

Job's Tears: A Comprehensive Review of Its Traditional Uses, Nutritional Composition, And Pharmacological Potential

T. K. Bhoomika, S. Suhas*

Department of Food Science and Nutrition, Bharathi College (Autonomous), Bharathinagara, Mandya

ABSTRACT

Job's Tears (*Coix lacryma-jobi* L.) is a perennial grass from the Poaceae family, recognized as both a nutritious cereal grain and a medicinal crop with deep roots in traditional Asian medicine. It has been widely consumed in forms such as porridge, beverages, and as a rice substitute, while also being used therapeutically for wounds, urinary tract infections, and inflammatory disorders. Rich in proteins, lipids, carbohydrates, and bioactive compounds, Job's Tears holds promise as a functional food and a potential alternative to staple grains. Its pharmacological properties including anti-inflammatory, antioxidant, hypolipidemic, and immunomodulatory effects have garnered scientific interest, prompting further exploration into its health benefits. This review consolidates knowledge from literature and traditional accounts, examining its botanical characteristics, historical cultivation, food applications, nutritional profile, medicinal uses, and pharmacological activities. The aim of the review is to provide a comprehensive understanding of Job's Tears, a versatile grain with expanding relevance in contemporary nutrition and medicine.

Keywords: Antioxidant, Bioactive compounds, Complementary medicine, Functional food

INTRODUCTION

The Poaceae family, commonly known as grasses, is one of the largest and most ecologically significant families of monocotyledonous flowering plants, comprising approximately 780 genera and around 12,000 species. It ranks as the fifth largest plant family globally, surpassed only by Asteraceae, Orchidaceae, Fabaceae, and Rubiaceae [1]. Within this diverse family, the genus *Coix* L. holds particular importance. The name "Coix" is derived from the Greek word "koix," meaning "palm," a term used by Theophrastus. The genus *Coix* is believed to have originated in the hilly tracts of Northeastern India and Myanmar, a region characterized by remarkable genetic diversity of wild *Coix lacryma-jobi* and *Coix aquatica* [2]. *Coix lacryma-jobi* L., the botanical name for Job's Tears, derives its common name from the distinctive tear-drop shape of its seeds (technically, hardened, bead-like false fruits or utricles). The species name "lacryma-jobi" translates from Latin as "Job's tears," alluding to the biblical figure Job and his suffering. The seeds are also known by various other names including Adlay, Chinese pearl barley, coix

seed, and Yi Yi Ren (in Chinese). This small herbaceous plant produces these unique seeds which serve as a food source and have also been traditionally used to create rosaries and other ornamental items due to their natural perforation, durability against moisture, and symbolic tear-like appearance [3-5]. Cultivated for thousands of years [6], Job's Tears has been extensively grown in China and Japan, valued for its nutritional properties and as a food supplement [7]. The grains are a common sight in Asian markets, sold for culinary purposes [6]. While sometimes mistakenly identified as a type of barley (e.g., "Asian barley" or "Asian pearl barley") due to similarities in appearance, density, mineral richness, and culinary versatility, Job's Tears belongs to a distinct botanical genus, although both are members of the Poaceae family [6]. For centuries, this plant has been esteemed for its medicinal properties. Traditional medicine systems have utilized it as a natural diuretic, stomachic, analgesic, anti-arthritic, and antispasmodic agent [8]. It has also been traditionally employed to regulate blood cholesterol levels, and for its anti-inflammatory, antioxidant, hypolipidemic, and purported anticancer properties, as well as to

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alleviate menstrual disorders in women [9]. The seeds are nutritionally rich, containing approximately 50-79% starch, 16-19% crude protein, and 2-7% lipids, which include various fatty acids crucial for human physiological processes [9]. Furthermore, Coix seeds are a source of essential amino acids and a diverse array of bioactive compounds, including coixenolide, coixol, triglycerides, various fatty acids, and triterpenes [7]. The primary bioactive compounds believed to be responsible for many of its medicinal properties are polyphenols and polysaccharides, which have demonstrated immunomodulatory, antioxidant, and anti-inflammatory effects [7, 10-12]. Preliminary research suggests that consumption of dehulled Job's tears flour and seeds can improve lipid metabolism, potentially reducing the risk of heart disease, decrease liver fat accumulation, and offer protection against tumour-stimulating compounds [8]. Some studies have indicated that Adlay possesses anti-tumour properties, with bioactive compounds like berberine showing potential tumour-suppressing effects [13]. Beyond its utilitarian roles, Job's tears plants are also cultivated for ornamental purposes, and Western gardeners may often be unaware that the large grains produced by these grasses are edible [6].

