fatigue caused by radiotherapy and chemotherapy;

⊙ Clinical Data: After 30 days of administration to chemotherapy patients, the average number of white blood cells increased by 2.1×10^9/L, the incidence of leukopenia decreased from 78.3% to 26.3% (a decrease of 52%), and the contents of immunoglobulins IgA and IgG increased by 28.0% and 31.5% respectively;

⊙ Mechanism Implementation: Rh2 directly induces tumor cell apoptosis, and ginseng polysaccharides activate macrophages and T lymphocytes, synergistically improving immunodeficiency caused by chemoradiotherapy and reducing the risk of infection.

2. Cardiovascular and Cerebrovascular First Aid and Chronic Disease Management: Shenfu Injection / Shenmai Injection

▲ Core Basis: The synergistic effect of ginsenosides Rg1/Rb1 (dilating blood vessels, improving myocardial ischemia, resisting arrhythmia) and ginseng polysaccharides (protecting vascular endothelium, regulating blood pressure), combined with other traditional Chinese medicine extracts to strengthen the effects of first aid and chronic disease conditioning.

▲ Typical Case 1: Shenfu Injection

⊙ Core Components: Red ginseng extract (total content of Rg1 and Rb1 ≥0.8mg/mL) + Aconite extract, a benchmark of traditional Chinese medicine injections;

⊙ Application Scenarios: First aid for cardiogenic shock, acute heart failure and hypotension, an essential drug for traditional Chinese medicine emergency;

⊙ Clinical Data: In the treatment of cardiogenic shock, the 24-hour effective rate was 89.7%, the mean arterial pressure increased from 52mmHg to 78mmHg, and myocardial contractility was significantly enhanced (left ventricular ejection fraction increased by 23.5%);

⊙ Mechanism Implementation: Rg1/Rb1 dilates coronary arteries, increases myocardial blood supply, inhibits Ca^{2+} overload and resists arrhythmia; ginseng polysaccharides protect vascular endothelial cells, reduce vascular damage, and synergistically maintain blood pressure stability to save the lives of critically ill patients.

▲ Typical Case 2: Shenmai Injection

⊙ Core Components: Red ginseng extract (Rg1+Rb1 ⩾0.6mg/mL) + Ophiopogon japonicus extract;

⊙ Application Scenarios: Adjuvant treatment of coronary heart disease, viral myocarditis and shock, improving myocardial ischemia and cardiac function;

⊙ Clinical Data: Combined with western medicine in the treatment of coronary heart disease angina pectoris, the attack frequency decreased from 5.8 times per week to 2.0 times (a decrease of 65%), the dosage of nitroglycerin decreased by 68.3%, and the improvement rate of ECG ST segment depression reached 72.5%;

⊙ Mechanism Implementation: Rg1 dilates blood vessels, improves myocardial ischemia and reduces myocardial oxygen consumption; ginseng polysaccharides regulate blood lipids, protect vascular endothelium, delay the progression of atherosclerosis, and long-term use can reduce the recurrence risk of cardiovascular and cerebrovascular events.

3. Immune Regulation and Inflammation Control: Ginseng Polysaccharide Injection, Compound Ginseng Immune Capsules

▲ Core Basis: The synergistic effect of ginseng polysaccharides (activating immune cells, inhibiting inflammatory factors) and ginsenoside Rd (anti-inflammatory, balancing immune response), focusing on immune reconstruction and chronic inflammation conditioning.

▲ Typical Products: Ginseng Polysaccharide Injection (National Drug Approval H22025759), Compound Ginseng Immune Capsules;

▲ Application Scenarios: Immune reconstruction after tumor chemoradiotherapy, adjuvant treatment of chronic hepatitis and autoimmune diseases (such as rheumatoid arthritis);

▲ Clinical Data: After postoperative use of ginseng polysaccharide injection in tumor patients, the levels of immunoglobulins IgG and IgA increased by 28% and 32% respectively, and the infection risk decreased from 58% to 18% (a decrease of 40%); after 3 months of administration

to patients with chronic hepatitis, the liver function indicators ALT and AST decreased by 45.3% and 41.7% respectively;

⊙ Mechanism Implementation: Ginseng polysaccharides activate NK cells and macrophages, increase the $CD4^+/CD8^+$ ratio, and reconstruct the body's immune function; ginsenoside Rd inhibits the release of inflammatory factors such as IL-6 and TNF-α, balances the immune response, and reduces chronic inflammatory damage.

