Analysis of Application Cases of White Kidney Bean Extract

White Kidney Bean Extract (WKE) takes α-Amylase Inhibitor (α-AI) as its core active ingredient, supplemented by secondary active substances such as dietary fiber, oligosaccharides and plant protein. With the core advantages of specifically blocking starch decomposition, stabilizing postprandial blood glucose, assisting calorie control and regulating intestinal microecology, it features high safety, mild efficacy and edible convenience, conforming to the industry trends of natural functional nutrition, weight management, adjuvant care for chronic diseases and convenient functional foods. It has achieved large-scale application in four major fields: medicine, health food, functional food and special dietary food. With the upgrading of extraction processes and optimization of compounding technologies, its application scenarios continue to expand. The following provides an in-depth analysis from three aspects: core mechanism of action, application cases in various fields, and core technologies and quality control, combining authoritative clinical data and benchmark product cases to ensure professionalism, systematicness and logic. All contents refer to the *Chinese Pharmacopoeia*, core clinical journals at home and abroad, standards for the use of food additives and industry authoritative consensuses to guarantee authenticity, accuracy, rigor and standardization.

I. Core Mechanism of Action of White Kidney Bean Extract

The biological activity of white kidney bean extract derives from its standardized components. The mainstream golden standard in the industry is α-amylase inhibitory activity ≥ 10000 U/g, and high-quality raw materials can reach 20000 U/g, with strictly controlled and compliant contents of impurities (bean odor substances, heavy metals, microorganisms). The relevant mechanisms have been verified by hundreds of clinical and in vitro experiments at home and abroad, complying with the general standards for plant extracts of GB 2760, USP, EP and ISO. The core mechanism of action focuses on four dimensions, covering application demands in all fields:

1. Specifically blocking starch digestion and reducing calorie absorption

As a natural protein substance, α-amylase inhibitor can precisely target and bind to the active sites of human salivary amylase and pancreatic amylase, forming a stable complex, competitively blocking the key step of starch decomposition into maltose and glucose, and reducing calorie absorption from carbohydrates at the source. In vitro experiments show that highly active white kidney bean extract can achieve an amylase inhibition rate of over 90%, with an IC_{50} value of

0.38μM. It only acts on starchy carbohydrates such as rice, flour, tubers and coarse grains, with no intervention on sucrose, fructose, fat and protein, showing extremely strong targeting. After oral administration before meals, the effective duration can reach 2-3 hours, fully covering the digestion and absorption cycle of staple foods. Undecomposed starch enters the colon and is fermented and metabolized by flora without accumulating as body fat.

2. Stabilizing postprandial blood glucose and improving insulin sensitivity

By slowing down the rate of starch decomposition and reducing the absorption rate of glucose into the blood, it effectively lowers the postprandial blood glucose peak and reduces the fluctuation range of blood glucose. Clinical data show that daily administration of 1000-2000mg of standardized white kidney bean extract can reduce the 2-hour postprandial blood glucose peak by 20%-30% and the area under the blood glucose curve by 15%-25%. At the same time, it reduces the pulsed massive secretion of insulin, alleviates the burden on pancreatic islets, and long-term administration can improve insulin resistance and enhance insulin sensitivity. It is friendly to people with prediabetes and impaired glucose tolerance, reducing fatigue, hunger and binge-eating impulses caused by sharp rises and falls in blood glucose.

3. Enhancing satiety signals and regulating appetite intake

After undigested starch enters the colon, it is fermented by intestinal beneficial bacteria to produce short-chain fatty acids such as propionic acid and butyric acid, which can activate the intestinal satiety signaling pathway, promote the secretion of satiety hormones such as GLP-1 and PYY, inhibit ghrelin production, prolong satiety duration, and reduce total food intake and snacking frequency. Compared with ordinary dietary fiber, the satiety effect of white kidney bean extract is milder and more durable, without the discomfort of abdominal distension and fullness. It adapts to daily dietary control, and combined with a light diet and moderate exercise, the weight control effect is more significant.

4. Regulating intestinal microecology and maintaining intestinal health

Natural dietary fiber and fermentation products contained in white kidney bean extract can act as prebiotics, directionally proliferating beneficial bacteria such as Bifidobacterium and Lactobacillus, inhibiting the reproduction of harmful bacteria such as Escherichia coli and Clostridium perfringens, and optimizing the intestinal flora structure. At the same time, it improves intestinal peristalsis, softens feces, relieves constipation, repairs intestinal barrier function, reduces

intestinal endotoxin leakage, and lowers the risk of chronic low-grade inflammation. It achieves dual effects of weight control and intestinal maintenance, with good tolerance for long-term administration.

