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Red Dragon (*Hylocereus polarizes*) Fruit Peel Herbal Tea with The Addition of Cinnamon, Ginger, and Orange Zest

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ABSTRACT

The peel of dragon fruit is a waste. The meat of dragon fruit is the most frequently consumed; the peel is rarely used and is only wasted. The natural antioxidant lycopene may be found in the skin of dragon fruit. Dragon fruit skin can be processed to make herbal tea. This study aims to ascertain the yield, moisture content, and organoleptic testing to produce dragon fruit peel tea and the effects of adding cinnamon, ginger, and lemon zest. The research treatments included lemon zest at 40%, ginger at 14%, and cinnamon at 6% concentrations. Three treatment levels and three replications were employed in the fully randomized design (CRD) for data analysis. According to the study's findings, the best way to treat a dragon fruit peel herbal tea bag that contains 6% cinnamon powder was to know how adding cinnamon, ginger, and lemon zest to the process of making dragon fruit peel tea affects the yield, moisture content, and organoleptic test. According to the respondents' liking, the taste test scored 3.91%, scent 3.88%, and color 4.45% (loved) (liked). Based on SNI 3836.2013 about tea quality criteria, which stipulates that the maximum moisture content included in tea powder is 8%, a yield of 8.64%, and a moisture content of 0.48% satisfy the tea quality requirements.

Keywords: dragon fruit peel, cinnamon, ginger, lemon zest, red dragon fruit peel tea

INTRODUCTION

Indonesia is familiar with dragon fruit, often sweet or honey cactus. Dragon fruit has thorns on each stem segment, and 30-35% of it is fruit skin, yet frequently, this skin is discarded as garbage (Yesti *et al.* 2023). Even though dragon fruit skin offers several health advantages, the red dragon fruit is one of the varieties now grown extensively in Indonesia *(Hylocereus polarizes)* (Pepadu *et al.* 2023). Few know that dragon fruit skin may be turned into various goods, including herbal tea beverages (Gumanti *et al*. 2023). Due to the high levels of antioxidants and antibacterial properties found in dragon fruit skin, herbal drinks made from this material may be utilized as a natural beverage that can be good for health (Anjliany *et al.* 2022). The high moisture content of dragon fruit peels is 94.05%, and their short shelf life is two challenges in managing them. The high moisture content of dragon fruit makes the skin vulnerable to microbial assault, which might harm the skin's structural elements (Matarru *et al*. 2023).

To fight this, a procedure is necessary to reduce the moisture content of the dragon fruit skin and, by drying it out, improve the product's resilience to microbial attack (Hariadi 2023). The drying conditions that produced the best outcomes were as follows: 18 h at 50°C, 14.03% moisture content, 14.23% ash content, 2.713 ppm antioxidant activity, fresh dragon fruit skin aroma, astringent flavor, and highly brilliant. All of the panelists loved the color red. To mask the disagreeable taste of dragon fruit peel tea, flavoring substances must be utilized when making dragon fruit peel herbal tea. Cinnamon ((*Cinnamomum burmanni*) is employed as a flavoring agent because it contains substances typically utilized to enhance the flavor and scent of herbal teas, such as eugenol, safrole, cinnamaldehyde, tannins, calcium oxalate, resins, and tanning agents. The amount of cinnamon utilized is 6% cinnamon filtrate, with a total phenol content of 166.02 ppm, an antioxidant activity of 76.62%, and flavonoids (positive) (Arumsari *et al*. 2019).

