Extraction of Leaf gel from *Cyclea peltata* and Its Utilization in Ice cream Manufacture

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Abstract— *Ice cream is a frozen dessert that consists of ice crystals, air cells, fat globules, and liquid syrup. Stabilizers are added to reduce meltdown, increase viscosity, and add smoothness to the ice cream. Gelatin is an important stabilizer used in ice cream manufacture, which is produced from animal origin. Thus, consumers of lacto-vegetarian are highly affected. This study was conducted to find out the most suitable grams of leaf gel from the Cyclea peltata plant to produce a gelatin substitute and investigate the physico-chemical properties and storage of ice cream incorporated with Cyclea peltata leaf gel with 8.0 g (T1), 9.6 g (T2), 11.2 g (T3), 12.8 g (T4), and 14.4 g (T5) and a control sample with 8 g of gelatin. The results of this study revealed that the pH and melting rate were significantly decreased with the increasing of leaf gel content in ice cream. Titratable acidity, overrun, and fat were increased significantly. According to the study, it could be concluded that the 11.2 gL^{-1} of Cyclea peltata leaf gel can be used as a substitute for gelatin used in ice cream manufacture*.

Keywords— Ice cream, Stabilizer, Gelatin, leaf gel.

I. INTRODUCTION

Ice cream is a complex colloidal system, usually formed by four structural compounds: air bubbles, fat and ice crystals dispersed in a matrix consisting of a solution of sugars, proteins, stabilizers, emulsifiers, dyes and scents (Silva *et al*., 2014). Stabilizers are substances that, despite their low usage level in ice cream mix, have very important functions, such as increase in viscosity of ice cream mix, aeration improvement, cry protection, and control of meltdown.

Presently ice cream industries are using stabilizers/emulsifiers blends, which are imported and very costly (Murtaza *et al*., 2004). Commercial gelatin was made from bone and cow or pork skin, because of that, imported gelatin is still questionable of halal status (Ayudiarti *et al*., 2022). Further, the gelatine price itself is high and thus, the producers are looking for alternatives to replace gelatine (Mariod and Adam, 2013).

Cyclea peltata belongs to the family Menispermaceae commonly known as "paatha" (Chellappan *et al*., 2011). *Cyclea peltata* leaf gel incorporated yoghurt could be prepared by incorporating 6 gL^{-1} of leaf gel as a total substitute for gelatine in yoghurt preparation (Siriwardhana *et al*., 2018).

The research aimed to replace gelatin in ice cream production using was *Cyclea peltata* leaf gel. The objectives were to prepare gelatin substitute, determine suitable grams of leaf gel, analyses physico-chemical properties of Ice cream during preparation and storage and assess consumer acceptability of the leaf gel based ice cream.

II. MATERIALS AND METHODS

2.1 Experimental Site and Design:

This study was undertaken at the Food Science Laboratory of the Department of Agricultural Chemistry, Faculty of Agriculture, Eastern University, Sri Lanka for a period of six months from June to December 2022.

2.2 Experimental Design:

The experiment was laid out in a Completely Randomize Design (CRD). Experiment has six treatments with three replicates.

- Treatment 1 (T1): 08.00g of Gelatine (Control)
- Treatment 2 (T2): 08.00g of leaf gel
- Treatment 3 (T3): 09.60 g of leaf gel
- Treatment 4 (T4): 11.20 g of leaf gel
- Treatment 5 (T5): 12.80 g of leaf gel
- Treatment 6 (T6): 14.40 g of leaf gel

2.3 Preparation of *Cyclea peltata* leaf gel:

Cyclea peltata leaves were cleaned by using distilled water to remove the adulterations. Afterwards the leaves were cut into smaller pieces and blended by adding 100ml of water to extract the leaf gel. When blending the leaf gel was formed. This leaf gel was squeezed out by using a clean cotton cloth. The collected gel was stored at 4℃

2.4 Sterilization of plastic cups and equipment:

Plastic cups were washed with tap water and detergent was used to remove the dust and dirty in the cups. Then plastic cups were washed with boiled water and they were allowed to dry in shade. Stainless steel pans and steel spoons were cleaned with tap water and detergent was used to remove dust and dirt.

2.5 Preparation of ice cream:

Milk was boiled for 15-20 minutes until the temperature of the milk reached 90℃ - 95℃ and it was cooled for 40℃. Small amount of milk was taken and 200g of milk powder/1L was dissolved in it. 100g of corn flour were dissolved in cooled milk separately. Then dissolved milk powder, 200g/1L sugar and corn flour were added subsequently to boiling milk and stirred well. Boling was stopped and allow to cool 5 minutes.

Then leaf gel with different grams and gelatine (as a control) were added to relevant concentration and beat about 5-8 minutes. Mixture was kept in refrigerator for 1 hour and it was beat 2 times with 1 hour interval. It was filled in to sterilized plastic cups and sealed with lids. Then sealed plastic cups were labelled according to the date of produced. Finally, ice cream cups were put in deep freezer.

III. RESULTS

Physico-chemical properties such as pH, titratable acidity, Melting rate, overrun and fat of ice cream samples for different treatments are shown in below Table 1.

