Characteristics of Frozen Yoghurt Enriched with Red Dragon Fruit Skin Extracts (Hylocereus polyrhizus)

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Abstract. The composition of the dragon fruit skin with fruit has a weight of 30-35% of the fruit weight and has not been widely utilized. Previous studies have suggested that red dragon fruit skin extracts with water solvent contain 1.1 mg / 100 ml anthocyanin. The content of anthocyanin can function lower cholesterol content in blood, besides red dragon fruit skin contains fiber about 46.7% which is very good for health. This study aims to determine the chemical characteristics of frozen yogurt red dragon skin fruit to antioxidant levels, fiber content, pH, Total acid content and frozen yogurt melting time. The design of the research was Randomized Complete Design (RAL) of 1 factor, which was treated as red dragon skin fruit extract, consisting of 4 treatment levels: 0%, 25%, 35%, and 45%. The results showed that the addition of red dragon fruit extract increased antioxidant levels ranging from 4.00 to 12.25%, crude fiber content ranged from 1.037 to 1.625%, total acid ranged from 0.73 to 1.14%, and decreased the pH value of 5.48 - 4.39 and has a melting time of frozen yogurt 17.20 - 22.88 minutes.

Introduction

Dragon fruit skin is an untapped component compared to its fruit. Leather Dragon fruit weighs 30-35% of the weight of the fruit that has not been widely utilized and only disposed of as waste [1]. [2] The dragon fruit skin contains about 46.7% fiber which is very good for health. The content of red dragon fruit leather fiber is higher than pear, orange and persi fruit. [3] adding that dietary fiber has benefits for the health of the human body that control weight or obesity, cope with diabetes, prevent gastrointestinal disorders, colon cancer (colon) and reduce blood cholesterol levels. Red dragon fruit skin contains alkaloid compounds, steroids, triterpenoids and flavonoids. [4] Red dragon fruit skin has antibacterial activity in Staphylococcus aureus bacteria. [5] Super red dragon fruit skin is rich in polyphenols and a good source of antioxidants. However, antioxidants have weaknesses, among others, that are easily damaged when exposed to oxygen, light, high temperature and drying [6].

The skin of dragon fruit as a natural dye source is done on the processing of dry noodles with a combination of sweet corn produces whitish yellow color. It is thought that the addition of sweet corn extract binds the anthocyanin from the dragon fruit skin extract [7]. [7] reported that antioxidants in dry noodles with a combination of sweet corn and dragon fruit skin ranged from 5.9 to 20.0 mg / liter. This value is lower than the results of the study [8] antioxidant activity in super red dragon fruit skin extract showed a high value of 96.945 ± 73.2772 mg / L. The loss of antioxidants in dry noodle processing is suspected because in the process of noodle processing do 2 (two) times of heating process, that is during
the process of steaming and drying that use sunlight, thus reducing the antioxidant content in dry noodles [7]. Therefore super red dragon fruit skin is very feasible to be a functional food processing products into frozen yogurt, because the processing process uses low temperatures so as to minimize antioxidant damage.

This study aims to determine the characteristics of frozen yogurt red dragon fruit skin against antioxidant activity, fiber content of food, pH, total acid content and melting time. The benefits of this research is to provide information to the public about frozen yogurt red dragon fruit skin as food products of high nutritional value and artificial coloring.

Materials and Methods

2.1 Materials

The materials used in this research are pure culture Lactobacillus bulgaricus and Streptococcus thermophilus, skim milk, white sugar, dragon fruit skin, cream, aquades, and others. The tool used in this research is Autoclave, jar, hand mixer, pH meter, spectofotometer, and aluminum.

