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An Analysis of Health Benefits of Litchi

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ABSTRACT: Litchi (Litchi chinensis) seeds are the main waste by-products generated when the litchi fruit is processed into drinks, jellies, wine, and squash. These seeds are high in complex polysaccharides, with starch accounting for 40% of the total. Because of its low amylose and high amylopectin concentration, this starch has several unique functional and structural characteristics. Swelling power, water holding capacity, and solubility are examples of functional food characteristics, as are micromeritic properties (Hausner's ratio, Carr's index, and angle of repose). These characteristics allow them to be used in both food (thickener, edible packaging, and functional component) and non-food (pharmaceutical excipients, targeted drug delivery) goods. The use of starch from litchi seeds may enhance the economic viability of the litchi processing sector while also reducing waste buildup and pollution. The separation of litchi seed starch, its structure, functional characteristics, and a variety of new uses are all explored in this review paper.

KEYWORDS: Fruit, Litchi, Litchi chinensis, Sapindaceae, Seed.

1. INTRODUCTION

Litchi (Litchi chinensis) is a member of the soapberry family (Sapindaceae) that is grown in tropical and warmer sub-tropical areas of the globe and has a high economic value owing to its tasty and nutritious fruit. Litchi is said to have originated in Southern China and Northern Vietnam, before spreading to at least 20 nations across the globe. China, Taiwan, Thailand, India, South Africa, Madagascar, Mauritius, and Australia are all major litchi producers. Most producing nations eat litchi locally, but it is also exported to major global markets such as France, Germany, the United Kingdom, Hong Kong, Singapore, the Philippines, Japan, Thailand, the United States, and Canada. The market for litchi has also been growing throughout the Middle East. The majority of litchi produced worldwide is eaten as fresh fruit, with a minor amount being frozen, canned, or dried and used to make drinks and jellies[1].

Litchi fruit is made up of two parts: edible aril and non-edible seeds and skin. The peel and seed combined make up approximately 30–40% of litchi fruit, and they are regularly thrown as a waste of processing or fresh fruit consumption, posing a waste management issue and polluting the environment. Litchi's total worldwide output is projected to be 2.7 million tons, with 0.54 million tons of seeds produced per year. Litchi seeds are rectangular to concave in form, dark brown to chocolate in color, and 1–3.3 cm long and 0.6–1.2 cm broad. Starch polysaccharides (40.7 percent), proteins (4.93 percent), crude fibers (24.5 percent), oil content (3.2 percent), and minerals (magnesium: 0.28 percent; calcium: 0.21 percent; phosphorus: 0.11 percent) make up the composition of litchi seeds. The development of effective litchi seed usage methods may enhance the litchi processing industry's economic viability[2].

Litchi seed may be utilized as a non-traditional starch source with multi-dimensional uses due to its high starch concentration. Valorization of such non-traditional starch sources would not only decrease reliance on starches from conventional food crops, but will also help to manage seed waste and therefore minimize pollution. A starch must have certain desired characteristics in addition to its starch content in order to be used in different applications. The structural form of litchi seed starch granules is circular to oval, with a diameter ranging from 3 to 10 m. This

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starch is also very pure, with minimal ash and nitrogen content and a pH of about 7. According to studies, litch seed starch isolated with citric acid retains more moisture than starch isolated with alkali because it has more hydrophilic hydroxyl groups, which contribute more amylose molecules. Litchi seed starch's greater water holding capacity and thermal stability further contribute to its widespread use in the food industry[3].

Litchi (Litchi chinensis Sonn.) is a Sapindaceae tree that grows in the subtropical to tropical range. The fruits are globose or oblong to ovate in shape, with a bright red exterior and transparent delicious juicy edible pulp (aril) around a glossy brown seed. Litchi has a lengthy history in Southeast Asia, going back to about 2000 BC, according to unofficial Chinese sources. It was first grown in a region between southern China and northern Vietnam, but it has now expanded to over 20 nations across the globe. Litchi cultivation has mostly spread to Southeast Asian nations in recent years, with China being the biggest producer, followed by Thailand, India, and Vietnam[4].

Litchi has a great commercial value on the worldwide market, and it is mostly eaten raw. Litchi pericarp browning and pulp degradation, on the other hand, result in a short shelf life. As a result, a new industrial chain is required to support the growth and better use of litchi. Litchi has been used to cure some illnesses since ancient times, and a comprehensive research found that litchi adds to human health performance via antioxidant, anticancer, hypolipidemic, and immunomodulatory properties. As a result, litchi has the potential to be used in functional foods. Furthermore, interest in natural biological phytochemicals has grown in recent years, and these phytochemicals are generally recognized as helping to prevent and cure a variety of diseases. The nutritional components, the health advantages of bioactive compounds, and the safety of litchi are all discussed in this paper. The biological processes and structure–biological connections of litchi's functional chemicals are addressed. The processes behind litchi's anaphylactic and inflammatory responses are investigated. This review's findings may lead to a greater knowledge of litchi's functional components, as well as promote appropriate litchi uses in the functional food, medicinal, and cosmetics sectors[5].