Furthermore, ginger contains phenolic components like oleoresin, which may resist free radicals and inhibit oxidation, so making ginger an antioxidant (Santiasih *et al.* 2023). Ginger, particularly *emprit* (java ginger, *Zingiber officinal* evar. marum), is widely utilized as a mix component in food and beverage manufacturing. Emprit ginger, with a 6.9% higher oleoresin concentration than

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other varieties, is utilized in the panelists' preferred watermelon peel, which contains 14% ginger and 0.5% cloves. Lemon (*Citrus limon* L) peel is strong in limonin, an essential oil that improves the flavor of tea. Juice accounts for around 45% of a lemon's weight, together with the fruit's exterior, interior, and leftover pulp (55%). (Kobo *et al*. 2022, Sifa 2023) The use of lemon zest powder in green tea manufacturing yielded the greatest results, with a treatment that comprised 40% lemon zest powder with a moisture level of 7.79%, 40% antioxidant activity, 99.98 mg GAE/g total phenol, and total dissolved solids 0.32 brix. Dragon fruit peel, which includes antioxidants, phenol levels, and betacyanin that are favorable to health, can now be used as a herbal tea drink rather than discarded (Slamet *et al*. 2022). However, dragon fruit skin tea lacks flavor (Kuscahyantari 2022). When brewing dragon fruit peel tea, use flavorings such as cinnamon powder, ginger powder, and lemon zest powder to mask the unpleasant flavor and add scent and flavor to make it more appealing. It is recognized by society. The purpose of this study is to determine the moisture content yield and organoleptic tests used to make dragon fruit peel tea, as well as the impacts with adding cinnamon, ginger, and lemon zest.

METHODS

The study was conducted in October 2022 at the Food Technology Laboratory, Faculty of Agriculture, Bosowa University in Makassar. Analytical scales, drying cabinets, ovens, blenders, 30 mesh sieves, hemofilter paper, sealer machines, desiccators, and glassware were all part of the equipment. The ingredients were red dragon fruit peel, cinnamon, ginger, lemon, and purified water.

Data Analysis

The completely randomized design (CRD) data analysis technique used three treatment levels and three replications to analyze each element's effects and interactions on the analysis parameters. If the variable has an influence on the parameters being analyzed, additional testing was performed using the least significant difference (LSD).

Experimental Design

The first step was the preparation of cinnamon powder, which entails cutting the cinnamon stick to a size of roughly 1 cm, drying it at 60°C for 6 h, grinding the cinnamon to make a powder, and then sifting the powder. Next, the ginger was cleaned appropriately to eliminate debris, and then the skin was removed to create java ginger powder. The ginger was sliced into thin slices with a thickness of less than 1 cm, dried at 60°C for 6 h, pulverized in a blender, and finally sieved to produce ginger powder. The subsequent step was to manufacture lemon zest powder, which was made from orange peel that has been cut to a thickness of about 2 cm, dried for 6 h at 60°C, pulverized using a blender and filter. The penultimate process was manufacturing dragon fruit peel tea (Ariyani *et al*. 2021).

The dragon fruit was diced first, and the skin of the fruit is removed after cleaning it adequately to remove dirt. The skin of the dragon fruit is then sorted to get rid of the scales and stalks. About 2 cm squares of dragon fruit skin were taken off. To get dragon fruit peel tea powder, continue drying in a cabinet drier at 50°C for 18 h, size reduction using a blender and sifting. Once the dragon fruit peel tea powder had been weighed (94%, 86%, and 60%), it was time to add the cinnamon, ginger, and lemon zest powders (6%, 14%, 40%, respectively). In the last step, 2 g of tea were weighed and wrapped in hemofilter paper and chemical bags (Arianto 2021; Latarissa *et al*. 2022).

