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Analysis of effective components and uses of extracts from baobab

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Abstract: *Baobab is a unique tropical plant, which is widely used because of its rich nutritional components and medicinal value. This paper analyzes the composition and method of the extract, and puts forward some theoretical basis for the use of practical cases, aiming to provide corresponding theoretical basis for the comprehensive utilization of baobab.*

Keywords: *Baobab, Extract, Active ingredient, use*

1. Introduction

Baobab is a tropical tree species that thrives in warm climates and exhibits tolerance to high temperatures. Frost significantly impacts the growth of baobab trees. These trees flourish in regions with annual precipitation ranging from 300 to 800 millimeters. Despite this, baobab trees demonstrate remarkable adaptability. While they prefer acidic to alkaline soils and well-drained, fertile conditions, they also thrive in clay and sandy soil environments. Baobab trees typically reach a height of approximately 20 meters, with the trunk base diameter ranging from 6 to 9 meters, and some specimens can achieve a diameter of up to 12 meters. The leaves of this tree are palmately compound, with leaflets that are oblong to obovate in shape, and the underside of the leaves is sparsely covered with stellate hairs. The petioles measure between 10 and 20 centimeters in length. Flowers of the baobab tree are solitary or paired, emerging from the upper leaf axils of the branches, and are accompanied by two bracts. The calyx is leathery, deeply divided into five segments, and is white in color, with a wrinkled texture. It is attached to the base of the stamen tube, which contains numerous stamens. The fruit is elongated and oval-shaped. Extracts from the baobab tree are rich in active compounds and offer various benefits, including use as a dietary supplement, promoting fat oxidation during weight loss, moisturizing properties, and antioxidant effects. Consequently, baobab extract is an ideal ingredient for numerous skincare products, helping to maintain skin hydration and enhance skin firmness. Additionally, its medicinal properties, such as its ability to clear heat and reduce swelling, provide valuable insights for the development of pharmaceuticals.[1]This article analyzes the effective components and uses of baobab extract to maximize the benefits of baobab and provide more services.

2. Effective components of baobab extract

2.1 Ingredients

Baobab extract contains a wealth of effective.The ingredients have brought many benefits to human health. These components are not only present in the dried leaves and young leaves of the baobab tree, but also widely distributed in its fruits and seeds, which together constitute the unique nutritional value of the baobab tree.

In the dried leaves of baobab, the protein content is as high as 13%-15%, which provides a rich source of amino acids for the human body, helping to maintain the normal function of muscles, bones and the immune system; The sugar content is between 60% and 70%, providing the body with sufficient energy sources to help maintain the needs of daily activities. Leaves are also rich in oils and ash, among which oils contain a variety of unsaturated fatty acids, which help to lower cholesterol and improve cardiovascular health. Ash contains a variety of mineral nutrients such as calcium, iron, potassium, magnesium, manganese, molybdenum, phosphorus and zinc, which play an indispensable role in maintaining normal physiological functions of the human body.

Although the protein content of young leaves is slightly lower than that of dry leaves, it also has

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nutritional value. Young leaves are rich in antioxidant substances such as vitamin A, vitamin C and beta carotene, which not only help to enhance immunity and prevent common diseases such as colds, but also protect eyes, skin and other organs from free radical damage and delay the aging process [2].

The fruit of the baobab tree is also a nutrient-rich natural food, the fruit contains a lot of sugar, cellulose and vitamin C, of which the content of vitamin C is extremely high, is 10 times that of the orange. Vitamin C plays an important role in enhancing immunity, promoting iron absorption and maintaining skin health. The fruit is also rich in protein and fat, providing comprehensive nutrition for the human body.

The seeds of the baobab tree are rich in fat, protein, sugar and cellulose and other nutrients, which provide energy for the human body, but also promote intestinal peristalsis, improve digestive function, help the body accelerate the metabolism of waste and toxins, and maintain a healthy body.