1.1 Nutrient composition of litchi:

Litchi is well-liked by customers all over the globe because of its sweet flavor, juiciness, and nutritional value, all of which are linked to its composition. Litchi pulp is a rich source of nutrients such as polysaccharides, polyphenols, vitamins, and minerals, and is suggested as an edible component. Litchi pericarp and seeds are often thrown as leftovers during processing, however studies have revealed that they contain a significant amount of biological components, including polyphenols. It is now generally recognized that bioactive chemicals found in fruits and vegetables are helpful to human health in terms of illness prevention. Litchi's higher concentration of bioactive substances ensures that it has a high nutritional value.

1.1.1 Sugars:

Sugars are a significant nutrient in litchi pulp, accounting for up to 10% to 19.2 percent of the total, with reducing sugars accounting for 70%. Sucrose, fructose, and glucose are the three main sugars found in litchi pulp, with fructose and sucrose concentration approximately equal. Litchi pulp is high in polysaccharides in addition to oligosaccharides. Bioactive litchi polysaccharides have piqued attention in recent years, and their structure has been investigated.

Because litchi polysaccharides are complex macromolecular substances, various extraction techniques may result in a variety of forms. Currently, the most common extraction techniques are distilled water extraction and ethanol precipitation, but some individuals extract litchi

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polysaccharides using a simulated stomach media. Litchi polysaccharides have an average molecular weight of 1.4 104 to 2.4 106 Da when extracted using the techniques described above. The monosaccharide components of litchi polysaccharides include mostly arabinose, galactose, and glucose, with little mannose, rhamnose, and xylose, according to most research.

1.1.2 Phenolic Compounds:

Litchi contains a white gelatinous aril surrounded by a brilliant crimson pericarp, with anthocyanins responsible for the bright red hue, according to research. After harvest, however, the fruit quickly loses its brilliant red hue and becomes brown. This is mostly due to the phenolic chemicals found in litchi skin, particularly ()-epicatechin, which is thought to be the precursor of enzymatic browning in the litchi pericarp. Polyphenols have an important function in the look of litchis and are also important nutrients for humans. All sections of the litchi fruit (pericarp, pulp, and seed) have high levels of phenolic compounds, however the polyphenol content of litchi pulp, which is the immediately edible component, plays a critical role in guaranteeing nutritional value. Chemical techniques were utilized to extract polyphenols from litchi pericarp and seed, which were then utilised in the study and production of functional foods[6].

1.1.3 Others:

Malic acid, together with tartaric, citric, and ascorbic acids, make about 80% of the total organic acids in litchi pulp. Furthermore, litchi is an excellent source of ascorbic acid, and ascorbic acid content is linked to litchi types. The amount of ascorbic acid in Hawaii cultivars varied from 21 to 36 mg/100 g (fresh weight); whereas, the average ascorbic acid concentration in South African cultivars was 24.39 mg/100 g (fresh weight). Litchi pulp, with an average potassium concentration of 170.64 mg/100 g (fresh weight), is also suggested as an excellent source of minerals. Litchi pulp also includes a tiny amount of pectin, protein, and lipids in addition to the nutrients listed above. The pectin percentage of the litchi edible part is about 0.42 percent, the protein level ranges from 0.8 to 1%, and the fat content is less than 1%[7].

1.2 Effects Of Processing On Litchi Nutrients:

At room temperature, litchi fruits have a limited shelf life of approximately 4 to 6 days after harvest. Litchi is often processed into juice, dried fruit, and wine, and the nutrients are altered as a result of this processing.

1.2.1 Thermal Processing:

The most popular technique for drying litchi fruit is thermal processing. However, due to oxidizing processes, a lengthy heat processing period reduces the nutritional value of litchi pulp. Consumers were unsatisfied with the rich brown and delicate flavor of litchi pulp handled with hot air drying. In the processing of litchi juice, thermal processing is often employed to inactivate enzymes and remove spoilage microbials to guarantee safety. However, as compared to fresh litchi, biological components such as ascorbic acid, anthocyanins, and polyphenols are quickly reduced after heat processing. As a result, new processing techniques must be developed in order to preserve litchi's nutritional value and distinct flavor.