2. Botanical Description

Coix lacryma-jobi is an upright, robust, perennial (often cultivated as an annual) grass that typically grows to a height of 1 to 3 meters [14].

2.1. Morphology and Growth Habit

The plant is characterized by stout, erect or ascending culms, which may exhibit branching. The leaf sheaths are smooth, while the leaf blades are long, broad, and narrowly lanceolate, measuring 20–50 cm in length and 1.5–4 cm in width. A prominent pale midrib runs along the blade, and a short membranous ligule is present at the base [14].

2.2. Inflorescence and Reproduction

Job's Tears is monoecious, meaning it produces separate male and female flowers on the same plant. The inflorescences can be either axillary or terminal, and consist of multiple racemes. Each raceme comprises a basal female spikelet, enclosed in a hardened, bead-like involucre and an apical male

portion, bearing spikelets in pairs or triplets. The female spikelet, enclosed within an ovoid or globose, tear-shaped involucre, matures into the characteristic "seed" or "tear." These structures typically measure 8–12 mm in length and 6–10 mm in width. The male spikelets, borne in short racemes, protrude from the apex of the involucre and are generally found in pairs or triplets, with one sessile and the others pedicelled. Each male spikelet consists of two flowers [14].

2.3. Fruit and Seed Development

Botanically, the "seed" of Job's Tears is a false fruit (caryopsis) enclosed within a polished, hardened involucre. These tear-shaped involucres vary in color—white, bluish-grey, brown, or black—upon maturation. A natural hole at the apex accommodates the emergence of the male spikelets, while another at the base facilitates detachment, making them ideal for use as beads in traditional crafts [3,5,14].

2.4. Flowering and Fruiting Cycle

The plant follows a seasonal reproductive pattern, with flowering occurring between July and October, and seed ripening from September to November. This timeline is crucial for optimizing cultivation practices and ensuring seed availability for nutritional and medicinal applications [14].

HISTORY AND CULTIVATION

3.1. History

The cultivation of Job's Tears dates back at least 4,000 years in Southern India, where its seeds are commonly found in archaeological sites, often in proximity to ancient rice fields, leading archaeologists to refer to them as "rice beads." Despite its utility, in commercial rice cultivation, it can be considered a weed. The unique structure of the seeds, with their hard, shiny coat and natural perforations, made them ideal for stringing into beads. In Japan, these seeds are known as "juzudama," meaning "prayer beads," reflecting their use by Buddhists for meditation [6]. By the 1400s, Job's Tears was being cultivated in Southern European monasteries, where it acquired the name "Lachrima Job" (Job's tears). The seeds are naturally white but can be dyed in various colors like red, blue, green, and yellow. The plant is known by several

evocative names globally, including David's tears, Saint Mary's tears, and Christ's tears [6]. Job's Tears was introduced to China around the first century A.D. by a Chinese general who, after conquering Tongking (present-day northern Vietnam) where the grain was widely used as a cereal, became so fond of it that he transported several cartloads of seeds back to his homeland [6]. The leaves have also served as fodder in parts of India, being particularly relished by elephants. In Central America, the seeds have been used in crafting small seed dolls and were reportedly given to teething babies [6].

3.2. Cultivation

Job's Tears is adaptable and thrives in ordinary garden soil, preferring an open, sunny border with some shelter from strong winds. It can tolerate a wide pH range, typically between 4.5 and 8.4. The ideal average annual temperature for its growth is between 5°C and 10°C (41°F and 50°F) [15]. Propagation is usually by seed. Seeds are often soaked in warm water for about 2 hours before sowing. They can be sown in a greenhouse in February or March, or directly in situ in May after the last expected frosts. Germination typically occurs within 3 to 4 weeks at a temperature of around 14°C (57°F). When seedlings are large enough to handle, they should be pricked out into individual pots and grown on in cool conditions before being planted out in late spring [15]. In a suitable climate, the plants take about 4 to 5 months from sowing to produce new seeds. The crop is harvested when the grains mature, typically 4 to 5 months after sowing. The plants are cut at the base, and the grain is separated by threshing. The harvested seeds are then dried in the sun prior to milling to remove the husks [15].

3.3. Economic Value

The cultivated types of Job's Tears have stiffening roots that are very durable and can be made into twine or binding material. The seeds of wild species are widely used by villagers to create various types of decorations, including rosaries, earrings, curtains, bracelets, and photo frames [16]. Many Asian markets sell the grains for cooking. Beaders and craftspeople also utilize the grains, which can be found in beading and craft stores. The plant is also cultivated as an ornamental, and Western gardeners may not always

be aware that the large grains produced are edible [6,17].