2.2 Extraction Method

Fruits and fruits of baobab are rich in polyphenols with high nutritional and medicinal value. Traditional extraction and purification methods are inefficient, which limits the development and utilization of baobab resources. In this paper, methods of extracting GBB (gamma-butyrobetaine, gamma-butyl betaine ethyl ester) from baobab trees are analyzed as follows:

Treatment process: The baobab fruit is thoroughly washed to remove surface impurities and possible pollutants to ensure the purity of the polyphenol compounds extracted later. The washed baobab fruit is dried at a drying temperature of 105 ℃ for 24 hours to ensure that the moisture is fully removed and the active ingredients are not destroyed by high temperatures. After the completion of drying, the grinding work is carried out, and the crushed baobab fruit is passed through the 20-mesh screen, the particle size of the 20-mesh screen is about 1mm, and the subsequent extraction effect will not be affected by too large or too small particle size.

Extraction method 1: Ultrasonic-Assisted Ethanol Extraction Method. The crushed BFS was extracted using an ultrasonic cell crusher. By optimizing parameters such as ethanol concentration, extraction temperature, and extraction time (e.g., 300 mL of 50% ethanol per 10 grams of BFS powder, with an amplitude set at 30% and temperature controlled at 60° C), efficient polyphenol extraction was achieved. The clarified liquid was then obtained through filtration, laying the foundation for subsequent purification steps. Extraction method 2: Hot water extraction method, the BFS powder is mixed with water in a certain proportion, heated to boiling and kept for a period of time. The extraction rate of polyphenols was effectively improved by three times extraction and combining with the liquid medicine, and then food grade diatomite was added for filtration to obtain the clarified liquid medicine. Compared with the two methods, ultrasonic assisted ethanol extraction method has higher extraction efficiency and higher extraction efficiency.

Separation and purification: This process is mainly to selectively adsorb and elute the liquid medicine through the macroporous resin column. The liquid medicine is passed through the treated D300 macroporous resin column at a flow rate of 1.5±0.1 BV/h to ensure that the liquid medicine can fully contact the resin, and at the same time to avoid insufficient adsorption caused by too fast flow rate. The resin column is rinsed with purified water. Until the electrical conductivity of the effluent drops below 50 μs/cm, this step is to remove unadsorbed impurities and other small molecules remaining in the resin column to ensure the purity of subsequent elution steps; After washing, the resin column is eluted with ethanol solution of a certain concentration to effectively destroy the adsorption force between polyphenol compounds and resin, enabling GBB (gamma-butyrobetaine ethyl ester) to desorption from the resin. In the elution process, effluent is collected, which is rich in target GBB. The collected effluent is concentrated under reduced pressure at 60 °C to remove excess ethanol and water. The concentration can be increased through reduced pressure concentration to facilitate subsequent drying.

As a polyphenol alkaloid extracted from baobab tree, GBB has the following advantages over other alkaloids:

Low cost: Baobab has abundant resources, strong adaptability to the growing environment, and short growth cycle of raw materials. Compared with other alkaloids, the extraction efficiency of GBB can reach 90%, and the extraction efficiency of other alkaloids can reach 75%. GBB has a wide range of raw materials and low cost, reducing production costs, and using GBB has stronger market competitiveness than using other alkaloids.

With regard to safety, the GBB activity index is high, and its toxicity index is rated at 5. Compared

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with other alkaloids, GBB demonstrates a higher level of safety. Additionally, GBB exhibits greater stability under various environmental conditions, and its biological activity is less likely to be compromised during the preservation process, making it easier to store and reducing associated costs. In the food industry, GBB serves as a natural antioxidant due to its excellent stability, effectively extending the shelf life of food while preserving its nutritional value..

Can be used in weight loss process, GBB as a dietary supplement, taken before exercise, can help dieters sweat, accelerate the burning of fat, through sweating, GBB also helps to speed up metabolism, so as to burn calories and fat more effectively, achieve weight loss purposes; GBB also helps to provide nutrients to damaged muscles, helping them to repair quickly after high-intensity exercise and reducing the damage caused by exercise.