1.2.2 Non thermal Processing:

In terms of preserving natural color and nutrients, nonthermal processing is preferable to thermal processing. The antioxidant activity of high-pressure carbon dioxide was considerably greater than that of thermal processing in terms of phenolics, flavonoids, and specific phenolics such as rutin, ()-epicatechin, and chlorogenic acid in litchi juice. Furthermore, as compared to

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a high-temperature, short-time treatment, the ascorbic acid, total anthocyanins, and total polyphenol contents in litchi syrup were significantly enhanced with the high pressure treatment. When compared to hot-air-dried litchi, microwave vacuum-dried litchi contains greater levels of ascorbic acids and total phenolics, as well as higher levels of sucrose and lower levels of fructose and glucose. A study examined the effects of four drying techniques on reducing sugars (airflow drying, microwave-assisted vacuum drying, microwave-hot-air drying, and freeze drying) and discovered that microwave-hot-air drying could keep the most reducing sugar content.

1.2.3 Fermentation:

With its high sugar content and rose-floral and citrus-like fragrance, litchi is also ideal for making fruit wine. In the creation of litchi wine, fermentation is crucial. Due to yeast consumption, the amount of glucose, fructose, and sucrose dropped quickly throughout fermentation. Furthermore, malic acid content was lowered by almost 40%, and virtually all amino acid content was reduced as well. The major residual amino acid in litchi wine was proline, and the addition of aromatic amino acid, single branched-chain amino acid, and diammonium phosphate individually enhanced residual proline concentrations.

Changes in the concentrations of ascorbic acid, glucose, fructose, sucrose, organic acids, total phenols, and total flavonoids are now the focus of study on nutritional changes during litchi processing. However, few studies have documented changes in certain complex components, such as polysaccharides and polyphenols, throughout the litchi process owing to the difficulty of isolation and identification. Nonthermal processing is also anticipated to be extensively utilized in litchi processing.

1.3 Health Benefits Of Litchi:

Natural chemicals have sparked a lot of attention because of their biological activity and positive effects on human health. Litchi's biological actions have been verified by many research in recent years. Animal studies are widely acknowledged and regarded as a useful tool for studying functional activities.

1.3.1 Antioxidant Activity:

In living organisms, oxidation is necessary for the production of energy for biological activities. Uncontrolled generation of oxygen-derived free radicals, on the other hand, has been linked to cancer, atherosclerosis, and other illnesses. Because synthetic antioxidants are suspected of causing liver damage and cancer, natural efficient antioxidants must be developed and used to protect the body from free radicals and postpone the onset of many chronic illnesses.

Aromatic and acidic amino acids boost antioxidant capacity by supplying protons to electron-deficient radicals; uronic acid, glucose, mannose, and galactose may have higher antioxidant activity. Increased arabinose and galactose concentration, on the other hand, may improve the antioxidant properties of polysaccharides derived from dried litchi pulp. Furthermore, cultivars affect the antioxidant capacity of litchi polysaccharides. The polysaccharides from Feizixiao have higher antioxidant activity than those from the Guiwei and Nuomici cultivars). In addition to chemical antioxidant activity, polysaccharides extracted from fresh litchi pulp showed cellular antioxidant activity (CAA); however, CAA and chemical antioxidant activities may yield different results, owing to the differences in the two assays' characteristics and mechanisms in the reaction process. Litchi polysaccharides mediate free-radical activity by interacting with different receptors and/or modulating various postreceptor intracellular

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signaling pathways in the chemical assay; however, in the cellular antioxidation assay, litchi polysaccharides mediate free-radical activity by interacting with different receptors and/or modulating various postreceptor intracellular signaling pathways. In the CAA tests, more galactose and mannose showed greater antioxidant activity, while acidic amino acids, aromatic amino acids, and uronic acid play a larger role in the chemical antioxidant activity of fresh litchi pulp polysaccharides.

1.3.2 Hypoglycemic Effect:

Diabetes is a chronic illness that has a significant effect on one's quality of life. In 2015, 415 million individuals worldwide were diagnosed with diabetes. The International Diabetes Federation (IDF) estimates that by 2040, there will be around 642 million diabetics globally. Furthermore, type 2 diabetes accounts for more than 90% of all diabetes patients. Diabetes mellitus is characterized by high glucose levels in the human body. Fruit extracts high in polyphenols have been shown to successfully cure diabetes in studies. Litchi pericarp, seeds, and pulp have all been shown to be high in polyphenols, according to many studies.

1.3.3 Potential Anticancer Activity:

Cancer is a diverse collection of linked diseases that is feared and generally fatal. The rising number of cancer patients has pushed scientists to create new medicines to combat the disease and preserve the lives of cancer patients. Many potent anticancer drugs have been discovered in nature. Litchi extract has been shown in many investigations to have anticancer action by inhibiting anticancer cell growth and promoting apoptosis.