II. Health Product Field: Functional Segmentation and Scenario-Based Coverage (Dependent on Synergistic Effect of All Components)

The health product field is mainly composed of compound extracts, focusing on three scenarios: anti-fatigue, cognitive improvement and qi-blood conditioning, which are suitable for daily nourishment needs, taking into account functionality and safety, and relying on the synergistic effect of the three components to achieve precise scenario coverage.

1. Anti-Fatigue and Energy Enhancement: Red Ginseng Extract Soft Capsules/Oral Liquid

▲ Core Basis: The synergistic effect of ginsenoside Rg1 (improving cell energy supply), ginseng peptides (anti-fatigue and high absorption) and ginseng polysaccharides (nutritional supplement) relieves physical and mental fatigue and improves the body's energy level.

▲ Typical Case 1: Cheong Kwan Jang Red Ginseng Extract Oral Liquid

⊙ Core Components: 6-year-old red ginseng extract, total ginsenoside content ⩾5% (Rg1+Rb1 ⩾1.2mg/mL), containing a small amount of ginseng polysaccharides and peptides;

⊙ Application Scenarios: Mental fatigue of office workers, physical fatigue of athletes, energy supplement for postoperative debility people, focusing on "mild nourishment and rapid anti-fatigue";

⊙ Market and Test Data: Annual sales exceed 10 million boxes. After 8 weeks of continuous administration to office workers, the Fatigue Scale-14 (FS-14) score decreased from 11.2 to 6.5 (a decrease of 42%); after 4 weeks of administration to athletes, the endurance test score increased by 15%, and the post-exercise recovery time was shortened by 30%;

⊙ Mechanism Implementation: Rg1 activates mitochondrial ATP synthase, improves cell energy supply efficiency and reduces the accumulation of fatigue substances; ginseng peptides quickly supplement nutrition and relieve muscle fatigue; ginseng polysaccharides enhance immunity and avoid immune decline caused by fatigue.

▲ Typical Case 2: Xiuzheng Ginsenoside Soft Capsules

⊙ Core Components: Compound extract of ginsenosides Rg1/Rb1 (total content ⩾8%), combined with ginseng peptides (molecular weight <1000Da);

⊙ Application Scenarios: High-intensity workers and athletes, specifically relieving mental fatigue and post-exercise muscle soreness;

⊙ Test Data: After 4 weeks of administration, the attention concentration of mental workers increased by 35%, memory increased by 28%; the blood lactic acid content of athletes decreased by 27%, and the duration of muscle soreness was shortened by 40%.

2. Cognitive Improvement and Brain Nourishment: Ginsenoside Rb1 Compound Preparations

▲ Core Basis: The synergistic effect of ginsenoside Rb1 (neuroprotection, inhibiting Aβ protein deposition) and Rg1 (promoting neurogenesis), combined with Ginkgo biloba extract, etc., to strengthen the effect of cognitive improvement, focusing on the elderly and mental workers.

▲ Typical Case 1: DHC Ginkgo Ginseng Tablets

⊙ Core Components: Ginsenoside Rb1 (⩾2mg/tablet) + Ginkgo biloba extract, containing a small amount of ginseng polysaccharides;

⊙ Application Scenarios: Memory decline in the elderly, early intervention of Alzheimer's disease (AD), cognitive fatigue of mental workers;

⊙ Clinical Verification: After 6 months of administration to patients with early AD, the Mini-Mental State Examination (MMSE) score increased from 18 to 20.2 (an increase of 12%), the error rate of memory test decreased by 42%, and cognitive function was significantly improved;

⊙ Mechanism Implementation: Rb1 inhibits β-amyloid deposition, reduces neuronal apoptosis and protects hippocampal neurons; Rg1 promotes hippocampal neurogenesis, improves synaptic plasticity and enhances memory and cognitive function; ginseng polysaccharides supplement nutrition and assist in the repair of nerve cells.

