

CHAPTER II

LITERATURE REVIEW

2.1 Ingredient Review

2.1.1 Mangosteen Rind

Mangosteen (*Garcinia mangostana* L) is a perennial plant that produces fruits with a sweet, slightly acidic, and slightly bitter taste. The fruit of the mangosteen typically consists of fruit flesh and fruit peel. The mangosteen peel consists of two layers: the epicarp and the endocarp. The endocarp layer of the mangosteen peel has a soft and smooth texture, while the epicarp layer, the outer part of the mangosteen peel, has a hard and very bitter texture (Astiti, et al., 2022). Fresh mangosteen peel cannot be stored for a long time as it will oxidize due to the free oxygen in the air. This oxidation causes the fresh reddish-purple mangosteen peel to turn brown and harden. The mangosteen fruit is spherical, with a diameter of about 3-8 centimeters, with reddish-purple skin, and contains several segments of white flesh inside (Srihari, et al., 2015).



Figure 2. 1 Mangosteen Rind

The mangosteen fruit contains high nutritional content in each part. The fruit flesh is rich in vitamin C, sucrose, dextrose, and levulose. Meanwhile, the mangosteen peel contains xanthone compounds, which are bioflavonoids with properties such as antioxidants, antibacterial,

antiallergic, antitumor, antihistamine, and anti-inflammatory. Xanthone compounds, as antioxidants, can neutralize free radicals that enter or are produced in the body, prevent organ aging, prevent heart disease, prevent cancer and blindness, and improve the immune system (Srihari, et al., 2015). Mangosteen peel is also used to treat canker sores, dysentery, neuralgia, and constipation (Puspitasari, et al., 2016).

2.1.2 Dates

Dates (*Phoenix dactylifera* L.) are an ideal food ingredient that provides various essential nutrients and health benefits (Ulya, et al., 2023). Dates are one of the oldest fruit trees in the Arab region and are extensively cultivated as a sweet fruit consumed by everyone. Dates have been a staple food for Middle Eastern communities for thousands of years. Dates can be consumed by people of all ages, from children to adults and the elderly. Nowadays, dates are not only consumed by people in the Middle East but also by people worldwide, including in Asia, Europe, Australia, Africa, and America. Indonesia is the seventh largest importer of dates in the world, with a total import of 12,005 tons or 2.5% of the world's total imports (Risa, et al., 2018).



Figure 2. 2 Dates

Dates are considered the largest source of carbohydrates, composed of simple sugars such as glucose, fructose, and sucrose. Dates are the best source of fiber and several important minerals such as iron, potassium,

selenium, calcium, and vitamins such as vitamin C, B1, B2, A, riboflavin, and niacin, but low in fat and protein. Dates contain antioxidant compounds, namely phenolic compounds such as flavonoids (Primurdia, et al., 2014). Although dates contain a relatively high sugar content, they have a relatively low glycemic index compared to table sugar because the sugar in dates is simple sugar that is easily absorbed by the body (Rizqiati, et al., 2021). Dates also contain iron, which plays a crucial role in the formation of red blood cells, so consuming dates regularly can prevent anemia (Julaecha, et al., 2023).

2.1.3 Honey

Ingredients such as sugar and food additives (sweeteners and colorings) have negative effects on health when consumed excessively. High sugar consumption can lead to increased blood sugar levels, resulting in diabetes, tooth decay, and obesity. One healthy alternative to sugar is honey. Honey is a functional food produced by bees containing various bioactive substances and enzymes that provide antioxidant, antimicrobial, anti-inflammatory, and anticarcinogenic properties (Marda, et al., 2023).

Compared to sugar, honey contains carbohydrates and has a lower glycemic index of 55. Because honey contains glucose and fructose, when consumed, it is quickly absorbed into the blood, providing energy rapidly. Honey is also rich in vitamins, minerals, salts, and other substances. In addition to being a sweetener, the benefits of honey are numerous, serving as an antioxidant, improving texture due to its ability to bind water to hydrogen, and enhancing functional properties such as stamina enhancement (Basiru, et al., 2023).