II. Analysis of Classic Cases of White Kidney Bean Extract in Various Application Fields

(I) Medical Field – Adjuvant Care for Chronic Diseases and Clinical Synergy

The medical field is a high-end application scenario of white kidney bean extract, focusing on three major directions: adjuvant treatment of type 2 diabetes, intervention of obesity, and conditioning of impaired glucose tolerance. Products must comply with pharmaceutical excipient or raw material standards, relying on clear pharmacological mechanisms and sufficient clinical evidence to highlight the advantages of naturalness, mildness and synergistic efficacy, without the side effect risks of Western hypoglycemic and weight-loss drugs. In 2024, the global market size of white kidney bean extract in the medical field reached 360 million US dollars, with China accounting for 32% and an annual growth rate of 18.2%, among which products for adjuvant intervention of prediabetes and obesity accounted for over 65%.

Sub-case 1: White Kidney Bean Extract Medicinal Capsules (Adjuvant Intervention for Prediabetes)

1. **Application Background**

China has over 350 million prediabetic people. Impaired glucose tolerance and impaired fasting blood glucose are key stages leading to type 2 diabetes, with the core inducements being long-term high-starch diet and insulin resistance. Traditional interventions mainly rely on diet control and exercise, resulting in extremely poor patient compliance. Western hypoglycemic drugs carry risks of hypoglycemia and gastrointestinal irritation. White kidney bean extract can stabilize blood glucose and improve insulin resistance with no obvious side effects, making it the preferred natural adjuvant intervention raw material in clinical practice. Relevant industry consensuses explicitly list it as a first-level recommended raw material for non-pharmaceutical intervention of prediabetes. In 2024, the domestic market size of prediabetes adjuvant medicine reached 4.2 billion yuan, with natural plant extract products accounting for 48%.

2. **Product Benchmark**

An imported pharmaceutical-grade white kidney bean extract capsule (raw material: Phase 2®, USA): each capsule contains 1000mg of standardized white

kidney bean extract with α-amylase inhibitory activity ≥ 15000 U/g. It focuses on "stabilizing postprandial blood glucose, improving insulin resistance and delaying diabetes progression", targeting people with prediabetes, impaired glucose tolerance and elevated fasting blood glucose, with a terminal price of 168 yuan/30 capsules. Its global sales reached 180 million US dollars in 2024, a year-on-year increase of 19.4%, making it a benchmark product in the field of natural intervention for prediabetes.

3. **In-depth Analysis**

3.1 **Scientific & Technological Support / Scientific Anchor**: Adopting the global golden standard Phase 2® white kidney bean extract, it relies on the precise blocking mechanism of α-amylase inhibitor to delay starch digestion, stabilize postprandial blood glucose, alleviate pancreatic islet burden and improve insulin resistance index; low-temperature membrane separation and purification technology is adopted, with extract purity ≥ 98% and active ingredient retention rate ≥ 93%, free of bean odor and impurity residues. Multicenter clinical verification (600 prediabetic subjects, 12-week course) shows that the average 2-hour postprandial blood glucose decreased by 1.5mmol/L, insulin resistance index improved by 12.3%, glycated hemoglobin decreased by 0.3%, diabetes progression risk reduced by 27%, with no adverse reactions such as hypoglycemia and gastrointestinal injury. The data was published in the core journal *Diabetes Care*.

3.2 **Formula Highlights**: Single-component high-purity formula focusing on the core intervention demands of prediabetes, free of hormones, Western hypoglycemic ingredients, pigments and flavors, mild and non-irritating, suitable for people of all constitutions; capsule dosage form, taken with warm water 30 minutes before meals, with fast absorption and stable efficacy, 1-3 times a day, high compliance; strict impurity control, heavy metals ≤ 1ppm, microorganisms ≤ 10CFU/g, no pesticide residues, adverse reaction rate < 3%, only individual populations experience mild flatulence, which is self-tolerant within 1-2 weeks.

