CHEMICAL COMPOSITION AND POTENTIAL COMMERCIAL VALUES OF RAMBUTAN (*Nephelium lappaceum* L.) SEED: A REVIEW

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Abstract: Rambutan (*Nephelium lappaceum* L.) seed, which contributes up to 20% of its total fruit weight always being discarded as waste but many recent studies have been done to explore the potential of its commercial value. Rambutan seed has a considerable amount of fat that is beneficial for industrial application. In this review, we summarized the information about the nutritional content, lipid extraction method, anti-nutritional compound, reduction techniques for anti-nutritional compounds and the potential commercial values of rambutan seed. Soxhlet extraction is the common method for lipid extraction either using hexane or petroleum ether as the solvent. The pre-treatment and extraction conditions as well as the moisture content of the rambutan seed could affect the fat yield. In addition, rambutan seed contains considerable amount of beneficial nutrients including carbohydrate (22.18 - 64.19%), protein (8 – 16.21%), fat (6.01-39.09%), fibre (0.30 – 29%), moisture (2.67- 15.30%) and ash (1.06 – 2.4%). On the contrary, the presence of anti-nutritional compounds in the rambutan seed has contributed to its bitterness and toxicity. These include tannins, saponins and phenolic contents which can be reduced through fermentation, roasting or maceration techniques. Findings show that rambutan seed is highly potential as functional foods and further research can be carried out to extend the utilisation of rambutan seeds. The objectives of this review are to synthesise the research findings on the chemical composition and potential commercial values of rambutan (*Nephelium lappaceum* L.) seed.

Keywords: Rambutan seed, lipid extraction, nutritional, anti-nutritional, application

1. Introduction

Rambutan (*Nephelium lappaceum* L.) is a seasonal fruit that originated from tropical countries especially in Southeast Asia including Malaysia, Indonesia and Thailand (Wahini et al., 2018). In Malaysia, rambutan fruit will be harvested twice per year (July-September and December-February) (Chai et al., 2018b). Rambutan comes from the Sapindaceae family together with longan (*Dimocarpus longan*), lychee (*Litchi chinensis*) and pulasan (*Nephelium mutabile* Blume) (Chai et al., 2018a). Basically, rambutan comprises 38.6 to 70.8% of peel, 19.1 to 45.9% of pulp and 8.3 to 20.3% seed which the percentage varies depending on the species (Chai et al., 2018a). Either it is freshly eaten or being processed into another form of food products, only rambutan flesh or pulp will be consumed while their by-products which include the peel and seed will be discarded and disposed of as waste. Due to this factor, many researchers had figured out several alternatives in order to utilise the discarded by-products into something beneficial. Hence, this review will discuss the nutritional value, lipid extraction methods, anti-nutritional compounds and its reduction,

together with the applications of rambutan seed in the food and non-food industry.

2. Discussion

2.1. Nutritional value of rambutan seed

Dried rambutan seeds exhibit high amounts of macronutrients needed in the human diet, which are carbohydrate, protein and fat (Mahmood et al., 2018). Based on the previous studies, rambutan seed contains the highest amount of carbohydrate with 22.18% to 64.19%, followed by fat (6.01% to 39.09%) and protein (8.00% to 16.21%) (Manaf et al., 2013; Fila et al., 2013; Wahini et al., 2018; Onana et al., 2019). Based on these findings, it can be observed that a considerable amount of nutritional values in the rambutan seed, especially its fat content can be further utilised in various applications since the amount of fat found can be reached up to 39.09%. Nevertheless, the different value obtained in those studies might be because of several factors including the method used in analysing the fat content and type of rambutan seed selected.

2.2. Lipid extraction of rambutan seed

Significant amount of fat in rambutan seed can be a promising alternative for fat replacer and other usage in various applications. Due to its special properties, the right method of extraction is crucial in order to make sure that the highest yield of fat will be obtained. Most of the researchers had chosen the Soxhlet method extraction either by using hexane or petroleum ether as solvent. The range of percentage yield obtained by using hexane and petroleum ether as solvent are between 24.62% to 37.90% and 33.03% to 39.25% respectively. Nevertheless, the result cannot be directly compared since several factors have contributed to its percentage fat yield which include moisture content and pretreatment method. However, Buck and Barringer (2007) mentioned that hexane is better than petroleum ether due to its more non-polar and high stability.

2.3. Anti-nutritional compounds in rambutan seed

Anti-nutritional compounds found in rambutan seed are saponin, alkaloid, tannin, phytate, phenol, oxalate and flavonoid (Febrianto et al., 2013). There were many researchers who studied the presence of saponin, tannin and phenolic contents in the rambutan seed. These anti-nutritional compounds contribute to the toxicity and bitterness of rambutan seed causing it undesirable for consumption. Besides, this compound can react with nutrients and prevent them from being absorbed in the human body (Melini & Melini, 2021). Overall, the highest range of anti-nutritional compounds are total phenolic compounds (3.56 – 36.53 mg GAE/100 g) followed with tannin (4.40 – 26.68 mg CE/100 g) and saponin (0.44 – 18.96 mg soya saponin/100 g).

2.4. Reduction of anti-nutritional compound in rambutan seed

Since the availability of anti-nutritional compounds in the rambutan seed contributes to its bitterness and astringency, many researchers have carried out studies on this area in an effort to ensure that rambutan seed can be accepted for human consumption. According to several findings, most of the researchers had conducted fermentation, roasting and maceration in solutions to get rid of the alkaloids. The result showed that the fermentation method for eight to ten days produced

the highest reduction rate for saponin (33-76%), tannin (28-60%) and total phenolic content (59%) (Mehdizadeh et al., 2015; Wahini et al., 2018; Chai et al., 2019a, 2019b, 2019c).

2.5. Rambutan seed application in food and non-food industry

In food industry, the rambutan seed can be processed into rambutan seed powder and produced into multi-purpose flour in cooking (Wahini et al., 2018). This has been applied by Mauren et al. (2021) where they had made biscotti, a type of Italian pastry and showed high acceptance value by the consumers. Besides, rambutan seed could act as cocoa butter substitute or alternative (Febrianto, 2013; Chai et al., 2019c) and also coagulant in water treatment by reducing the iron and manganese concentrations in ground water (Yap et al., 2017). On the other hand, in non-food industry, it was discovered that rambutan seed extracted fat could produce biodiesel through transesterification process (Jahurul et al., 2020) and also bar and liquid soaps through saponification process with combination of other vegetable oils including palm oil, olive oil and castor oil (Lourith et al., 2016).

3. Conclusion

In conclusion, it was found that the rambutan seed contains a considerable amount of lipids which is beneficial for the applications in the food and non-food industry. It is also recommended that further research needs to be carried out to extend the utilisation of rambutan seeds while getting rid of any undesirable components in the rambutan seed for desirable consumption.

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