▲ Typical Case 2: Tongrentang Ginseng Brain-Nourishing Pills

⊙ Core Components: Ginseng extract (containing Rb1 and Rg1) + traditional Chinese medicine extracts such as Angelica sinensis and Lycium barbarum, with compound synergistic conditioning;

⊙ Application Scenarios: Memory decline and dizziness/tinnitus caused by qi-blood deficiency in the elderly, long-term administration can delay cognitive decline;

⊙ Market Feedback: After 3 months of administration to the elderly, memory increased by 35%, and the incidence of dizziness and tinnitus decreased by 58%.

3. Qi-Blood Conditioning and Women's Health: Compound Ginseng Extracts

▲ Core Basis: The synergistic effect of ginseng polysaccharides (promoting the proliferation of hematopoietic stem cells and increasing hemoglobin) and ginsenosides (regulating endocrine and balancing estrogen), combined with traditional Chinese medicine extracts such as Astragalus membranaceus and Angelica sinensis, focusing on women with qi-blood deficiency and endocrine disorders.

▲ Typical Case 1: Jifushen Shengbai Dai Capsules

⊙ Core Components: Ginseng extract (total saponin content ⩾3%) + Astragalus membranaceus extract + Angelica sinensis extract, with compound synergistic conditioning;

⊙ Application Scenarios: Women with qi-blood deficiency, immunodeficiency and postpartum debility, which should be taken under the guidance of a physician;

⊙ Clinical Data: After 1 month of administration to postpartum women, the hemoglobin content increased from 105g/L to 125g/L, and the relief rate of debility and fatigue symptoms reached 89%; after 3 months of administration to women with qi-blood deficiency, the improvement rate of sallow complexion reached 78%, and immunity increased by 40%;

⊙ Mechanism Implementation: Ginseng polysaccharides promote the proliferation of hematopoietic stem cells, increase hemoglobin and improve anemia; ginsenosides regulate endocrine, balance estrogen levels, and relieve menstrual disorders and postpartum debility.

▲ Typical Case 2: Ginseng Rose Drink

⊙ Core Components: Small-molecule ginseng peptides (molecular weight <1000Da, absorption rate ⩾90%) + rose extract, mild nourishment;

⊙ Application Scenarios: Young women with menstrual disorders, poor sleep quality and sallow complexion, focusing on "light nourishment and qi-blood conditioning";

⊙ Market Feedback: After 1 month of continuous administration, the improvement rate of menstrual disorders reached 72%, the sleep quality score increased by 38%, and the relief rate of sallow complexion reached 65%.

III. Cosmetics Field: Anti-Aging and Repair, a Standard for High-End Ingredients (Dependent on Saponins + Polysaccharides)

The application of ginseng extract in the cosmetics field takes ginsenosides (Compound K, Rg3) and ginseng polysaccharides as the core,

focusing on three directions: anti-aging and firming, barrier repair, and anti-hair loss and hair growth. Relying on its anti-inflammatory, antioxidant and cell proliferation-promoting effects, it focuses on high-end skin care and hair care, taking into account functionality and safety.

1. Anti-Aging and Firming: Ginsenoside Compound K (Amorepacific's Exclusive Technology)

▲ Core Basis: The antioxidant and collagen synthesis-promoting effects of ginsenoside Compound K (prepared by bio-enzyme conversion, with activity 10-100 times that of ordinary ginsenosides) inhibit collagen loss and improve skin elasticity.

▲ Typical Cases: Sulwhasoo Concentrated Ginseng Renewing Serum, Laneige Ginseng Renewal Series

⊙ Core Components: Bio-enzyme converted ginseng extract, Compound K content ⩾0.5%, combined with ginseng polysaccharides;

⊙ Technical Highlights: Amorepacific's exclusive bio-enzyme conversion technology converts ginsenosides into transdermally absorbable Compound K, increasing transdermal absorption rate by 6 times and achieving 72-hour sustained release;

⊙ Clinical Test Data: After 12 weeks of using the serum containing Compound K, skin elasticity increased by 22%, crow's feet depth decreased by 18%, skin firmness increased by 18%, and collagen synthesis increased by 35%;

⊙ Mechanism Implementation: Compound K inhibits the activity of MMP-1 (collagenase) to reduce collagen loss; promotes the proliferation of skin fibroblasts to increase the synthesis of collagen and hyaluronic acid; scavenges free radicals through antioxidant effect to reduce skin oxidative damage and delay aging.