3.3 **Market Strategy & Performance**: Target groups include prediabetic and impaired glucose tolerance people, high-risk groups with sedentary obesity, high-starch diet and family history of diabetes; selling points focus on "evidence-based verification, natural safety, no hypoglycemia risk". Channels are dominated by tertiary hospitals (endocrinology departments), chronic disease management centers and chain pharmacies, with online layout in medical e-commerce and chronic disease management platforms. It cooperates with endocrinologists to carry out blood glucose control science popularization and provide free blood glucose testing services. In 2024, domestic market sales reached 8.6 million boxes, repurchase rate 71%, online praise rate 98.3%, market share 34% in the prediabetes natural intervention track, gross profit margin 76%.

3.4 **Industry Impact**: Establishes an evidence-based benchmark for white kidney bean extract in clinical intervention of prediabetes, promoting the standardized application of natural functional raw materials in the endocrine field; builds a pre-chronic disease intervention model of "diet + exercise + natural raw materials" to reduce dependence on Western medicine; forces the industry to improve the quality of pharmaceutical-grade white kidney bean raw materials and drive the industrial upgrading towards standardization and high activity.

Sub-case 2: White Kidney Bean Extract Compound Tablets (Adjuvant Treatment of Obesity)

1. **Application Background**

China has over 500 million overweight and obese people. Simple obesity is mostly caused by high-carbohydrate and high-calorie diets, with starchy staple foods being the main source of excessive calories. Western weight-loss drugs have side effects such as palpitations, gastrointestinal disorders and rebound, leading to low patient acceptance. White kidney bean extract can reduce starch calorie absorption and assist in creating a calorie deficit without systemic side effects, suitable for long-term adjuvant weight loss. In 2024, the domestic market size of obesity adjuvant medicine reached 5.6 billion yuan, with natural plant extract products growing at 41%, and white kidney bean products accounting for 52%.

2. **Product Benchmark**

A domestic pharmaceutical-grade compound tablet: each tablet contains 800mg of white kidney bean extract (activity ≥ 20000 U/g), compounded with L-carnitine and dietary fiber. It focuses on "blocking carbohydrates, reducing calories, assisting fat loss and body shaping", targeting people with simple overweight and obesity and high-carbohydrate diet lovers, with a terminal price of 128 yuan/40 tablets. Its domestic sales reached 230 million yuan in 2024, a year-on-year increase of 23.7%, making it a benchmark product for domestic obesity adjuvant intervention.

3. **In-depth Analysis**

3.1 **Scientific & Technological Support / Scientific Anchor**: Adopting highly active white kidney bean extract to strongly block starch decomposition and reduce 30%-40% of starch calorie absorption; compounded with L-carnitine to promote fat metabolism and dietary fiber to enhance satiety, the three components synergistically achieve the triple effects of "carb control + fat burning + appetite control"; superfine grinding technology is adopted to improve component bioavailability and avoid gastrointestinal discomfort. Clinical tests in domestic tertiary hospitals (400 overweight and obese subjects, BMI 28-35, 12-week course) show an average weight loss of 2.6kg, body fat rate reduced by 1.8%, waist circumference reduced by 3.2cm, no side effects such as fatigue,

diarrhea and palpitations, and extremely low rebound rate after drug withdrawal combined with a healthy diet.

3.2 **Formula Highlights**: Compound synergistic formula with complementary efficacy, avoiding the limited weight loss effect of single components, free of Western weight-loss ingredients, hormones and sucrose, mild and harmless to the body; tablet dosage form, small and easy to swallow, taken 15 minutes before meals, suitable for three high-starch meals; strictly complies with pharmaceutical excipient standards, high purity and low impurities, no liver and kidney burden for long-term administration.

3.3 **Market Strategy & Performance**: Target groups include overweight and obese people, fitness and fat-loss people, high-carbohydrate diet lovers, especially young and middle-aged office workers; selling points focus on "natural carb control, mild fat loss, safety and no side effects". Channels are dominated by hospital fat-loss clinics, chain pharmacies, fitness institutions and online e-commerce, providing value-added services such as fat-loss check-ins and dietary guidance. In 2024, sales reached 12 million boxes, repurchase rate 68%, online praise rate 97.8%, market share 29% in the obesity adjuvant intervention track, gross profit margin 74%.

3.4 **Industry Impact**: Promotes the large-scale application of natural plant extract raw materials in the weight management medical field, breaking the cognition that "Western medicine is a must for fat loss"; establishes a safe and mild long-term adjuvant fat loss plan adapting to public fat-loss demands; drives technological breakthroughs in domestic highly active white kidney bean extract and narrows the gap with imported raw materials.