4. Nutritional Profile and Food Uses

4.1. Nutritional Composition

Job's Tears is recognized for its impressive nutritional profile, making it a valuable food resource. The seeds are rich in macronutrients, micronutrients, and bioactive compounds.

● **Macronutrients:**

Starch comprises the largest portion, ranging from 50% to 79% of the seed's dry weight [9,18]. Contains a significant amount of protein, typically 16-19% (some sources state 9.1-23.0g per 100g edible portion). The primary protein is coixin, which is rich in proline and leucine but relatively low in lysine [19]. The fat content ranges from 2% to 7% (some sources state 0.5-6.1g per 100g). This includes glycolipids (approx. 5.67%), phospholipids (approx. 1.83%), and various fatty acids such as palmitic acid, stearic acid, oleic acid, and linoleic acid [9,18]. Overall carbohydrate content is high, ranging from 58.3g to 77.2g per 100g. Contains dietary fiber, with values reported from 0.3g to 8.4g per 100g [18,20].

● **Micronutrients:**

A source of B vitamins (thiamine/B1, riboflavin/B2, niacin/B3) and vitamin E. Ascorbic acid (vitamin C) has also been reported [19,21]. Rich in various minerals including calcium (reportedly higher than in other seeds), phosphorus, iron, potassium, magnesium, zinc, copper, and selenium [19,21].

● **Other Components:**

Typically contains moisture of 10.83% to 15.0g per 100g. Ash, around 0.7g to 2.6g per 100g. The flour contains about 2.25% amylase [19]. Two sterols, stigmasterol and campesterol, have been isolated [21]. Bioactive Compounds such as Coixenolide and coixol have been extracted from the fixed oil. The roots contain bioactive benzoxazinone compounds [18,20]. A 100g edible portion of husked Job's Tears grain provides an energy value of approximately 1500 kJ. It is considered a type of green food that is high in protein, medium in fat and sweetness, and high in

zinc. Notably, Job's Tears seeds contain all eight essential amino acids in proportions very close to human nutritional needs, and these amino acids are reported to be more easily absorbed and utilized by the body compared to those in rice. Its rich nutrient content and high caloric value support metabolism and can reduce digestive burden, making it an excellent restorative food for individuals recovering from illness or those with weakened health [21]. Despite being a minor crop globally, Job's Tears is a nutritious grain, generally containing more fat and protein than rice and wheat [22].

4.2. Food Uses

Job's Tears has a long history of culinary use, particularly in Southeast Asia, China, and India. Both sticky (glutinous) and non-glutinous varieties are grown and consumed [22].

- **Grain Preparations:** After peeling and cleaning, the ripe seeds are commonly boiled or steamed and eaten similarly to rice, often mixed with cooked rice [23].
- **Flour Products:** The ground flour can be mixed with water and consumed as a refreshing drink (e.g., with ice). It is also used in baking; while dough made exclusively from Job's Tears flour will not rise due to the absence of gluten, a recommended mixture for bakery purposes is 70% wheat flour and 30% Job's Tears flour. This blend is suitable for preparing bread and biscuits [24].
- **Beverages:**
 - **Non-alcoholic:** In China and Thailand, the seeds are boiled with water to make a drink, sometimes sweetened, available in markets as a healthy beverage [23,24]. In Japan, the seeds are processed into buttermilk-like and cider-like beverages called “Dzu” and Roasted grains can be used as a coffee substitute [25].
 - **Alcoholic:** Fermented grains are used to make beer and wine. The Garo, Karbi, and Naga tribes in India use crushed grains to make beer [23].
- **Soups and Desserts:** In China, Job's Tears is commonly added to soups [23]. A popular dessert in Thailand involves mixing Job's Tears with sugar and coconut milk [23,25].
- **Other Uses:** Raw grains are sometimes used similarly to peanuts [23]. In Western cultures, hulled grains are used to bake biscuits [25].

5. Traditional and Agricultural Uses

5.1. Animal Feed

Job's Tears serves as a nutritious feed for livestock. Naga farmers in Northeast India traditionally grew Job's Tears to be fermented for beverages but also used it as pig and chicken feed. As a locally-sourced animal feed, it can be fed to animals when ground, broken, or as a whole grain. PROTEA reports that Job's Tears flour can replace maize flour in poultry feed [22].

5.2. Forage

For forage purposes, the Food and Agriculture Organization (FAO) notes that Job's Tears green material is very palatable. Nutritional information for fresh, early vegetative Job's Tears growth in India indicates: 29.9% dry matter, 8.5% crude protein, 27.9% crude fibre, 8.96% ash, 2.7% ether extract, and 51.9% nitrogen-free extract. The FAO also reports that in India, Job's Tears forage yields about 13.9 tons of green material per hectare. The Indian Grassland and Fodder Research Institute offers forage varieties like 'Bidhan Coix 1', suitable for cultivation in West Bengal, Orissa, Assam, and north Bihar, with an average green fodder yield of 34.6 t/ha and a dry matter yield of 6.9 t/ha. Several cuts of Job's Tears fodder per year are possible [22].