RESULTS AND DISCUSSION

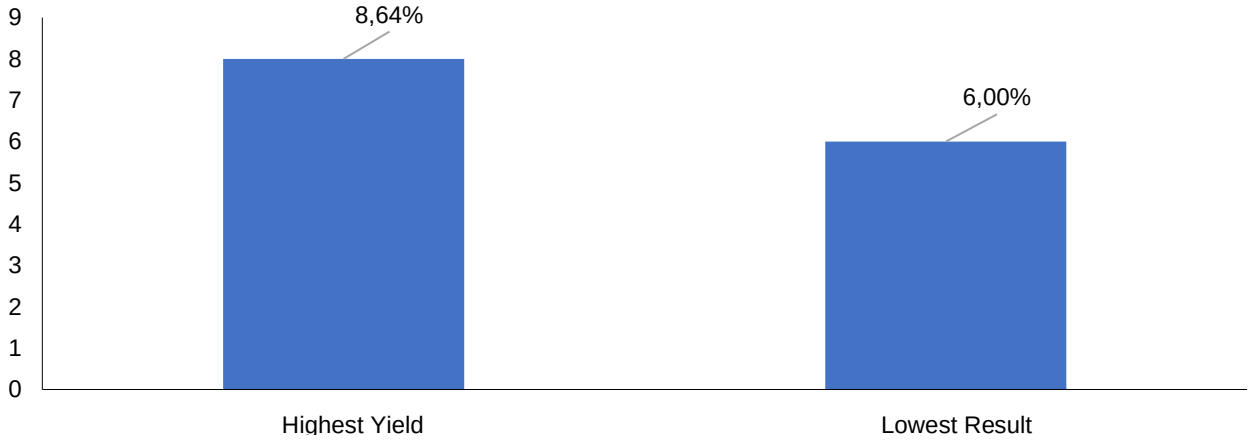
The drying technique for the dragon fruit skin teabag began with lowering the moisture level of the dragon fruit skin using a cabinet dryer. The tea powder was obtained by mashing and sieving the dragon fruit peel. To increase the flavor and scent of dragon fruit peel tea, cinnamon powder, ginger, and lemon zest were added (Fadhilah 2021). Three herbal tea treatments produced from dragon fruit peel powder were tested in this experiment. The panelists' level of preference for dragon fruit peel tea with herbal tea added was utilized to determine the yield, moisture content, and organoleptic tests (color, aroma, and taste) (Aulya and Yuliawati 2021). Ginger (PB), Lemon Zest (PC), and Cinnamon (PA). The herbal teas' observed parameter analysis was tabulated (Table 1).

Yield

Red dragon fruit peel herbal tea with cinnamon, ginger, and lemon zest had an average yield of 6.0% to 8.64% (Figure 1). The most significant output, 8.64%, was achieved from the PA treatment (6% cinnamon), while the lowest yield, 6.00%, was obtained from the PC treatment (40% lemon zest). These findings reflect Kusumaningrum's (2013) observation that the gain reduces when more material components are lost during processing. Red dragon fruit peel herbal tea with cinnamon, ginger, and lemon zest at the 5% level had a statistically significant effect, according to the analysis of variance, with a sig value of (0.000<0.05). The red dragon fruit peel teabags were processed with the

Table 1 Research results of red dragon fruit peel herbal tea

Parameters	Treatment		
	PA (Cinnamon 6%)	PB (Ginger powder 14%)	PC (Lemon zest 40%)
Yield (%)	8.64	6.56	6.00
Moisture content (%)	0.48	0.49	0.47
Organoleptic test:			
- Color	4.45	4.07	4.00
- Aroma	3.88	3.91	3.57
- Flavor	3.91	3.27	2.65



Source: Processed data by researchers, 2022.
Figure 1 The yield of red dragon fruit skin herbal tea.