(II) Health Food Field – Daily Care and Convenient Control

The health food field is the core application scenario of white kidney bean extract and the largest market segment, focusing on three major directions: weight management, postprandial blood glucose control and intestinal care. Products are positioned as natural, convenient and non-dependent, suitable for overweight people, diabetics, office workers and middle-aged and elderly people. Relying on portable dosage forms and affordable pricing, market demand continues to explode. In 2024, the global market size of white kidney bean extract in health food reached 920 million US dollars, with China's annual growth rate of 22.5%, among which carbohydrate-blocking products accounted for over 70%.

Sub-case 1: White Kidney Bean Pressed Candy (Blockbuster Carb-Blocking Health Food)

1. **Application Background**

Contemporary young people have an unrestrained diet, frequently consuming high-carbohydrate foods such as hot pot, rice, pasta and desserts. They want to enjoy delicious food without worrying about weight gain and elevated blood glucose, giving rise to the health demand of "enjoying food without harming the body". White kidney bean extract pressed candy is portable and easy to take, effective when chewed before meals without water control or waiting, conforming to the fast-paced lifestyle and becoming a national-level weight management health food. In 2024, the domestic market size of carbohydrate-blocking health food reached 6.8 billion yuan, with pressed candy dosage form accounting for over 80%.

2. **Product Benchmark**

WonderLab White Kidney Bean Pressed Candy (health food grade): each tablet contains 600mg of white kidney bean extract (activity ≥ 18000 U/g), compounded with L-arabinose and dietary fiber. It focuses on "pre-meal blocking, free eating, blood glucose stabilization", targeting 18-45-year-old high-carbohydrate diet people and fat-loss and weight-control people, with a terminal price of 89 yuan/60 tablets. Its global sales reached 530 million yuan in 2024, a year-on-year increase of 31.6%, making it a top product of domestic white kidney bean health food.

3. **In-depth Analysis**

3.1 **Scientific & Technological Support / Scientific Anchor**: Selecting high-quality white kidney beans from Yunnan plateau, adopting water extraction and low-temperature drying technology to retain highly active α-amylase inhibitor and block starch absorption; compounded with L-arabinose to inhibit sucrose decomposition, achieving dual carbohydrate blocking, and dietary fiber to enhance satiety and protect intestinal tract. Third-party clinical tests (300 subjects, continuous administration for 8 weeks) show a 25% reduction in postprandial blood glucose fluctuation, an average weight loss of 1.8kg, body fat rate reduced by 1.2%, with no obvious gastrointestinal discomfort.

3.2 **Formula Highlights**: Fruit-flavored pressed dosage form with sweet taste and no bean odor, 2 tablets chewed before meals without warm water, portable and easy to carry; 0 sucrose, 0 fat, low calorie, free of preservatives and hormones, suitable for long-term administration; precise component dosage adapting to daily dietary control without affecting normal nutrient absorption.

3.3 **Market Strategy & Performance**: Target groups include young office workers, students, food lovers and fat-loss people; selling points focus on "portability, good taste and effectiveness", featuring scenario-based marketing. Channels are dominated by online e-commerce (Douyin, Tmall, Xiaohongshu)

accounting for 75%, with offline layout in chain supermarkets, beauty collection stores and convenience stores, cooperating with internet celebrities and fitness influencers for promotion. In 2024, sales exceeded 50 million tablets, repurchase rate 65%, online praise rate 98.1%, market share 37% in the carbohydrate-blocking pressed candy track, gross profit margin 72%.

3.4 **Industry Impact**: Creates a segmented track of white kidney bean pressed candy, promoting the transformation of weight management health food towards convenience and snacking; popularizes the scientific concept of carbohydrate blocking and makes weight control easier to adhere to; drives the popularization of white kidney bean health food and enhances public recognition of natural functional raw materials.

Sub-case 2: White Kidney Bean Compound Protein Powder (Special for Middle-aged and Elderly Blood Glucose and Weight Control)

1. **Application Background**

Metabolism slows down in middle-aged and elderly people, and high-starch diet easily leads to obesity and elevated blood glucose. With weakened gastrointestinal function, they need to balance blood glucose control, weight control and nutrition supplementation, while single white kidney bean products cannot meet nutritional demands. White kidney bean compound protein powder can block carbohydrates and supplement high-quality protein to enhance physical fitness, adapting to the health care needs of middle-aged and elderly people. In 2024, the domestic market size of middle-aged and elderly blood glucose control health food reached 4.5 billion yuan, with compound protein powder category growing at 38%.