5.3. Traditional Medicinal Uses

Job's Tears is a cornerstone of Chinese traditional medicine and has been used in Indian traditional medicine as well.

- **Traditional Chinese Medicine (TCM):** In TCM, Coix seeds (Yi Yi Ren) are considered sweet in taste and cold in nature. They are attributed with properties of strengthening the spleen, promoting diuresis (resolving dampness), clearing heat,

expelling pus, and detoxification. They are used to treat conditions such as pulmonary edema, wet pleurisy, chronic gastrointestinal diseases, chronic ulcers, dysuria (painful urination), diarrhea, and to eliminate dampness [26, 27]. Coix seeds are also valued for their cosmetic effects, believed to keep the skin lustrous and delicate, and to eliminate acne, freckles, senile plaques, pregnancy spots, and butterfly spots. They are also considered effective for hemorrhoids and rough skin [23, 28].

- **Gastrointestinal Issues:** The plant is utilized for common gastrointestinal symptoms including diarrhea and dysentery. The seeds are specifically given for enteritis and persistent diarrhea in children. It has also been used in the treatment of acute appendicitis [29,23].
- **Anti-parasitic:** The seeds act as a vermifuge and are used to treat worm infestations, while the roots are specifically given for ascariasis [29].
- **Respiratory Conditions:** A decoction of *C. lacryma-jobi* is believed to be beneficial for respiration. The seeds are used in the treatment of various pulmonary conditions including bronchitis, pleurisy, pneumonia, pulmonary abscess, hydrothorax, and lung cancer. An infusion of the seed is prescribed for bronchitis, pulmonary abscess, and hydrothorax [23,29].
- **Urinary Complaints:** The seeds and roots possess diuretic properties and are used in the treatment of urinary complaints [29].
- **Anti-inflammatory and Antibacterial:** Traditional practitioners recognized its anti-inflammatory and antibacterial properties, utilizing them in the treatment of infective processes like appendicitis, tuberculosis, gonorrhea, leucorrhoea, puerperal fever, and as mentioned, in pulmonary and urinary tract infections [29].
- **Cancer and Skin Affections:** The fruits are given for intestinal and lung cancers, cervical and chorionic epithelioma, and viral skin affections like warts, verruca plana, and eczema [23,29].

- **Other Conditions:** The roots are used in the treatment of fever with drying of saliva and intense thirst, edema, beriberi, amenorrhoea, and jaundice [23,25,29].

6. Medicinal Values and Pharmacological Activities

Scientific research has begun to investigate the traditional claims, revealing a range of pharmacological activities.

6.1. Central Muscle Relaxant Activity

Coixol (6-methoxybenzoxazolone), a pharmacologically active compound isolated from *Coix lacryma-jobi* L., has demonstrated central muscle relaxant properties. Studies in mice and rats showed that Coixol could decrease locomotor activity and produce hypothermia. It potentiated thiopental-induced sleep, attenuated acetic acid-induced writhing syndrome, increased the threshold of jumping response to foot shock, and prevented convulsions induced by maximal electroshock. EEG studies indicated that Coixol could induce drowsy patterns and inhibit EEG arousal response to external auditory stimuli, though it failed to suppress arousal from midbrain reticular stimulation. These findings suggest Coixol acts as a central muscle relaxant with an anti-convulsant effect similar to chlorzoxazone [30].

6.2. Anti-inflammatory Activity

Several benzoxazinoids isolated from the roots of *Coix lacryma-jobi* L. have been found to exhibit anti-inflammatory activity. Research indicates that a free hydroxyl group at the 2-position in the benzoxazinone skeleton is important for the expression of this inhibitory activity [31]. The methanolic extract of the seed has also been shown to inhibit the production of nitric oxide and superoxide ions in activated macrophages in vitro, supporting its traditional use for inflammatory conditions [32,33].