2. Barrier Repair and Soothing: Ginseng Polysaccharide/Oligosaccharide Extracts

▲ Core Basis: The synergistic effect of ginseng polysaccharides (promoting the proliferation of keratinocytes and synthesis of ceramide) and ginseng galacturonic acid oligosaccharides (anti-inflammatory and oil-controlling), focusing on sensitive skin and barrier-damaged skin, relieving redness and stinging.

▲ Typical Case 1: Wanbi Ginseng Rejuvenating Set

⊙ Core Components: 86.7% Changbai Mountain ginseng extract, containing ginseng polysaccharides (⩾5%) and ginsenoside Rd, using nano-fresh injection technology to improve transdermal absorption rate;

⊙ Application Scenarios: Dry skin and slightly sensitive skin, focusing on "anti-wrinkle, firming + barrier repair", mild and non-irritating;

⊙ Test Data: After 15 days of use, skin moisture increased by 38%; after 4 weeks of use, transepidermal water loss (TEWL) decreased by 22%,

and the repair rate of barrier damage reached 75%;

⊙ Mechanism Implementation: Ginseng polysaccharides promote the proliferation of keratinocytes and synthesis of ceramide to repair the skin barrier; ginsenoside Rd inhibits inflammatory factors to relieve skin redness and stinging, and synergistically enhances skin resistance.

▲ Typical Case 2: Winona Ginseng Soothing Cream

⊙ Core Components: Ginseng polysaccharides (≥3%) + oat β-glucan, specifically repairing sensitive skin;

⊙ Application Scenarios: Sensitive skin and skin with red blood streaks, relieving redness, stinging and dry itching;

⊙ Test Data: After 4 weeks of use on sensitive skin, the redness index decreased by 40%, the stinging sensation was relieved by 55%, and skin tolerance increased by 62%.

3. Anti-Hair Loss and Hair Growth: Whole Plant Ginseng Extract Shampoo

▲ Core Basis: The synergistic effect of ginsenoside Rg1 (dilating scalp capillaries and improving scalp microcirculation) and ginseng peptides (nourishing hair follicles) activates hair follicles, prolongs the anagen phase of hair follicles, and reduces telogen hair loss.

▲ Typical Case 1: 8-Minute Ginseng Anti-Hair Loss Shampoo

⊙ Core Components: Whole plant ginseng (root/stem/leaf) extract, containing ginsenoside Rg1 (≥0.1%) and ginseng peptides;

⊙ Application Scenarios: Androgenetic alopecia, telogen alopecia and postpartum alopecia, focusing on "mild anti-hair loss and nourishing hair roots";

⊙ Market Feedback: After 3 months of continuous use, hair loss decreased by 45%, hair density increased by 23%, and hair root thickness increased by 38%;

⊙ Mechanism Implementation: Rg1 dilates scalp capillaries, increases scalp blood perfusion by 17%, and provides sufficient nutrition for hair follicles; ginseng peptides nourish hair follicles, prolong the anagen phase of hair follicles, reduce hair follicle atrophy, and reduce telogen hair loss.

▲ Typical Case 2: Ryoe Ginseng Hair Care Series

⊙ Core Components: Korean ginseng extract (containing Rg1 and Rb1) + ginger extract, synergistically anti-hair loss and hair growth;

⊙ Test Data: After 2 months of use, hair loss decreased by 35%; after 3 months of use, the rate of new hair growth increased by 28%, and hair

gloss increased by 42%.

IV. Functional Food Field: Medicine-Food Homology and Daily Penetration (Dependent on Synergistic Effect of All Components)

The functional food field is mainly low-dose ginseng extract, focusing on daily light nourishment and energy supplement scenarios, covering beverages, leisure foods and other categories. Relying on the synergistic effect of the three components, it takes into account taste and functionality to achieve daily penetration.

1. Beverages: Ginseng Coffee / Ginseng Peptide Oral Liquid

▲ Core Basis: The synergistic effect of ginsenoside Rg1 (refreshing and relieving caffeine side effects) and ginseng peptides (high absorption and nutritional supplement), combined with carriers such as coffee and water, to meet the daily needs of office workers.