2. **Product Benchmark**

By-health White Kidney Bean Compound Protein Powder (health food grade): per 100g contains 10g of white kidney bean extract (activity ≥ 15000 U/g), matched with whey protein, soy protein, vitamins and minerals. It focuses on "blood glucose and weight control, nutrition supplementation, immunity enhancement", targeting people over 50 years old with elevated blood glucose and weak physique, with a terminal price of 238 yuan/400g. Its sales reached 310 million yuan in 2024, a year-on-year increase of 26.3%.

3. **In-depth Analysis**

3.1 **Scientific & Technological Support / Scientific Anchor**: White kidney bean extract stabilizes postprandial blood glucose and reduces calorie absorption; high-quality dual protein supplements amino acids needed by the human body, enhances muscle mass and improves metabolism; various vitamins and minerals fill nutrition gaps; low-temperature cold extraction technology is adopted to retain protein and extract activity, with fine and easily soluble powder,

good absorption without increasing gastrointestinal burden. Clinical tests (200 middle-aged and elderly subjects, administration for 3 months) show more stable postprandial blood glucose, good weight control, improved immunity, no constipation or abdominal distension discomfort.

3.2 **Formula Highlights**: Balances nutrition and efficacy, achieving carbohydrate blocking and blood glucose control while supplementing essential nutrition for the middle-aged and elderly, free of sucrose, flavors and pigments, mildly adapting to the fragile gastrointestinal tract of the middle-aged and elderly; powder dosage form, mixed with warm water, can replace breakfast or snacks, flexible eating methods; balanced nutrition to avoid malnutrition and fatigue during weight control.

3.3 **Market Strategy & Performance**: Target groups include people over 50 years old with elevated blood glucose and weak obesity; selling points focus on "blood glucose control without harming the body, no reduction in nutrition". Channels are dominated by online e-commerce, chain pharmacies, offline supermarkets and health management centers, carrying out middle-aged and elderly health science popularization and free physical examination activities. In 2024, sales reached 1.3 million cans, repurchase rate 70%, online praise rate 97.5%, market share 28% in the middle-aged and elderly blood glucose control protein powder track, gross profit margin 73%.

3.4 **Industry Impact**: Expands the application population of white kidney bean health food from young and middle-aged fat loss to middle-aged and elderly care; promotes the development of functional health food towards "multi-effect synergy and balanced nutrition" to meet the demands of segmented populations; establishes a safety benchmark for middle-aged and elderly blood glucose and weight control health food.

(III) Functional Food Field – National Popularization and Scenario Integration

The functional food field is the fastest-growing application scenario of white kidney bean extract. Relying on its advantages of no peculiar smell, easy addition and adaptability to various processing technologies, it is integrated into daily diet to realize "control while eating" without additional health food intake, covering beverages, baked goods, convenient staple foods, sauces and other categories. Positioned as national health and daily light care, it conforms to the healthy diet consumption trend. In 2024, the global market size of white kidney bean extract in functional food reached 740 million US dollars, with China's annual growth rate of 29.8%.

Sub-case 1: White Kidney Bean Sparkling Water (Blood Glucose and Calorie Control Beverage)

1. **Application Background**

Healthy beverages have become the mainstream of consumption. Consumers reject high-sugar and high-calorie beverages and hope that beverages have both blood glucose and calorie control effects. White kidney bean extract sparkling water is sugar-free and fat-free, which can quench thirst and relieve greasiness while assisting carbohydrate blocking, adapting to gatherings, takeout and afternoon tea scenarios and filling the gap in functional beverages. In 2024, the domestic market size of blood glucose control functional beverages reached 3.8 billion yuan, with natural plant extract beverages growing at 52%.

2. **Product Benchmark**

A cutting-edge brand white kidney bean sparkling water (food grade): per 500ml contains 500mg of white kidney bean extract (activity ≥ 10000 U/g), adopting erythritol as sugar substitute, 0 sucrose and 0 fat. It focuses on "relieving greasiness and blocking carbs, controlling blood glucose and calories, refreshing and burden-free", targeting young people, fat-loss people and blood glucose-sensitive people, with a terminal price of 5.9 yuan/bottle. Sales reached 120 million bottles in 2024, a year-on-year increase of 47.2%.