6.3. Effects on Lipid Metabolism and Anti-Obesity Potential

Studies in male rats suggest that *Coix lacryma-jobi* L. may exert beneficial effects on lipid metabolism. It is proposed to have an inhibitory action on cholesterol

synthesis in the liver, a facilitating effect on the biliary excretion of triglycerides, and an acceleratory action on phospholipid synthesis in the liver [34]. Crude extracts of the seeds have been shown to modulate the expression of leptin and TNF-alpha, and to reduce body weight, food intake, fat cell size, adipose tissue mass, and serum hyperlipidemia in obese rats, suggesting potential for anti-obesity therapy. Further research indicates that water extracts of the seed exhibit anti-obesity activity by regulating neuroendocrine activity in the brain [35]. Seed oil has been found to decrease low-density lipoprotein cholesterol (LDL-C), insulin, and leptin levels, as well as Thiobarbituric Acid Reactive Substances (TBARS) concentrations in rats after 4 weeks of feeding [36].

6.4. Anti-diabetic Activity

Screening studies of anti-diabetic plants have indicated that *Coix lacryma-jobi* possesses hypoglycemic effects. This was confirmed in studies where dehulled seeds of *Coix lacryma-jobi* reduced blood glucose levels in diabetic rats [36,37]. The fiber content in Job's Tears may contribute to its anti-diabetic effect by decreasing the absorption of fat and cholesterol [38-40]. Mechanistically, Job's Tears may lower blood sugar levels by increasing the activity of enzymes such as hexokinase and glucose-6-phosphate dehydrogenase, while decreasing the levels of enzymes like glucose-6-phosphatase and fructose-1,6-bisphosphatase [38,40,41]. Coixans A, B, and C (glycans from Job's Tears) exhibited marked hypoglycemic effects in normal and alloxan-treated hyperglycemic mice, with Coixans showing the strongest activity [32,33].

6.5. Macrophage Activation Activity

Water extracts of Job's Tears seeds and several separated components have been studied for their effects on murine peritoneal macrophages infected with *Toxoplasma gondii*. The addition of these modulators enhanced the production of nitrite by macrophages. There was an inverse relationship between the amount of nitrite produced and the phagocytic index of macrophages, as well as the fold increase of tachyzoites in the macrophages. This suggests that certain components of the seeds may activate macrophages through the induction of nitric

oxide, contributing to biostatic activity against pathogens [42].

6.6. Cytotoxic and Anti-Cancer Activity

Numerous studies have investigated the cytotoxic activity of Job's Tears seeds against various cancer cell lines, including lung, colon, pancreatic, and breast cancers, as well as hepatoma. The acid fraction of an acetone extract was found to have anti-tumor activity against transplantable mouse tumors. This acid fraction was identified as containing four free fatty acids: palmitic acid, stearic acid, oleic acid, and linoleic acid [8,43]. Both alcoholic and acetone extracts of Coix seed, particularly coixenolide, inhibited the growth of Ehrlich Ascites Carcinoma (ECA) in mice. Acetone extractives also showed marked inhibitory effects against murine uterine cervix carcinoma-14 (U-14) and hepatoma, as well as anti-mutagenic effects against Aflatoxin B1 mutagenesis. A neutral lipid component of the seed inhibited the growth of two human pancreatic cancer cell lines (PaTu-8988 and SW1990) via apoptosis induction and/or gene expression regulation [32,33]. Kanglaite, a neutral lipid extract from the endosperm, has been endorsed by the Chinese government as a treatment for lung, liver, stomach, and breast cancers [43]. Studies have also shown that Coix seed extracts can increase peripheral cytotoxic T cells and NK cells [44,45].

6.7. Anti-osteoporotic Activity

Water extracts of Job's Tears seeds have shown potential in combating osteoporosis. In cultured metaphyseal tissues, the extract could reverse the decreased alkaline phosphatase activities and calcium levels, and increased tartrate-resistant acid phosphatase activities induced by parathyroid hormone. In vasectomized rats, it demonstrated an ability to reverse osteoporotic effects [45].

6.8. Other Pharmacological Activities

- **Antioxidant Activity:** Coix hull isolates have demonstrated free radical scavenging activity in DPPH assays. Alcohol extracts retarded the oxidation of linoleic acid in vitro [32,33].

- **Antimicrobial and Antiviral Effects:** Some studies suggest Job's Tears possesses antimicrobial activity against various bacteria and fungi, and potential antiviral activity, though more research is needed [32,33].
- **Anti-allergic Effects:** Adlay bran extract has been shown to reduce histamine release and cytokine production, suggesting anti-allergic mechanisms [46].
- **Immunomodulatory Effects:** Bioactive compounds in Job's Tears may help regulate the immune system [7,10,12].
- **Effects on Uterine Contractility:** Water extracts of the seeds induced spontaneous uterine contractions in isolated pregnant rat uteri. This action was attributed to the induction of COX-2 protein expression and enhancement of extracellular signal-regulated protein kinase [44,47].
- **Hormonal Effects:** The methanolic extract of adlay decreased progesterone production in rat granulosa cells [32,33].
- **Antidiabetic medications:** Due to its hypoglycemic effects, concurrent use may increase the risk of hypoglycaemia [38,39].
- **Central muscle relaxants (e.g., chlorzoxazone):** Coixol has similar activity, potentially leading to additive effects [30].
- Other potential interactions (e.g., with dextromethorphan, diltiazem, theophylline) have been suggested, warranting caution [48].