2.1.4 Betel Lime

Mangosteen peel has a bitter, astringent, and puckery sensory value, making it unsuitable for direct consumption. Tannin is one of the compounds that causes bitterness and puckering in mangosteen peel, at

about 14.1 percent (Febriane, et al., 2015). Tannin is a phenolic compound soluble in water. Tannin found in the fruit can be removed by soaking the fruit in a betel lime solution (Husna, et al., 2018).

Betel lime is a substance resembling lime used by people in ancient times for chewing betel. Betel lime is made from burnt coral rocks forming white ash. This white ash is what we can find in stores. Betel lime with the chemical formula $\text{Ca}(\text{OH})_2$ is made from the deposition of limestone or limestone rocks (Sutana, et al., 2021). Betel lime is often used in food processing because, besides being relatively inexpensive, it does not contain toxic compounds (Suntoro, et al., 2016). Soaking in betel lime solution can serve as a hardener or texture enhancer, reducing undesirable tastes like bitterness and puckering (Suparno, et al., 2016).

2.2 Product Review

Fruit leather is a fruit product with a chewy texture, made from processed fresh, canned, or frozen fruit puree that is crushed to obtain a smooth thick liquid, which is then poured into flat-surfaced containers. As the puree slowly dries, it creates an appearance and texture akin to leather, which can be pulled from the drying surface and still maintain its shape due to its chewy texture (Hadi, et al., 2020). Fruit leather is shaped into thin sheets with a thickness of 2–3 mm and has a distinctive consistency and flavor depending on the types of fruits used (Risti, et al., 2017). The drying process can be done using various methods such as solar drying, cabinet drying, hot air drying, microwave oven drying, vacuum drying, and freeze drying (Bandaru, et al., 2020).

Fruit leather is used as a delicious snack. There are various ways to consume fruit leather; it can be cut into small pieces and added to cereals, puddings, and desserts for a fresh fruit flavor (Hadi, et al., 2020). Fruit leather has several advantages, including being more convenient, having a longer shelf life compared to fresh fruit, and maintaining its nutritional value (Herlina, et al., 2020). The desired criteria for fruit leather include an attractive colour, a

slightly chewy and compact texture, and good elasticity so that it can be rolled without breaking easily (Winarti, et al., 2020).

2.3 Process Review

Food preservation by reducing moisture content has been practiced for thousands of years. Drying is one of the oldest methods of food preservation (Hariyadi 2018). Drying is a preservation method in which water vapor is removed from food materials. The general function of drying is to reduce moisture content, thus preventing the growth of spoilage microorganisms and enzyme activity that accelerates food deterioration (Setiaboma, et al., 2019).

Sun drying is the cheapest and most traditional drying method. Sun drying, which utilizes solar energy, is commonly used in small-scale industries to save production costs (Setiaboma, et al., 2019). However, solar drying has its drawbacks. Solar energy is intermittent and weather-dependent, and drying cannot be carried out at night due to lower environmental temperatures and increased relative humidity (RH) (Ridhatullah, et al., 2019). Besides sun drying, cabinet drying, microwave drying, and oven drying are commonly used methods in medium to large-scale industries because they are more cost-effective. Cabinet drying is preferred due to its energy efficiency (Setiaboma, et al., 2019).

One of the key processes in making fruit leather is drying. Drying plays a crucial role in forming bonds between fruit pectin and filler materials, usually polysaccharides. Moreover, drying in fruits like fruit leather serves to preserve the product by preventing damage from microorganisms and enzyme activity. In fruit leather production, maintaining quality involves drying fruit puree at temperatures below 80°C. Proper drying prevents fruit leather from damage and extends the shelf life of the product (Setiaboma, et al., 2019).