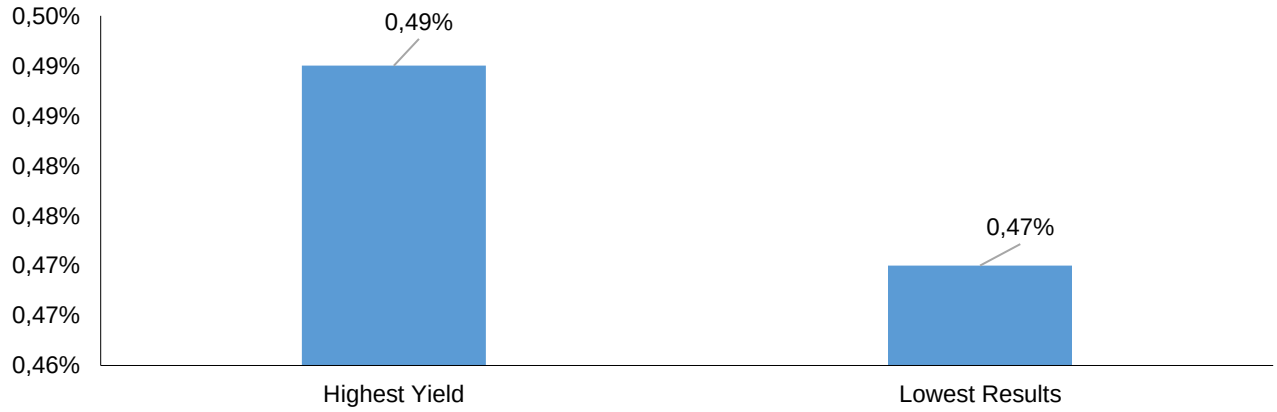
inclusion of cinnamon, ginger, and lemon zest. The results demonstrated that the PA (6% cinnamon) treatment to PB (14% ginger powder), and PC (40% lemon zest), was highly significant. A sig value of 0.000<0.05 was employed, and the PB treatment comprised 14% ginger, whereas the PC contained 40% lemon zest.

Moisture Content

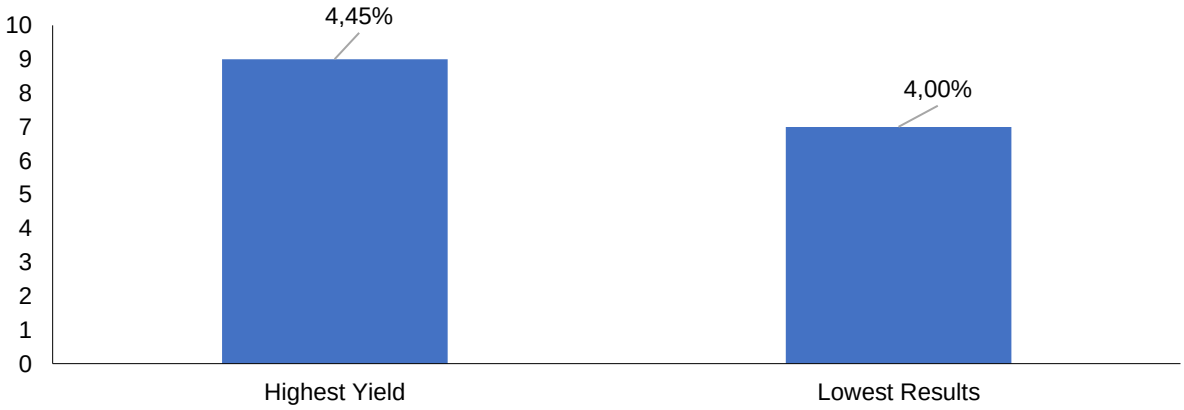
The red dragon fruit peel herbal tea bag's moisture content provided an average yield between 0.47% and 0.49% when combined with cinnamon, ginger, and lemon zest. Figure 2 illustrates that the PB treatment (14% ginger powder), which gained the highest moisture content, had a value of 0.49%, while the PC treatment (40% lemon zest), which received the lowest moisture content, had a value of 0.47%. These findings complement Widiyana's report from 2021, suggesting that java ginger powder has a high moisture percentage of 7–12%. The results of the analysis of variance demonstrated that the addition of cinnamon, ginger, and lemon zest to red dragon fruit peel herbal tea at the 5% level had no significant impact on the sig value (0.742 > 0.05). This value was based on the tea quality standard (SNI No 3836.2013), which stipulates that the maximum moisture content of the teabag is 8% so that the red dragon fruit herbal skin tea satisfies the moisture content quality requirements of herbal tea. The percentage of water in a substance is its moisture content. Food flavor, texture, and appearance can all be altered by water (Gunawan 2021). Dry tea is hygroscopic and influences humid circumstances, as well as red dragon fruit skin tea when it is dry, the moisture content in dried red dragon fruit skin herbal tea needs to be considered so that the quality of the tea does not decline. Other elements to consider include the type of packaging utilized (Umami 2021).