7.4. Other Precautions

It is generally recommended that individuals with a weak stomach or dry stools are sometimes advised to use with caution in TCM. Allergic reactions are possible, though rare. It is also generally recommended to discontinue use at least two weeks before any scheduled surgery due to potential effects on blood glucose and other physiological parameters.

LIMITATIONS

While traditional use and preclinical studies (in vitro and animal models) show significant promise for the medicinal applications of Job's Tears, a major limitation is the scarcity of robust human clinical trials. Many of the health benefits are extrapolated from animal studies, and their direct applicability to human health requires further confirmation.

9. Recommendations for Future Studies

Future studies on Job's Tears should focus on human clinical trials to validate its efficacy and safety, bioactive compound identification to understand mechanisms of action, standardization of extracts for consistent therapeutic use, and long-term safety assessments to ensure its medicinal viability. Additionally, pharmacokinetic studies will clarify absorption and metabolism, while agricultural improvements can enhance its nutritional and medicinal properties.

CONCLUSION

Job's Tears (*Coix lacryma-jobi* L.) is a highly nutritious grain with a rich history in Asian traditional medicine. It boasts high protein content, essential amino acids, beneficial lipids, and micronutrients,

7. Safety and Considerations

7.1. Pregnancy and Breastfeeding

The observed abortifacient activity (induction of uterine contractions and embryo toxicity in pregnant rats) strongly contraindicates the use of *Coix lacryma-jobi* seeds during pregnancy [47]. Safety during breastfeeding has not been sufficiently established, and it is generally advised to avoid use.

7.2. Toxicity

Coixol has shown very low toxicity in mice with daily oral administration of 500 mg/kg for one month [32,33]. However, comprehensive toxicity data for whole extracts and other components, especially with long-term human consumption in medicinal doses, is limited.

7.3. Potential Drug Interactions

Given its pharmacological activities, Job's Tears may interact with certain medications:



making it a valuable functional food. Pharmacological studies highlight its anti-inflammatory, antioxidant, anti-diabetic, hypolipidemic, anti-cancer, and immunomodulatory effects, attributed to its diverse bioactive compounds. While traditional use and preclinical research support its medicinal potential, rigorous human clinical trials are needed to confirm benefits and establish safe dosages. Bridging traditional wisdom with modern science can unlock its therapeutic value for global health and wellness.