In summary, GBB, as a polyphenol alkaloid extracted from baobab tree, showed significant advantages in bioactivity and stability compared with other alkaloids. Baobab extract also has the functions of antioxidant, moisturizing, anti-inflammatory, clearing heat and deswelling, flavoring, etc. Combined with L-carnitine, it also has the effect of weight reduction. In the third section of this paper, the use of extract is analyzed in detail.

3. Uses of baobab extract

3.1 Moisturize and improve skin

Seed oil, the extract of baobab tree, is a nutrient-rich natural oil, rich in a variety of fatty acids, such as palmitic acid (unsaturated fatty acid), oleic acid (monounsaturated fatty acid) and linoleic acid (polyunsaturated fatty acid), which are good for human health, linoleic acid as a natural component of sebum, It has a positive promoting effect in strengthening the skin lipid barrier and maintaining the normalization of skin metabolism. Combined with skin care products, it helps to prevent skin water loss, keep the skin hydrated, and is easy to be absorbed by the skin epidermal tissue, which can better protect skin water loss. Baobab seed oil has high permeability and nourishing properties, which can help the skin to restore elastic luster, such as for dry skin and skin with damaged barriers, can enhance the skin's natural barrier function, reduce water loss through the epidermis, and restore the skin to a healthy state. Upon cutaneous injury. The use of baobab extracts can promote the repair and regeneration of skin cells and reduce the depth of scars. For example, in the treatment of stretch marks, applying baobab seed oil to the parts where stretch marks appear every day can effectively prevent the formation of stretch marks. For stretch marks that have formed, they can also be applied and massaged to reduce their appearance and depth and help the skin to restore smoothness and firmness [3].

In order to verify the recovery effect of baobab seed oil on skin, baobab seed oil was combined with paraffin and petroleum jelly emulsion, and compared with the blank group with nothing added, the experiment was carried out on the legs, and the oil was applied twice a day for 12 consecutive days. According to the test results, baobab seed oil can improve the water content of the stratum corneum within 30 minutes. The specific experimental results are shown in Figure 1.

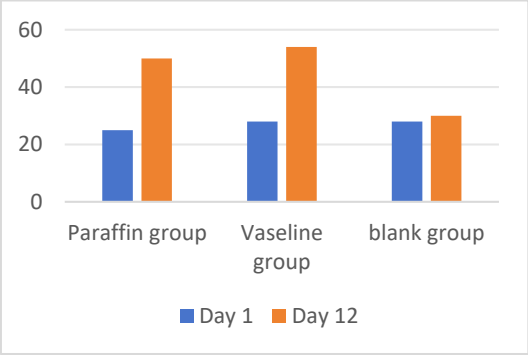

Figure 1. Display diagram of the water content of the cuticle

From the data in Figure 1, we can see that baobab seed oil can increase the water content of the stratum corneum in a short period of time, indicating that it has excellent instantaneous moisturizing effect, and for those who need quick relief from dry skin, natural ingredients are more easily absorbed by the skin, avoiding the side effects of using chemical ingredients. Analysis of the reason may be because it is rich in unsaturated fatty acids and antioxidant substances, maintain the integrity of the skin

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barrier, prevent water loss, baobab seed oil also has the role of promoting the metabolism of skin cells, accelerate the renewal of the stratum corneum, and make the skin more smooth.

3.2 Prevent pimples and acne from forming

Baobab seed oil contains a high percentage of linoleic acid, a fatty acid that is beneficial to human health. Linoleic acid plays an important role in moisturizing the skin, helping to improve the water balance of the skin and making the skin softer and smoother. The linoleic acid in baobab seed oil also contributes to the healing process of skin diseases and sunburns, and is also effective in treating acne vulgaris. In addition to linoleic acid, baobab seed oil is also rich in antioxidants such as highly unsaponifiable substances, 75% of which are beta-sitosterols, which are able to fight free radical damage and protect skin cells from oxidative stress, thus helping to treat skin diseases and injuries. Baobab seed oil also contains A variety of vitamins and minerals, such as vitamins A, E and F, which are also essential for the health of the skin and can stimulate the regeneration of cells and tissues, enhance the skin's resistance, and further promote skin repair and healing. Baobab seed oil also has the effect of reducing burn pain and speeding up the regeneration of epithelial tissue. This makes it excellent in the treatment of acne and inflammation, and is especially suitable for the care of oily and acne-prone skin.