Color

The average yield for the red dragon fruit skin herbal tea bag from different treatments was between 4.00% and 4.45% (Figure 3). The PA treatment provided the greatest color rating score, 4.45% (like) (cinnamon score 6%). The PC treatment (40% lemon zest) similarly produced the lowest color rating, 4.00% (like). Red dragon fruit peels herbal tea with cinnamon, ginger, and lemon zest at the 5% level had no discernible impact on the sig value, according to the analysis of variance (0.06 > 0.05). Because color is a person's initial benchmark for



Source: Processed data by researchers, 2022.
Figure 2 Average Yield Moisture content of red dragon fruit peel herbal tea bag.



Source: Processed data by researchers, 2022.
Figure 3 Average yield Color of red dragon fruit peel herbal tea bag.

evaluating a product, color is vital for client approval (Lubis 2021).

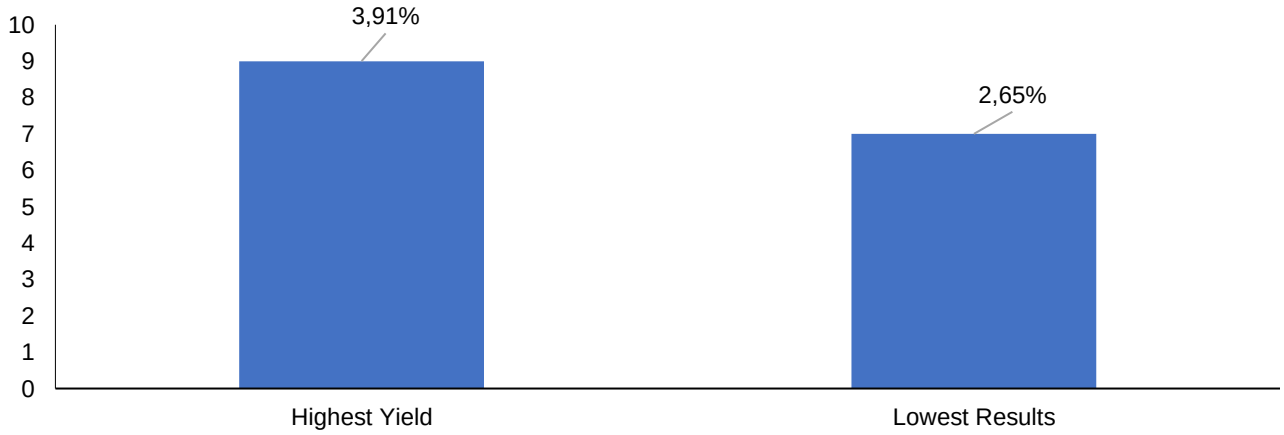
Additionally, cinnamon filtrate, which possesses anthocyanin color pigments, gives *salak* (snake fruit) peel in herbal tea a crimson hue (Sabila *et al*. 2021). Red dyes called anthocyanins are water-soluble. The color-forming ingredients of red dragon fruit peel powder and lemon zest powder altered the hue of the red dragon fruit peel tea steeped water utilized in this experiment. Tea bag soaking water is colored by the skin of red dragon fruit (which includes betacyanin coloring) and lemon zest (carotenoids contained in flavedo) (Nasir *et al*. 2020). A pigment called betacyanin generates reddish-purple hues. On the other side, lemons' yellow tint is induced by the presence of carotenoids in the flavedo and the internal transport system of the lemon. The color the steeping tea water makes will alter when the lemon zest is added; it will either fade or become less bright (Astuti 2020).