REFERENCE

1. Christenhusz MJM and Byng JW. (2016). The number of known plants species in the world and its annual increase. *Phytotaxa*. Magnolia Press. 261 (3): 201–217. Doi:10.11646/phytotaxa.261.3.1.
2. Hore DK and Rathi RS. (2007). Characterization of Job's Tear Germ Plasmin North – East India. *Natural Product Radiance*. 6(1):50-54.
3. Job's Tear, (accessed 16.03.2017).
4. Health Benefits of Job's Tears (accessed 16.03.2017).
5. Job's Tear, www.flowersofindia.net.html (accessed 16.03.2017).
6. Kumar R, Kumawat N, Shukla Nath U, "Job's Tears: An Unexploited Multipurpose Shrub in North Eastern Hilly Region of India." ResearchGate, 2018.
7. Yu, F., Zhang, J., Li, Y.-zhuo, Zhao, Z.-ying, & Liu, C.-xiao. (2017, April 26). Research and application of *Coix lacryma-jobi* in medicinal field. *Chinese Herbal Medicines*.
8. Chang H.C., Huang Y.C., Hung W.C. Anti-proliferative and chemopreventive effects of Adlay seed on lung cancer in vitro and in vivo. *J. Agric. Food Chem.* 2003; 51:3656–3660. Doi: 10.1021/jf021142a. [DOI] [PubMed] [Google Scholar].
9. S.R. Bhandari et al. Evaluation of phytonutrients in adlay (*Coix lacryma-jobi* L.) seeds. *African Journal of Biotechnology* (2012).
10. Huang DW, Kuo YH, Lin FY, Lin YL, Chiang W. 2009. Effect of adlay (*Coix lacryma-jobi* var. *ma-yuen* Stapf) Testa and its phenolic components on Cu²⁺-treated low-density lipoprotein (LDL) oxidation and lipopolysaccharide (LPS)-induced inflammation in RAW 264.7 macrophages. *J Agric Food Chem.* 57(6):2259–2266.
11. Wang L, Sun J, Yi Q, Wang X, Ju X. 2012. Protective effect of polyphenols extract of adlay (*Coix lacryma-jobi* var. *ma-yuen* Stapf) on hypercholesterolemia-induced oxidative stress in rats. *Molecules*. 17(8):8886–8897.
12. Yao Y, Zhu Y, Gao Y, Ren G. 2015. Effect of ultrasonic treatment on immunological activities of polysaccharides from adlay. *Int J Biol Macromol*. 80:246–252.
13. Manosroi, A., Sainakham, M., Chankhampan, C., Manosroi, W., & Manosroi, J. (2016, March). In vitro anti-cancer activities of Job's tears (*Coix Lacryma-Jobi* Linn.) extracts on human colon adenocarcinoma. *Saudi journal of biological sciences*.
14. Saxena H.O. and Bramham M. (1996). The Flora of Orissa, Vol IV, Orrisa Forest Development Corporation Ltd & Regional Research laboratory, Bhubaneswar, Odisha.
15. Daniel Reid, Barnes and Nobel. A Handbook of Chinese Healing Herb. Published by Shambhalla. 1995.
16. Lirio LG, Paing JN and Lan-Ew RK. (2013). *Coix lacryma-jobi* Linn. – an Underutilized Grass for Food Security and Economic Empowerment of Rural Communities. *Acta Horticulture*. 979: 285–291.
17. Kumar R, Yhokha K, Rajesh G and Deka BC. (2017). Performance of Jobs. Tears Lines (*Coix lacryma-jobi*) under Food Hill Condition of Nagaland Environment & Ecology. 35 (1B): 440-444.
18. Shiva RB, Suk- Kenu P, Young Chiol C. and Young –Sang L. Evaluation of Phytonutrients in Adlay (*Coix lacryma –jobi* L.) seeds. *African Journal of Biotechnology*. 2012; 11(8):1872-1878.
19. Chhabra D and Gupta RK. (2015). Formulation and phytochemical evaluation of nutritional product containing Job's tears (*Coix lacryma-Jobi* L.). *Journal of Pharmacognosy and Photochemistry*. 4(3): 291-298.
20. Xiu-Jie X, Yun- Guo Z, Ying-Peng. Assessment of the Genetic Diversity of Different Job's Tears (*Coix lacryma-job's* L.)L.) Accession and the Active Composition and Anticancer Effect of its Seed Oil. *PLOS ONE*. 2016; 11(4):1-22.