Five subjects were organized to use skin care products containing baobab seed oil during the experiment, such as face cream and cleanser, which all contained baobab seed oil. The preliminary problems and post-use conditions of the subjects were recorded, as shown in Table 1.

Table 1 prevents formation of acne and acne from the data sheet

age-bracket	Experimental number	Skin properties	initial problem	utility time	After using
20-25	1	Oily skin	The acne is frequent	15 Days	The number of acne is reduced by 20%, and the skin oil secretion is balanced
				One month	The number of acne was reduced by 60%
	2	Combination	Mild acne	15 Days	Reduce acne resolution by 30%
				One month	Acne subsided, skin smoothness improved
	3	dry skin	Occasionally acne	15 Days	40%
				One month	Skin oil secretion regulation, acne did not appear again
	4	Sensitive	Pink thorns and red spots	15 Days	Acis reduced by 20% and erythema by 20%
				One month	Reduced acne, reduced erythema, and increased skin tolerance
	5	Mature skin	Aging acne	15 Days	Acne was improved by 30%
				One month	Significant improvement in acne, and increased skin elasticity
20-25	1	Oily skin	The acne is prone to	15 Days	The number of acne outbreaks decreased
				One month	The acne has no obvious trace, and the skin is smooth
	2	Combination	acne and acne	15 Days	Acne resolution decreased by 30% and acne decreased by 35%
				One month	Acne, acne subsided, smooth skin
	3	dry skin	Pink thorns occasionally	15 Days	The number of acne episodes has decreased
				One month	The acne did not appear again
	4	Sensitive	Acne is more severe	15 Days	Acne fade 20%
				One month	There is no obvious trace of acne and increased skin tolerance
	5	Mature skin	Acne, mild acne	15 Days	Acne improved 50% and acne 50%
				One month	Acne and acne improve significantly, while skin elasticity and smoothness increased

3.3 Hair care

Baobab seed oil is rich in vitamin E and high in fatty acids, which can play an excellent role in nourishing and repairing dry, brittle and split hair. Baobab seed oil can effectively smooth the rough parts of hair and provide much-needed moisture and nutrients to damaged hair, thanks to its fatty acid content, which can deeply nourish hair and restore its elasticity and shine. The antioxidant effects of vitamin E

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also help protect hair from free radical damage and delay the aging process of hair. Baobab seed oil can also help relieve itching caused by dandruff, which is often accompanied by dry and itchy scalp, while baobab seed oil can moisturize the scalp and improve the scalp environment, thereby reducing or avoiding scalp itching.

Baobab seed oil is very easy to use as a hair care oil. Just apply it directly to the scalp and hair, then wear a shower cap and leave it for 1-3 hours, and finally wash it with shampoo. This method can make the hair fully absorb the nutrients of the baobab seed oil, making the hair softer and smoother, as silky. Five participants were organized and their hair care process using baobab seed oil was recorded, and the data in Table 2 were obtained.