Aroma

The average yield ranged from 3.57% to 3.88% when red dragon fruit skin aroma was employed to color herbal tea (Figure 4). The PB treatment produced the highest scnet score, 3.88% (almost preferred) (14% ginger). Comparatively, the PC treatment (40% lemon zest) produced the lowest scent score, 3.57% (very liked). Because ginger had a potently spicy flavor that interfered with both the flavor and fragrance of the red dragon fruit skin tea in the PB treatment (ginger 14%), the panelists' preference for the aroma was most significant in the PB treatment (Ginger 3.91), for this reason. These data confirm Sasmita (2022) observation that flavoring greatly affects organoleptic reactions and customer acceptability of herbal tea products. The panelists enjoy the characteristic ginger fragrance produced by the essential oils naturally present in ginger powder's flavor (Utami *et al*. 2020).

Including cinnamon, ginger, and lemon zest at the 5% level, the red dragon fruit skin colors herbal tea, although

Source: Processed data by researchers, 2022.
Figure 4 Average result of the aroma of herbal tea with red dragon fruit peel.



Source: Processed data by researchers, 2022.
Figure 5 Taste of red dragon fruit skin herbal tea.

the variance analysis revealed no significant change in the sig value (0.24 > 0.05). A product's scent has a tremendous attraction and can spike hunger by enhancing the sense of smell (Nasir *et al*. 2020). The nose's sense of smell may distinguish a product's scent by smell or aroma from folate molecules. The scent of a food product predicts its quality (Shofinita *et al*. 2020).

Taste

The average yield of 2.65% to 3.91% was attained for the flavor of red dragon fruit peel herbal tea from various treatments (Figure 5), demonstrating that the PA treatment provided the most excellent flavor score, 3.91% (almost preferred) (6% cinnamon). Meanwhile, the PC treatment (40% lemon zest) provided the lowest taste score (2.65%) (dislike). The PA treatment (6% cinnamon) got the panelists' most impressive taste preference (3.91). The panelists decided adding cinnamon (PA) and ginger to tea would make it taste sweeter (PB). This is most likely owing to the ginger oleoresin compound's copious components that combine to form a characteristic spicy flavor, giving red dragon fruit herbal tea its powerful flavor. At the same time, cinnamon (PA) gives cinnamaldehyde and eugenol, which produce a pleasant scent and a characteristic cinnamon flavor, making the finished dragon fruit skin tea popular with consumers.

The findings corroborate Kusumawati *et al*. (2020) conclusion that cinnamaldehyde, an antioxidant, also serves as a taste, aroma, and colorant in food, notably useful beverage goods. The PC treatment (40% lemon zest) received the panelists' lowest taste rating of 2.65. It is claimed that this changes the chemicals in orange peels. Orange peel is well recognized for having a bitter aftertaste from the compounds *n*-arginine and limonene. All kinds of oranges possess limonin molecules, which, when heated, generate a bitter flavor (by boiling water) (Fitriani *et al*. 2014).

Red dragon fruit peel herbal tea with cinnamon, ginger, and lemon zest at the 5% level showed a

significant effect, according to the analysis of variance, with a sig value (0.000 > 0.05). The LSD in the follow-up test results for the treatment of adding cinnamon, ginger, and lemon zest to the flavor of red dragon fruit peel tea of PA (6% cinnamon) to PB (14% ginger) and PC (40% lemon zest) significantly different sig (0.000< 0.05), as well as PB (14% ginger) treatment to PC (40% lemon zest) with a sig value (0.001< 0.05).

CONCLUSION

The research showed variations in creating dragon fruit peel tea by adding cinnamon, ginger, and lemon zest and assessing the yield, moisture content, and organoleptic testing. The trial treatment consisted of 6% cinnamon, 14% ginger, and 14% ginger—40% lemon zest. Herbal tea bags with red dragon fruit peel and 6% cinnamon powder were the most effective treatment in this experiment. Based on respondents' preferences, the taste score was 3.91%, scent 3.88%, and color 4.45% (like).

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