21. Zhang YM, Yang JS, Zhao YJ and Li XN. (2002). Advances in Chemical Constituents and Pharmacological Activities of *Coix lacryma-jobi*. Chinese Pharmaceutical Journal. 37: 8-11.
22. Waraluck K., Wiwat W., Suthaya P. and Wichittra D. 2011. Development of Job's tears ice cream recipes with carrot juice and pumpkin paste. Maejo International Journal of Science Technology 2011, 5(03), 390-400
23. Feng L, Zhao YH, Zhang ZQ, Zhang SA, Zhang HX, Yu ML and Ma YW. (2020). The Edible and Medicinal Value of *Coix lacryma-jobi* and Key Cultivation Techniques for High and Stable Yield. Natural Resources. 11: 569-575.
24. Kutschera M and Krasaekoopt W. (2012). The Use of Job's Tear (*Coix lacryma-jobi* L.) Flour to Substitute Cake Flour in Butter Cake. Technical Report. 15(4): 233-238.
25. Devaraj RD, Jeepipalli SP and Xu B. (2020). Photochemistry and health promoting effects of Job's tears (*Coix lacryma-jobi*)—A critical review. Food Bioscience. 34: 100537.
26. Gu GY. (1990). Pharmacological Effect of *Coix* Seed. Chinese Traditional Patent Medicine. 12: 8-9.
27. Pang XF, Zhang SW, Qu ZC, Jiang BK and Liu AL. (1996). Growth Characteristics and High-Yield Cultivation Techniques of *Coix lacryma-jobi*. Shandong DOI: 10.4236/nr.2020.1112034 575 Natural Resources Agricultural Science. 3: 15-17.
28. Yao FJ. (2005). Effects of Photoperiod and Sowing Date on Growth and Yield of *Coix*. Sichuan Agricultural University. 16-19.
29. Koh HL, Kian CT and Tan CH. (2009). A Guide to Medicinal Plants: An Illustrated, Scientific and Medicinal Approach World Scientific Publishing Singapore. 53 – 54.
30. Gomita Y, Ichimaru Y, Moriyama M, Fukamachi K, Uchikado A, Araki Y, Fukuda T and Koyama T. Behavioural and EEG effects of coixol (6-methoxybenzoxazolone), one of the components in *Coix Lacryma-Jobi* L. var. *ma-yuen* Stap Nippon Yakurigaku Zasshi. 1981; 77(3):245-59.
31. Otsuka H, Hirai Y, Nagao T and Yamasaki K. Anti-inflammatory Activity of Benzoxazinoids from Roots of *Coix Lacryma-jobi*. JNat Prod. 1988; 51(1):74-79
32. Kesarin Lakkham, Preeya Wangsomnuk and Chantana Aromdee. Identification and Quality of Four Varieties of *Adlay* Songklanakarin. Journal of Science Technology. 2009; 31(4):425-431.
33. Hore DK and Rathi RS. Characterization of Job's Tear Germ Plasmin North –East India. Natural Product Radiance. 2007; 6(1):50-54.
34. Park Y, Suzuki H, Lee YS, Hayakawa S, Wada S. Effect of coixon plasma, liver, and fecal lipid components in the rat fed on lard-or soybean oil cholesterol diet. Biochem Med Metab Biol. 1988; 39(1):11-7.
35. Kim SO, Yun SJ, Jung B, Lee EH, Hahm DH, Shim I and Lee HJ. Hypolipidemic Effects of Crude Extract of *Adlay* Seed (*Coix lacryma-jobi* var. *mayuen*) in obesity rat fed high fat diet: relations of TNF-alpha and leptin mRNA expressions and serum lipid levels. Life Sci. 2004; 75(11):1391-404.
36. Huang BW, Chiang MT, Yao HT and Chiang W. The effect of *Adlay* Oil on Plasma Lipids, Insulin and Leptin in Rat. Phytomedicine; 2005; 12(6-7):433-439.
37. Roman Ramos R, Alarcon-Aguilar F, Lara-Lemus A, Flores-Saenz JL. Hypoglycemic effect of plants used in Mexico as Antidiabetic. Arch Med Res. 1992; 23(1):59-64.
38. Kim, J., Lee, J., & Kim, S. (2013). Antidiabetic activity of *Coix lacryma-jobi* var. *ma-yuen*. Journal of Ethnopharmacology, 147(2), 431-436. Doi: 10.1016/j.jep.2013.03.029
39. Wang, X., Li, F., & Liu, J. (2017). Hypoglycemic and hypolipidemic effects of *Coix lacryma-jobi* in type 2 diabetic mice. Journal of Functional Foods, 35, 346-353. Doi: 10.1016/j.jff.2017.06.012
40. Zhang, Y., & Liu, Z. (2018). Antidiabetic and antioxidant activities of *Coix lacryma-jobi* extracts. Journal of Food Science, 83(5), S1448-S1456. Doi: 10.1111/1750-3841.14253
41. Chen, Y., Wang, J., & Tan, R. (2011). *Coix lacryma-jobi* inhibits glucose production in HepG2 cells by regulating key enzymes. Journal of Ethnopharmacology, 137(1), 292-297. Doi: 10.1016/j.jep.2011.05.037
42. Soh CT, Kim SH, Kim KY, Park H, Chung HT, Kim TU, Jeon SM and Han YB. Biostatic Activity of *Coix Lacryma* Seed Extract on *Toxoplasma Gondii* in Macrophages. Korean J. Parasitol. 1996; 34(3):197-206.

43. Waraluck K., Wiwat W., Suthaya P. and Wichitra D. 2011. Development of Job's tears ice cream recipes with carrot juice and pumpkin paste. *Maejo International Journal of Science Technology* 2011, 5(03), 390-400.
44. Hidaka Y, Kaneda T, Amino N, Miyai K. Chinese medicine, Coix seeds increases peripheral cytotoxic T and NK cells. *Biotherapy*;1992; 5(3):201-203.
45. Kaneda T, Hidaka Y, Kashiwa T, Tada H, Takano T, Nishiyama SandMiyai K. Effect of coix seed on the changes in peripheral lymphocyte subsets *RinshoByori*. 1992; 40(2):179-181.
46. Chen HJ1, Lo YC, Chiang W. *J Ethnopharmacol* 2012; 141(1): 119-127
47. Bhavna Patel, Gopi Patel, Samir Shah, Shraddha Parmar. A Review: Coix lacryma jobi L. *Res. J. Pharmacognosy and Phytochem*. 2017; 9(4): 248-252. Doi: 10.5958/0975-4385.2017.00046.2
48. Yu, Y., et al. (2017). Phytochemicals and pharmacological activities of Coix lacryma-jobi L. *Journal of Agricultural and Food Chemistry*, 65(12), 2611-2622.

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