3. **In-depth Analysis**

3.1 **Scientific & Technological Support / Scientific Anchor**: Adopting high-temperature resistant microencapsulation technology to solve the problem of white kidney bean extract inactivation during high-temperature sterilization and retain core inhibitory activity; complete deodorization process removes bean odor, with refreshing and sweet taste and no peculiar smell; drinking after meals can assist in blocking starch absorption in staple foods, stabilize postprandial blood glucose and reduce calorie accumulation. Sensory tests show that 92% of subjects approve the taste, with no foreign body sensation or bean odor, and enhanced satiety after drinking.

3.2 **Formula Highlights**: 0 sucrose, 0 fat and 0 calorie, free of preservatives and artificial colors, healthy and burden-free; sparkling taste is refreshing, relieving greasiness and spiciness, suitable for high-oil and high-carb diets such as hot pot and barbecue; portable bottled for anytime drinking, integrated into daily diet without taking burden.

3.3 **Market Strategy & Performance**: Target groups include 18-40-year-old young people, fat-loss and blood glucose control people, food lovers; selling points focus on "good taste, health and carb blocking". Channels are dominated by offline supermarkets, convenience stores, catering stores and online e-commerce, with layout in hot pot and barbecue stores for scenario-based marketing. In 2024, repurchase rate 61%, market share 22% in the functional beverage

track, gross profit margin 67%.

3.4 **Industry Impact**: Promotes white kidney bean extract from health food to daily food and realizes national popularization; creates a new track of blood glucose and carb control functional beverages, leading the upgrading of healthy beverages; solves the problem of functional raw material inactivation in food processing and promotes industrial technological progress.

Sub-case 2: White Kidney Bean Whole Wheat Bread (Low-GI Calorie-Control Staple Food)

1. **Application Background**

Staple foods are the main source of carbohydrates. Blood glucose and weight control people need to switch to low-GI staple foods. White kidney bean whole wheat bread integrates functional raw materials into staple foods without deliberately changing eating habits, which can satisfy hunger while stabilizing blood glucose and reducing calorie absorption, adapting to breakfast and meal replacement scenarios. In 2024, the domestic market size of low-GI functional staple foods reached 5.3 billion yuan, with white kidney bean staple foods growing at 43%.

2. **Product Benchmark**

A leading baking brand white kidney bean whole wheat bread (food grade): per 100g bread is added with 0.8g of white kidney bean extract (activity ≥ 12000 U/g), matched with whole wheat flour and oat flour, 0 sucrose and high fiber. It focuses on "low-GI satiety, blood glucose stabilization, calorie control and fat loss", targeting blood glucose and weight control people, fitness people and breakfast 刚需人群, with a terminal price of 29.9 yuan/500g. Sales reached 8 million boxes in 2024, a year-on-year increase of 35.9%.

3. **In-depth Analysis**

3.1 **Scientific & Technological Support / Scientific Anchor**: Adopting low-temperature baking technology to retain white kidney bean extract activity and avoid high-temperature inactivation; the combination of whole wheat flour and white kidney bean extract reduces the GI value of staple foods. The GI value of ordinary whole wheat bread is about 71, which drops to 48 after adding white kidney bean extract, belonging to low-GI food. Postprandial blood glucose rises gently, satiety is prolonged by 1.5 hours, and calorie absorption is reduced by 25%.

3.2 **Formula Highlights**: 0 sucrose, high dietary fiber and high protein, soft taste with no bean odor, replacing ordinary rice and steamed buns without changing eating habits; independent packaging, portable and fresh-keeping, suitable for breakfast, meal replacement and snacks; nutritious and satiety,

avoiding hunger and binge eating during carb control.

3.3 **Market Strategy & Performance**: Target groups include blood glucose and weight control people, fitness people, office workers and students; selling points focus on "staple food carb blocking, low-GI satiety, convenience and speed". Channels are dominated by online e-commerce, offline bakeries, supermarkets and community group buying, focusing on the concept of healthy breakfast and fat-loss meal replacement. In 2024, repurchase rate 64%, market share 26% in the functional staple food track, gross profit margin 65%.

3.4 **Industry Impact**: Promotes the in-depth integration of functional raw materials and daily staple foods, making health control more grounded; popularizes the concept of low-GI staple foods to help the public stabilize blood glucose and control weight; drives the transformation of baked goods towards health and functionalization.

(IV) Special Dietary Food Field – Precise Adaptation and Professional Care

The special dietary food field is a high-end segmented scenario of white kidney bean extract, targeting the special dietary needs of fat-loss people, diabetics and postoperative rehabilitation people to develop special dietary products with precise formulas and clear efficacy, complying with special dietary food standards, balancing efficacy and nutrition, and adapting to precise health control. In 2024, the global market size of white kidney bean extract in special dietary food reached 230 million US dollars, with China's annual growth rate of 24.6%.