▲ Typical Case 1: Nestlé Ginseng Coffee

⊙ Core Components: Red ginseng extract (total ginsenoside content ⩾0.5%) + caffeine, synergistically refreshing;

⊙ Product Highlights: Ginseng extract can reduce the side effects of palpitations and insomnia caused by caffeine, which is suitable for office workers to refresh in the morning and avoid drowsiness in the afternoon;

⊙ Market Feedback: Annual sales exceed 5 million cans. After drinking by office workers, the refreshing duration is extended by 2.5 hours, and the incidence of palpitations is reduced by 68%;

⊙ Mechanism Implementation: Rg1 synergizes with caffeine to activate the central nervous system, improve attention, and at the same time relieve the stimulation of caffeine on the cardiovascular system, reducing side effects such as palpitations and insomnia; ginseng polysaccharides supplement nutrition to avoid fatigue after refreshing.

▲ Typical Case 2: Xiuzheng Ginseng Peptide Oral Liquid

⊙ Core Components: Enzymatically hydrolyzed small-molecule ginseng peptides (molecular weight <1000Da, absorption rate ⩾90%), containing a small amount of ginseng polysaccharides;

⊙ Application Scenarios: Postoperative recovery, immunocompromised people and the elderly, focusing on "high absorption and mild nourishment";

⊙ Technical Highlights: Using enzymatic hydrolysis and fermentation technology to convert ginseng macromolecular proteins into small-molecule peptides, avoiding gastrointestinal digestion burden, which can be absorbed 15 minutes after oral administration;

⊙ Test Data: After 1 month of administration to postoperative people, the physical recovery speed increased by 40%, and immunity increased by 35%; after 2 months of administration to the elderly, the relief rate of debility and fatigue reached 82%.

2. Leisure Foods: Ginseng Soft Candies / Buccal Tablets

▲ Core Basis: The anti-fatigue and light nourishing effects of low-dose ginseng extract, combined with candy carriers, covering young consumer groups, realizing the combination of "leisure + nourishment".

▲ Typical Case 1: By-Health Ginseng Buccal Tablets

⊙ Core Components: Ginseng extract (total ginsenoside content ⩾0.3%), containing 50mg ginseng extract per tablet, low-dose light nourishment;

⊙ Application Scenarios: Young office workers and students, daily anti-fatigue and light nourishment, easy to carry;

⊙ Market Feedback: Young consumers account for 78%. After 4 weeks of continuous administration, the fatigue relief rate reached 65%, and the reputation score was 4.8/5.0.

▲ Typical Case 2: Korean Korean Ginseng Soft Candies

⊙ Core Components: Korean ginseng extract (total saponin content ⩾0.2%), combined with fruit juice, sweet taste and reducing ginseng bitterness;

⊙ Market Trend: In 2024, the global market size of ginseng functional food exceeded 8 billion US dollars, with an annual growth rate of 12%+. The Chinese market accounted for 35%, among which the growth rate of leisure ginseng food reached 18%, and young consumer groups became the main force.

Part 3: Core Technology and Application Trends of Ginseng Extract (Strengthening Professionalism and Systematicness)

The large-scale application of ginseng extract is inseparable from the support of core extraction and purification technologies; in the future, with the upgrading of technology and refinement of demand, its application will develop in the direction of precision, cross-border integration

and standardization, further releasing the value of natural active components.

I. Key Extraction and Purification Technologies (Supporting Component Purity and Activity)

Core technologies focus on "targeted enrichment of active components, improvement of absorption rate and retention of activity". The three mainstream technologies are as follows:

1. Supercritical CO_2 Extraction Technology

⊙ Core Advantages: Low-temperature (35-40℃) extraction avoids high-temperature damage to ginsenoside activity; targeted separation of rare ginsenosides (Rh2, Rg3) with purity ⩾95%; no solvent residue, high product safety, meeting the high standards of medicine and cosmetics;

⊙ Application Scenarios: Preparation of high-purity ginsenoside preparations (such as Shenyi Capsules) and high-end cosmetic extracts;

⊙ Data Support: The extraction efficiency is 30% higher than that of traditional solvent extraction, and the recovery rate of rare ginsenosides is more than 85%.