Table 2 Monkey bab seed oil as hair care oil

age-bracket	Experimental number	Hair type	Before use	After using	utility time
20-25	1	straight hair	Forked, rough and dry	smooth and soft	15 Days
	2	straight hair	Forked, rough and dry	Soft and shiny	30 Days
	3	buckle	Fury and difficult to manage	smooth and soft	15 Days
	4	buckle	Fury and difficult to manage	Easy to comb, elastic	30 Days
	5	sofa	Dark, dry	glossy	15 Days
	6	sofa	Dry, dim	More dense and shiny	30 Days
25-30	1	straight hair	It's greasy and shiny	fresh and cool	15 Days
	2	straight hair	It's greasy and shiny	Fresh and shiny	30 Days
	3	buckle	Soft and vulnerable	Strong hair quality	15 Days
	4	buckle	Soft and vulnerable	Hair quality is strong and tough, and it is not easy to be damaged	30 Days
	5	wavy hair	Rough, inelastic	smooth and soft	15 Days
	6	wavy hair	Rough, inelastic	Smooth and elastic	30 Days

3.4 Food

Baobab extract can be used as a refreshing drink and condiment ingredients, add a unique flavor at the same time, but also can bring a positive effect on human health, such as a drink added baobab extract, every 100 ml beverage contains 5 grams of baobab extract, its nutrients such as vitamin C, 20 mg per 100 ml; Potassium contains 50 mg per 100 ml; Improve the nutritional content of the drink. According to market research, 90% of consumers believe that the drink has a unique taste, refreshing and thirst quenching effect.

The young leaves of the baobab tree, which are highly nutritious, can be utilized as vegetables in various culinary preparations such as salads, soups, and sauces. These dishes are not only flavorful but also rich in a variety of vitamins, offering significant health benefits to humans. In particular, the young leaves are commonly incorporated into salads, with each serving containing 50 grams of baobab leaves. Each 100 grams of young leaves provides 2.5 grams of protein and 100 milligrams of calcium. As a result, this salad has gained popularity among health-conscious consumers, leading to a steady increase in sales..

The leaves of the baobab tree can also be ground into powder after drying, which can be used as raw materials for making pickles. The powder can not only increase the flavor of dishes, improve the taste, but also add characteristics to food and enhance the nutritional value of food. 50 grams of baobab leaf powder is added to each kilogram of pickled vegetables, which improves the taste of pickles at the same time, so that pickles are rich in vitamins, and are well received in the market. [4].

3.5 Medical Aspects

Each part of the baobab tree has a unique medicinal value, the leaves can be used to treat a variety of diseases, such as kidney and bladder diseases, asthma, fatigue, abdominal pain, tumors, diarrhea, trauma, insect bites and inflammation, can also be used to produce fever, cancer and heart disease treatment is

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also helpful; The bark of the baobab tree is used in a wider range of applications to prevent colds, treat toothaches, fevers and dysentery. The bark of the baobab tree is also used as a painkiller and to treat diseases such as diabetes and polyuria. Seeds, roots and other parts also have certain medicinal value, as shown in Table 3.

Table 3 Related cases

application area	effect	Data cases
Raising stomach and gallbladder	Promote digestion and improve gastrointestinal function	In clinical trials for patients with stomach problems, 85 percent of patients treated with baobab extract reported significantly improved stomach problems after a month of continuous use, according to the survey data.
clearing heat for detumescence	Reduce inflammation, detumescence and relieve pain	Data from arthritis patients with daily drugs containing baobab extract showed that 70% had significantly less swelling and pain in their joints within two weeks.
Stop bleeding and diarrhea	Shorten the time for hemostasis and relieve the diarrhea	According to survey data, treatment for mild diarrhea caused by indigestion cut the average time to antidiarrhea down to two days.
tranquilizing and allaying excitement	Relieve anxiety and promote sleep	In a study involving patients with insomnia, 60% of patients using baobab extract as adjuvant therapy, reported improved sleep quality and significant relief of anxiety.
anti-aging	Improve immunity and delay aging	A long-term study showed that people who had long consumed foods or extract supplements containing baobab extracts had more immunity and showed slower signs of skin aging than those who did not.
Cancer treatment	Inhibition of gastric cancer cell formation and expansion	The substances extracted from baobab trees showed the inhibition of gastric cancer cells in vitro, effectively inhibiting their proliferation and spread, providing a new potential source of drugs for cancer treatment.
Anti-inflammatory drugs	Treatment of skin inflammation and trauma	In some areas of Africa, local residents use the serous fluid of baobab leaves and fruits as anti-inflammatory drugs to treat skin inflammation and mild trauma, which has a long history.
Paper making, mat weaving and rope making	Using the cellulose in the bark	The bark of baobab is rich in cellulose, which can be used in paper making, mat weaving and rope making, and has the advantages of environmental protection and sustainable utilization.