2.1.1 Preparation of frozen Yogurt Extract Red Dragon Fruit Skin. The process of making yogurt begins with the separation of skin and fruit, then smoothing the skin of dragon fruit mixed with water using a blender. The finely ground dragon skin is then mixed with concentrated (0%, 25%, 35%, and 45%) dragon fruit juice with ingredients of each UHT (500 ml) milk, granulated sugar (50g), milk powder (50), and water (250 ml) The material has been mixed and then proceed with Pasteurisasi process for 30 seconds with temperature 90°C, after that done cooling the dough. Inoculation with starter culture as much as 3% of the volume of frozen yogurt dough (density ≥ 107 CFU / ml). The mixture was placed into a sterile container and then covered with aluminum foil then subsequently incubated at 43ºC for 16-20 hours. After incubation the yogurt dough is inserted into the refrigerator [6]. Furthermore, each yogurt treatment mixing with 100 grams of cream (whipping cream), 100 gr sugar, and vanilla essence to get frozen yogurt. The mixed material is then continued on the shaking process by hand mixer for 10 minutes (until fluffy). Frozen yogurt dough is put into the freezer for 5 hours, after 5 hours each dough is shaking with hand mixer until fluffy and soft texture like ice cream is obtained. The last step is freezing by putting the dough into the freezer for 24 hours.

Frozen yogurt dragon fruit skin extract was tested for antioxidant activity determined by DPPH free radical method [9], crude fiber content [10], pH [10], total acid, and melting time measurement [6].

2.1.2 Analysis of frozen yogurt extract red dragon fruit skin. Analysis of frozen yogurt extract red dragon fruit skin was conducted in the form of analysis of functional component, included for antioxidant activity determined by DPPH free radical method [10], crude fiber content [2], pH [2], total acid [3], and measurement of melting time [16].

2.1.3 Data analysis. The data were analyzed statistically using ANOVA test with 95% confidence level. If F arithmetic is greater than or equal to F table then analysis will be continued with DNMRT test at 5% level.

Results and Discussion

3.1 Antioxidant Activity Frozen Yogurt
The addition of dragon fruit skin extract to the various treatments against frozen yogurt can be seen in Figure 1. The antioxidant activity resulted in a combination of treatment values between 4.00 to 12.25%. The result of variance analysis showed that there was a significant effect on the treatment of adding red fruit dragon skin percentage with no treatment. As for the addition of dragon fruit skin extract with a concentration of 25-45% showed no significant difference. Increasing the percentage of skin dragon fruit extract concentration resulted in increased antioxidant activity. This suggests that within the skin of dragon fruit contained a considerable antioxidant content. [8] stated that a super red dragon fruit ethanol extract has strong antioxidant activity. [11] reported that The antioxidant activity of yoghurts in terms of free radical scavenging activity was found to be the lowest in plain yoghurts. Antioxidant activity is a parameter that shows the percentage of food ability in inhibiting free radical [1].

![Antioxidant Activity vs Concentration of Red Dragon Fruit Extract](image)

Figure 1. Effect of dragon fruit skin concentration on antioxidant activity of frozen yogurt. The numbers followed by different lowercase letters show significantly different (P <0.05).

[12] stated that the utilization of red dragon fruit skin for the manufacture of jelly produces antioxidant (DPPH) levels in various treatment combinations ranging from 20.856% -20.885%. [13] The antioxidant activity produced in yogurt from the addition of *S. polycstum* extract ranged from 6.08 to 63.30%. The results of antioxidant levels of frozen yogurt of dragon fruit skin were lower than the results of other studies. This is due to several factors, among others, when pasteurization of samples using high temperature 90°C, so that conditions will affect the stability of anthocyanin. [8] [14] states that the stability of anthocyanins is influenced by several factors such as temperature, pH, light and oxygen changes, and other factors such as metal ions.

### 3.2 Crude fiber content

The addition of red dragon fruit skin extract resulted in crude fiber content of 1.037 - 1.625% (Figure 2). The results showed that fiber content increased with increasing dragon fruit skin concentration, but did not show any significant difference. The highest concentration of fiber at the treatment of 45% concentration was 1.625% and the lowest in control treatment (0%) without dragon fruit skin added 1.037%. This is in accordance with the study [12] that the addition of red dragon fruit skin effect on the content of jelly candy fiber produced.
In Figure 2 it is seen that the increase in coarse fiber content is in line with the increased addition of dragon fruit skin extract. [15] stated that the coarse fiber content of fruits dragon fruit ice increases with the increasing percentage of dragon fruit skin because the fiber content of the dragon fruit skin is quite large. Red dragon fruit skin has fiber ranging from 36.2% - 41.3% [2]. The fiber content is very good for lowering cholesterol levels, the fiber will bind bile acids (end products of cholesterol) in the digestive tract which is then issued with feces. This means that the higher the consumption of fiber will be the more bile acids and fats released by the body [12]. However, the increased concentration of dragon fruit skin extracts causes a more rough texture of frozen yogurt that can lead to a decrease in consumer preferences. [16] Reports that the addition of apple extract causes the highest viscosity in ice cream mix but does not cause probiotic ice cream has higher firmness.