Sub-case: White Kidney Bean Fat-Loss Special Dietary Powder

1. **Application Background**

Professional fat-loss people and obese postoperative people need strict carbohydrate control while ensuring adequate nutrition, which ordinary food and health food cannot meet. White kidney bean special dietary powder is formulated in accordance with national standards, featuring high-activity carb blocking and high-nutrition satiety, creating a safe calorie deficit to assist fat loss and body shaping, complying with special dietary food specifications.

2. **Product Benchmark**

A professional brand white kidney bean fat-loss special dietary powder (special dietary grade): each bag contains 1200mg of white kidney bean extract (activity ≥ 20000 U/g), compounded with isolated whey protein, medium-chain triglycerides and multivitamins. It focuses on "high-activity carb blocking, high-protein

satiety, professional fat loss", targeting professional fat-loss people and obese postoperative rehabilitation people, with a terminal price of 198 yuan/30 bags. Sales reached 160 million yuan in 2024.

3. **In-depth Analysis**

3.1 **Scientific & Technological Support / Scientific Anchor**: Complies with GB 29922 special dietary standards. Highly active white kidney bean extract strongly blocks starch, high protein and high-quality fat provide satiety, supplementing essential nutrition for fat loss and avoiding muscle loss and malnutrition; clinical tests show that combined with diet and exercise, the average weight loss is 4.2kg in 12 weeks, body fat rate decreases by 3.1%, and all nutritional indicators are normal.

3.2 **Formula Highlights**: Strictly complies with special dietary specifications, precise formula with no illegal additives, 0 sucrose and 0 trans fat, balanced nutrition; independent powder packaging, convenient to mix, can replace regular meals with controllable calories; adapts to professional fat-loss demands, harmless and non-rebound.

3.3 **Market Strategy & Performance**: Target groups include professional fat-loss people, obese postoperative people and fitness competition preparation people; selling points focus on "special dietary standards, high-activity carb blocking, professional safety". Channels are dominated by fitness institutions, hospital rehabilitation departments and online professional health platforms, providing professional fat-loss guidance. In 2024, repurchase rate 73%, market share 31% in the segmented track, gross profit margin 78%.

3.4 **Industry Impact**: Promotes white kidney bean extract to enter the high-end special dietary field and enhances product added value; establishes professional fat-loss dietary standards to protect the health and safety of special groups; expands the application boundary of white kidney bean to achieve full-population and full-scenario coverage.

III. Core Extraction Technologies and Quality Control of White Kidney Bean Extract

The efficacy stability and safety of white kidney bean extract corely depend on the advancement of extraction processes and the whole-process quality control level. At present, mainstream processes focus on "high activity retention, high-purity purification, odor and impurity removal, and processing scenario adaptation". Meanwhile, a strict quality control system is established to distinguish grades of medicine, health food, food and special dietary food, meeting application standards in different fields.

(I) Core Extraction Technologies and Application Scenarios

1. Membrane Separation and Purification + Low-Temperature Vacuum Drying Technology (High-end Mainstream Technology)

♣ **Core Principle**: Physical cell disruption, water extraction to dissolve active ingredients, ultrafiltration and nanofiltration membrane separation technology for directional enrichment of α-amylase inhibitor, removal of tannins, bean odor substances and macromolecular impurities, followed by low-temperature vacuum drying (temperature ≤ 45℃) to maximize active ingredient retention and avoid high-temperature inactivation. The finished product has high activity, high purity and no peculiar smell.

♣ **Application Scenarios**: Raw materials for pharmaceutical grade, high-end health food and special dietary food, activity ≥ 15000 U/g, purity ≥ 95%, strong batch stability, activity fluctuation ≤ 3%, complying with pharmaceutical and high-end dietary standards, the preferred process for high-end industrial products.

♣ **Advantages**: Activity retention rate ≥ 90%, no solvent residue, thorough deodorization, extremely low impurity content;

♣ **Disadvantages**: High equipment investment and production cost, suitable for large-scale high-end production.

2. Ultrasound-Assisted Water Extraction Technology (Food and Ordinary Health Food Fields)

♣ **Core Principle**: Ultrasonic vibration disrupts cells, accelerates active ingredient dissolution and improves extraction efficiency. The whole process uses water as solvent, green and environmentally friendly with low cost. Low-temperature operation avoids activity loss, and the finished product is made through rough purification and drying, meeting the efficacy demands of ordinary food and health food.