The pulp can prevent dysentery and promote perspiration, which indirectly indicates that the use of the pulp and extract of the baobab tree helps to accelerate the body's metabolism and detoxification process, and when the body sweats, the metabolism will be increased, thus playing a certain auxiliary role in burning fat [5]. Simply eating the flesh of the baobab tree cannot directly lead to fat burning. It is necessary to combine living habits and exercise amount, etc. L-carnitine can be combined with the pulp extract of the baobab tree to achieve the effect of fat burning while meeting the substances needed by the human body. The combination of baobab pulp extract and L-carnitine has a positive effect on weight loss:

As a dietary supplement, GBB plays a positive role in weight loss. As a bioactive compound, GBB can promote the oxidative decomposition of fat and help to transport long-chain fatty acids to mitochondria for oxidative metabolism, thus converting fat into energy. This process has a positive impact on weight loss and body fat reduction, and the effect is more significant when combined with reasonable diet and moderate exercise. In the process of exercise and weight loss, lactic acid accumulation limits the endurance of exercise. GBB can optimize energy metabolism and effectively reduce lactic acid accumulation, thus alleviating fatigue symptoms during exercise. Assisting individuals in weight loss through exercise can help them more effectively manage the fatigue induced by physical activity, prolong exercise duration, and enhance the overall quality of exercise.GBB also helps to control appetite and reduce people's cravings for high-calorie foods, which is the key to weight loss success and better achieve weight loss goals.

L-carnitine, as a naturally occurring amino acid derivative, plays a role in promoting the oxidative decomposition of fatty acids in the human body. By increasing the intake of L-carnitine, the metabolic process of fat can be effectively accelerated and the accumulation of fat in the body can be reduced. The extract of baobab pulp is rich in various nutrients and can cooperate with L-carnitine to play a better role. In this paper, weight loss data of five persons using L-carnitine and baobab pulp extract GBB (gamma-butyrobetaine ethyl ester) are collected. The process of the extract was developed by SYNMR BIOTECHNOLOGY (SHANGHAI) LIMITED and is scientific, as shown in Figure 2.

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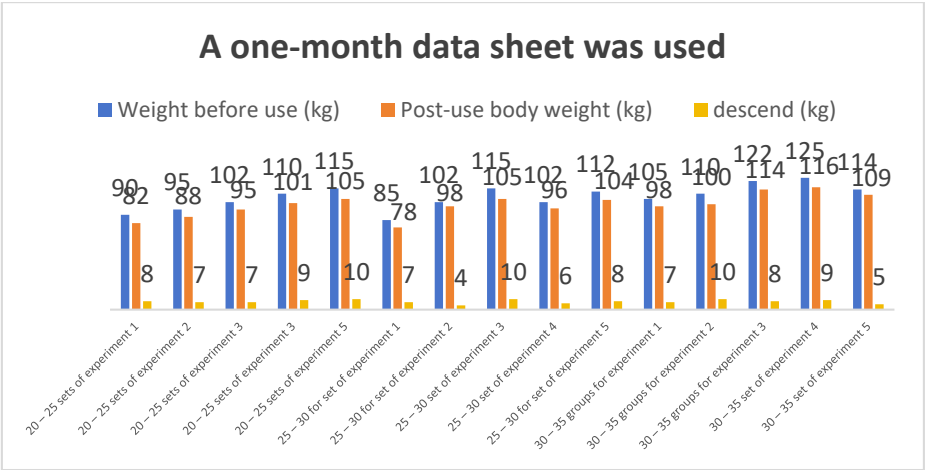