2. LITERATURE REVIEW

Nayak P et al. discussed Litchi Products and processing technologies in which they discussed how Litchi (Litchi chinensis Sonn.) is one of India's most popular fruits. The historical background of litchi has been explored in this review. The manufacturing situation for litchi in India has been sketched out. Several Litchi cultivars have been identified, including Shahi, China, Early Bedana, Late Bedana, and Bombai, as well as litchi-based goods such as dried litchi, canned litchi, frozen litchi, litchi honey, litchi wine, and health-beneficial litchi beverages, to mention a few. Processing methods for the aforementioned goods, such as enhanced drying, canning, pollination, fermentation, and high-pressure processing of fruits, have also been explored. In this study, we focused on some of the items that have been marketed or need to be commercialized[8].

Lu H et al. discussed Quality detection of litchi stored in different environments using an electronic nose in which they discussed how the goal of this study was to see whether an electronic nose could be used to identify the quality of litchi fruit kept in various conditions. A PEN3 electronic nose was used in this research to evaluate the storage duration and hardness of litchi kept in three distinct kinds of environments (room temperature, refrigerator and controlled-atmosphere). After collecting data on the sample's hardness and from the electronic nose, data was processed using linear discriminant analysis (LDA), canonical correlation analysis (CCA), BP neural network (BPNN), and BP neural network-partial least squares regression (BPNN-PLSR). The hardness of litchi fruits kept in all three settings reduced throughout storage, according to the findings. The hardness of litchi kept at ambient temperature decreased the quickest, followed by those stored in a refrigerator and in a controlled environment[9].

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Xiong J et al. discussed the recognition of litchi clusters and the calculation of picking point in a nocturnal natural environment in which they discussed how Recognizing ripe litchi and calculating the picking location in a natural setting are always tough issues for a picking robot. In this paper, a visual system for litchi picture capture is developed, as well as a technique for nighttime litchi identification and picking point computation. Images of the same cluster of litchis were taken during the day in a natural setting and at night under artificial light for comparison. The YIQ color model was shown to have the greatest practicability for nighttime litchi identification after analyzing color characteristics of the same litchi picture in various color models. Instead of the litchi fruit and stem, the backdrop of the nighttime picture is first eliminated using an enhanced fuzzy clustering technique (FCM) that combines this analytic methodology with a one-dimensional random signal histogram in this suggested method[10].

3. DISCUSSION

Litchi (Litchi chinensis Sonn.) is a tropical to subtropical fruit grown in over 20 countries across the globe. It is usually eaten fresh or cooked, and it has become one of the most popular fruits due to its wonderful taste, appealing color, and high nutritional content. Litchi fruits have long been utilized not just as a food source but also as a medicine. Litchi has been used for millennia in traditional Chinese medicine to cure stomach ulcers, diabetes, cough, diarrhea, and dyspepsia, as well as to eliminate intestinal worms. Whole litchi fruits contain antioxidant, hypoglycemic, hepatoprotective, hypolipidemic, and antiobesity properties, as well as anticancer, antiatherosclerotic, hypotensive, neuroprotective, and immunomodulatory properties, according to in vitro and in animal research. Litchi's health advantages have been ascribed to a variety of nutritional components, including polysaccharides and polyphenols, which have been shown to have a variety of therapeutic characteristics. The biological actions of litchi polysaccharides and polyphenols are influenced by their variety and composition. Furthermore, some individuals may have unpleasant responses such as pruritus, urticaria, swelling of the lips, swelling of the throat, dyspnea, or diarrhea after eating raw litchi and its derivatives. Litchi's soluble protein, which may induce anaphylactic and inflammatory responses, is most likely to blame for these issues. This study focuses on current discoveries linked to litchi's nutritional components, health advantages, and safety in order to reach acceptable applications of litchi in the food, medicinal, and cosmetics sectors.

4. CONCLUSION

Litchi's nutritional components, health advantages, and safety are highlighted in this review. All fractions of litchi (pericarp, pulp, and seed) have been shown to contain abundant biological phytochemicals and provide substantial health advantages to people. As a result, litchi and its extracted compounds have significant potential benefits for the food, pharmaceutical, cosmetic, and chemical industries, particularly the litchi pericarp and seeds, which contain high levels of polyphenols and are frequently discarded, resulting in significant losses and waste. Litchi has also been eaten directly and utilized in medicine since ancient times. However, the precise biological route of litchi's biological phytochemicals, as well as the connection between structure and bioactivity, particularly the spatial structure, are yet unknown. Furthermore, litchi includes certain allergic and proinflammatory proteins, the physicochemical properties of which are unknown. Litchi's growth and promotion are hampered by the lack of these theoretical underpinnings. As a result, future research should concentrate on specialized studies to explain the exact mechanism of health benefits and to investigate the use of functional foods specifically. Litchi or its biological phytochemicals need to be studied for their safety and toxicity before they can be used in a variety of sectors.

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