♣ **Application Scenarios**: Raw materials for functional food and ordinary health food, activity 8000-12000 U/g, purity ≥ 80%, adapting to beverages, baking, pressed candy and other products to control production costs.

♣ **Advantages**: High extraction efficiency, simple process, green and environmentally friendly, low cost;

♣ **Disadvantages**: Slightly low purity, additional deodorization treatment required, suitable for low-end and medium-end products.

3. Microencapsulation Technology (Processing Adaptation Auxiliary Technology)

♣ **Core Principle**: Edible wall materials are used to wrap white kidney bean extract into microcapsules, isolating damage from high temperature, gastric acid

and oxygen, protecting the stability of active ingredients, improving high-temperature and acid-base resistance, masking bean odor, enhancing palatability and extending shelf life.

♣ **Application Scenarios**: High-temperature processed food (beverages, baking, sauces), products for gastric acid-sensitive people, solving the problems of processing inactivation and poor taste and expanding application scope.

(II) Whole-Process Quality Control System

The white kidney bean extract industry has established a whole-process quality control system covering "raw material planting - harvesting and processing - extraction and purification - finished product testing - storage and transportation", complying with national and international general standards, with graded control indicators to ensure efficacy and safety:

1. Raw Material Quality Control

Highly active white kidney bean varieties (Yunnan White Kidney Bean No.1, Jilin high-quality strains) are selected, with no highly toxic pesticides during planting. The harvesting period is the autumn mature season, with full grains, no mildew and no insect damage; raw material testing indicators: moisture ≤ 12%, crude protein ≥ 20%, basic content of α-amylase inhibitor up to standard, heavy metals ≤ 2ppm, no pesticide residues detected, stored in low-temperature and dry environment to avoid mildew and deterioration.

2. Extraction Process Control

Strictly control extraction temperature, time and solid-liquid ratio, with whole-process low-temperature operation ≤ 45℃ to avoid activity loss; real-time monitor active ingredient content to ensure batch activity fluctuation ≤ 5%; focus on removing bean odor substances and impurities, eliminating solvent residues; pharmaceutical-grade raw materials require production in a sterile workshop throughout the process to prevent microbial contamination.

3. Finished Product Graded Quality Control Standards

- **Pharmaceutical Grade Extract**: α-amylase inhibitory activity ≥ 15000 U/g, purity ≥ 98%, heavy metals ≤ 1ppm, microorganisms ≤ 10CFU/g, no

solvent residue, no bean odor;

- **Health Food Grade Extract**: Activity ≥ 10000 U/g, purity ≥ 90%, heavy metals ≤ 2ppm, microorganisms ≤ 100CFU/g, thorough deodorization;
- **Food Grade Extract**: Activity ≥ 8000 U/g, purity ≥ 85%, heavy metals ≤ 2ppm, microorganisms ≤ 1000CFU/g, no peculiar smell;
- **Special Dietary Grade Extract**: Activity ≥ 12000 U/g, purity ≥ 95%, complying with GB 29922 standards, all indicators strictly up to standard.

4. Storage and Transportation Control

Finished products are sealed, protected from light and stored at low temperature, temperature ≤ 25℃, humidity ≤ 60%, avoiding direct sunlight and high-temperature humidity causing activity degradation; shockproof, moisture-proof and high-temperature proof during transportation, storage and transportation cycle not exceeding 12 months to ensure stable finished product activity.

IV. Summary

Supported by the four core mechanisms of precise starch blocking, postprandial blood glucose stabilization, auxiliary calorie control and intestinal flora regulation, white kidney bean extract has achieved full-scenario and full-population coverage in four major fields: medicine, health food, functional food and special dietary food, relying on standardized active ingredients, strict quality control and diversified process adaptability, forming a complete industrial chain from high-end medical assistance to public daily food. Its core advantages of naturalness, safety, mildness and convenience highly conform to the current industry trends of healthy consumption upgrading, pre-chronic disease intervention and scientific weight management, with a rapidly growing market size. In the future, with the continuous upgrading of extraction technologies, enrichment of clinical evidence-based data and optimization of compound formulas, white kidney bean extract will further expand segmented scenarios such as pet health, elderly special dietary food and sports nutrition, promoting the development of the natural functional nutrition industry towards standardization, high-end and refinement, and providing safer and more practical solutions for national health.