### 3.3 pH

Determination analysis of pH level of frozen yogurt of dragon fruit skin can be seen in Figure 3. The results showed that pH level decreased with the addition of skin concentration of dragon fruit. pH frozen yogurt produced is in accordance with the SNI 01-2981-1992 which ranges from 4.0 to 4.5. [17] reported that consumers prefer fermented products with pH on the range of 4.2 and 4.4. The highest pH level at treatment 0% was 5.48 and the lowest at 45% addition treatment was 4.39. This is in accordance with the study [18] that the pH is lower along with the higher number of red dragon fruit extracts. Decreased pH Frozen yogurt is influenced by the activity of lactic acid bacteria in breaking lactose into lactic acid. The resulting lactic acid is the result of sugar metabolism which causes a decrease in pH of yogurt. This is related to the increasing number of lactic acid bacteria using lactose. The more sources of sugar that can be metabolized the more organic acids are produced so that automatically the pH will also be lower [19].

Statistical analysis of pH data on each treatment of dragon fruit skin extract showed no significant difference. This is due to the processing of frozen yogurt dragon fruit skin done in freezers with very low temperatures (± -4°C) so that the activity and metabolism of lactic acid bacteria stalled. The production of lactic acid which stops at a very low temperature causes the pH value for each treatment to show no significant difference [20].
Figure 3. Effect of dragon fruit skin concentration at pH level of frozen yogurt. The numbers followed by different lowercase letters show significantly different (P <0.05).

3.4 Total Acid

Analysis of the determination of frozen yogurt acid level of dragon fruit skin can be seen in Figure 4. The results showed that the total acid content increased along with the addition of dragon fruit skin extract concentration. The total acid content ranged from 0.73 to 1.14%, it shows total frozen yogurt acid in accordance with the probiotic drink quality requirements set by the Indonesian National Standard which ranged from 0.5% - 2.0%.

According to Fig. 4, the total acid produced did not significantly affect any treatment of red dragon fruit skin extract. [21] added mango extract of 0 - 5% into yogurt drink did not give significant effect (p> 0.05) to total acid value value. The total acid content ranged from 0.7539 - 0.797%. [13] stated that yogurt from the addition of S. polycystum extracts yielded total acids ranging from 0.83 to 1.11%.

3.5 Melting Time

The effect of addition of concentration of dragon fruit skin extract to frozen yogurt can be seen in Figure 5. The results showed that the melting time increased with the addition of dragon fruit skin dragon concentration, but did not show any significant difference. Melting time of frozen yogurt of the oldest dragon fruit skin at 45% treatment was 22.88 minutes and fastest in treatment of 0% addition of 17.30 minutes.
The increase of melting time in the highest percentage treatment is thought to be due to the addition of dragon fruit skin extract resulting in higher total solids so it can absorb water and make frozen yogurt resistant to melting. [6] adding 0-6% skim milk in the manufacture of frozen yogurt yields a melting time ranging from 8.82 to 10.36 minutes. [15] adding red dragon fruit skin 0-6% yields a melting time ranging from 9.11 to 14.10 minutes. Both the above melting times are smaller than the frozen yogurt products of dragon fruit skin extracts. It is suspected that the amount of air trapped in the frozen yogurt mixture of the dragon fruit skin is more and more due to the fiber content contained in the dragon fruit skin. [22] states that the melting time of ice cream is affected by the amount of air trapped in the ice cream mixture, the ice crystals formed and the fat content inside.

4. Conclusions

Based on the results of the study showed that the addition of red dragon fruit skin extract increased antioxidant levels ranged from 4.00 to 12.25%, crude fiber content ranged from 1.037 to 1.625%, total acid ranged from 0.73 to 1.14%, and lowered the pH value 5.48 - 4.39 and has a melting time of frozen yogurt 17.20 - 22.88 minutes.

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