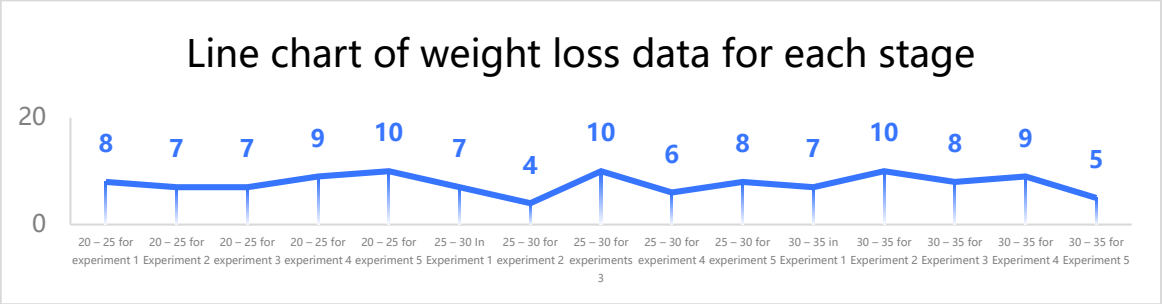

Figure 2 Weight loss data diagram

GBB helps to improve the metabolic rate of the human body by accelerating the process of fat metabolism and increasing the body's heat consumption, thus effectively burning calories and helping people achieve the goal of weight loss. Two 25-year-old dieters were tested, one using GBB and the other not using GBB, and the data of sweating and heat consumption during exercise were recorded and compared. See the effect of GBB, as shown in the data in Table 4.

Table 4 compares the used and unused data

experimenter	GBB	Exercise time (minutes)	Sweating capacity (g)	Calories consumed (kcal)	Body temperature after exercise (℃)
Experimenter A	Use	45	1200	500	37.1
Experimenter B	unused	45	850	400	36.5

It can be seen from the data that the amount of sweating with GBB is 1200 grams, and the amount of sweating without GBB is 850 grams, indicating that the use of GBB will produce more sweat during exercise, proving that GBB will increase the sweating effect, and the high calorie consumption will also promote the metabolic rate and accelerate the burning of fat. In order to verify the accuracy of the data, a one-month experiment was conducted on two men aged 25 and two aged 30. Various data were strictly recorded and weight loss was compared, so as to verify the effectiveness of GBB in the process of weight loss. Specific data are shown in Table 5.

Table 5 Comparison of weight loss data in one month

age	Use of GBB	Initial weight (kg)	Weight loss (kg)	Weight loss (kg)	Exercise time (minutes)	Sweating capacity (g)	Calories consumed (kcal)	Body temperature after exercise(℃)
25	Use	80	74	12	45	1300	550	37.5
25	unused	82	79	6	45	950	480	36.7
30	Use	85	80	10	45	520	530	37.3
30	unused	84	82	4	45	490	490	36.9

In terms of weight loss, the men who used the extract from the baobab tree showed more significant weight loss results. For sweating and calorie consumption, the men who used the extract from the baobab tree sweated more and consumed more calories in the same exercise time; in terms of body temperature after exercise, the men who used the extract from the baobab tree had slightly higher body temperature, which accelerates the process of fat metabolism. This verifies that the extract from the baobab tree has the function of increasing body heat and accelerating fat metabolism in weight loss, and the experimental

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personnel who used the extract from the baobab tree said that their desire for food was reduced and they did not feel too tired after exercise. Therefore, from the analysis of the data, the extract from the baobab tree has a positive promoting effect on weight loss and has no adverse effects.

4. Conclusion

The baobab tree, as a natural plant resource, has broad application prospects in many fields with its effective components extracted. With people's increasing pursuit of a healthy lifestyle, the value of baobab tree extracts is being widely utilized. To fully utilize the value of baobab tree extracts, it is necessary to strengthen the development and utilization of its effective components, and explore more potential application areas to improve the purity of the extracts.

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