2. Bio-Enzyme Conversion Technology

⊙ Core Advantages: Through specific enzymes (such as β-glucosidase), macromolecular saponins with high content in ginseng (such as Rb1, Rc) are converted into secondary saponins that are easy to absorb and have higher activity (such as Compound K, Rh2), with activity increased by 10-100 times;

⊙ Application Scenarios: Preparation of high-end cosmetics (such as Sulwhasoo Concentrated Ginseng Renewing Serum) and high-activity health products;

⊙ Technical Breakthrough: Enterprises such as Amorepacific and Jifushen have realized large-scale production, and the content of Compound K is 6000 times higher than that of traditional extraction.

3. Nanoencapsulation Technology

⊙ Core Advantages: Encapsulating ginseng extract (saponins, peptides) in nano-microcapsules (particle size 50-200nm) increases transdermal absorption rate by 3 times (cosmetics field) and intestinal absorption rate by 2 times (health products field), achieving 72-hour sustained release and prolonging the action time;

⊙ Application Scenarios: Cosmetic serums and oral health products (such as ginseng peptide microcapsule powder);

⊙ Data Support: After encapsulation, the transdermal absorption rate of ginsenosides increased from 12% to 45%, and the intestinal absorption rate increased from 65% to 88%.

II. Future Application Trends (Precision + Cross-Border Integration)

1. Precision: Single-Component Preparations Targeting Specific Needs

Based on the differences in the action targets of different ginsenoside subtypes, single-component preparations are developed to achieve "precision targeting": such as Rb1 single preparation for AD, Rg3/Rh2 compound preparation for tumors, and Rg1/Rb1 preparation for cardiovascular and cerebrovascular diseases, which improve the specificity of efficacy, reduce side effects, and establish content standards for single components to promote precision medicine in the pharmaceutical field.

2. Cross-Border Integration: Expanding New Scenarios and Increasing Product Added Value

Ginseng Extract + Probiotics: Synergistically regulate intestinal health and immunity, expand new scenarios for intestinal health, such as ginseng probiotic powder. Clinical data show that the combination of the two can enhance the immune enhancement effect by 50%;

Ginseng Extract + Stem Cell Factors: Used for medical beauty repair, promoting skin cell regeneration and repairing post-medical beauty damage, such as ginseng stem cell repair serum;

Ginseng Extract + Sports Nutrition: Develop special supplements for athletes to specifically relieve sports fatigue and accelerate muscle repair, in line with the development trend of the sports health industry.

3. Standardization: Establishing Industry Standards and Promoting Internationalization

Establish fingerprint chromatogram and active component content standards (such as Rg1, Rb1, Rh2, etc.) for ginseng extract, unify extraction processes and quality control standards, and solve the current industry problems of "uneven components and inconsistent quality"; at the same time, promote the international certification of ginseng extract, expand overseas markets, and enhance the international influence of Chinese authentic ginseng extract.

Part 4: Conclusion

The core value of ginseng extract lies in "clear components, clear mechanisms, sufficient evidence and diverse scenarios". Its three core components (ginsenosides, ginseng polysaccharides and ginseng peptides) act synergistically, covering multi-dimensional physiological functions such as immune regulation, anti-inflammation and antioxidation, adjuvant anti-tumor, cardiovascular and cerebrovascular protection, and anti-aging repair, providing solid scientific support for applications in four major fields.

Through the logical framework of "core mechanism + application cases + technical trends", this article analyzes the application value of ginseng extract in segments, highlighting professionalism, systematicness and logic: the first part systematically sorts out the core mechanism of action, combined with in vitro/in vivo/clinical data, clarifies the targets and synergistic effects of each component; the second part combines typical cases in various fields, connects mechanisms with practical applications, and analyzes product development and effects; the third part focuses on core technologies and future trends, looking forward to the development direction of the industry.

In the future, with the continuous upgrading of extraction technologies and the continuous expansion of application scenarios, ginseng extract will move from traditional nourishment to a new stage of precision, standardization and cross-border integration, further releasing the value of natural active components and becoming a benchmark for "modernization of traditional Chinese medicine and industrialization of natural components" in the big health industry.