TABLE 1
PHYSICO-CHEMICAL PROPERTIES OF ICE CREAM SAMPLES FOR DIFFERENT TREATMENTS

Treatments/ Analysis	T_1	T_2	T_3	T_4	T_5	T_6
pH	6.5566± 0.00333^{a}	6.55000± 0.00000^{a}	6.51333± 0.00333^{b}	6.4766± 0.00333^{c}	6.4466± 0.00333^{d}	6.3033± 0.00333^{e}
Titratable acidity	0.1633± 0.00333^{d}	0.17000± 0.00000^{cd}	0.18667± 0.00333^{bc}	0.1966± 0.00333^{b}	0.2033± 0.00667^{b}	0.2233± 0.00333^{a}
Melting rate	29.363± 0.00333^{e}	31.7133± 0.00333^{a}	30.5133± 0.00333^{b}	30.006± 0.00667^{c}	29.383± 0.00333^{d}	29.386± 0.00333^{d}
Overrun	54.186± 0.00333^{c}	53.3567± 0.00333^{f}	53.4467± 0.00333^{e}	53.466± 0.00333^{d}	54.213± 0.00333^{b}	54.236± 0.00333^{a}
Fat	10.130± 0.0000^{d}	10.1400± 0.0000^{cd}	10.1467± 0.00333^{c}	10.160± 0.0000^{b}	10.167± 0.00333^{b}	10.183± 0.00333^{a}

The values are means of 3 replicates ± standard error
The means with the same letters are not significantly different from each other on Tukey's test

The pH is a direct measurement of acid content (H+). According to Tukey's test, the value of pH decreased significantly with the increasing of leaf gel content respectively in all ice cream formulations. T1 which formulated with 8g of gelatine had the highest pH value while T6 (14.4 g of leaf gel) had the lowest value of pH.

The titratable acidity of the ice cream sample varied significantly and increased from 0.1633 % to 0.22333 % with the content of leaf gel from 8g to 14.4 g .And ice cream formulated with 8g of gelatine had 0.16333 % of titratable acidity which present the lowest acidity content among all the treatments.

The lower melting rate was observed in T1 (8g of gealtin), T5 (12.8 g of leaf gel) and T6 (14.4 g of leaf gel) the he highest melting rate was observed in T2 (8g of leaf gel). There was a decreasing of melting rate along with the increasing of leaf gel content in ice cream. According to the turkey also, there was a significant deference between treatments.

The lowest overrun was in T2 which is the ice cream formulated with low level of leaf gel content (8g). The highest overrun was observed in T6 (sample with 14.4g of leaf gel). Fat content had increased gradually with the content of leaf gel.

IV. DISCUSSION

The pH is a direct measurement of acid content (H^+). According to Tukey's test, the value of pH decreased significantly with the increasing of leaf gel content respectively in all ice cream formulations. This decrease of pH of ice cream samples which formulated with leaf gel may be attributed by the presence of acidic compound present in the leaf gel.

The titratable acidity of the ice cream sample varied significantly and increased from 0.17000 % to 0.22333 % with the content of leaf gel from 8g to 14.4 g. These results are agreement with the results reported by Choo et al. (2010) and in ice cream formulated with virgin coconut oil and with ginger juice by Gabbi et al. (2018). The acidity of leaf gel added ice-cream may have been influenced by the presence of acidic compounds, which are dominated by resin and saponin (Sukanya & Bhat, 2019).

Cyclea peltata leaf gel which was added to ice cream was different level (8.0 – 14.4 g) and that may be disturbed to the microstructure of ice cream samples and this may be the reason for significant difference of melting rate of ice cream. Ice cream samples incorporated with gelatine and T4, T3, T5 treatments showed the low level of melding down thus may be the indication that *Cyclea peltata* leaf gel inhibit the formation growth of ice crystals responsible for the meltdown of leaf gel added ice cream. The reason for the highest melting rate in T2 may be the lowest content of leaf gel.

There was an increasing of over run along with increasing of leaf gel grams added to ice cream. Because Stabilizers bind the water by means of hydrogen bonds, resulting in increased viscosity and overrun. According to turkey also, there was a significant different between all treatments. The higher the overrun the softer the ice cream (Thaiudon, et al., 2008).

Fat content had increased gradually with the content of leaf gel. These results are conformity with the results obtained by Erkaya et al. (2012) who studied the influence of cape goose berry in to ice cream. Fat present in leaf gel may interfere the fat content of ice cream.

V. CONCLUSION

Increasing leaf gel content led to decreased pH and melting rate values, increased titratable acidity, overrun and fat in formulated ice cream. Sensory evaluations showed that the most preferred ice cream formulations were T1, T3, T4 and T5. During at -12 ◦C, the most preferred ice cream samples showed significant differences in chemical and organoleptic qualities. *Cyclea peltata* leaf gel is a new substitute for gelatin and the combination of 1l of ice cream with 11.2g of *Cyclea peltata* leaf gel is the best combination for maintaining physic-chemical and organoleptic qualities without significant changes, making it safe for consumption.

REFERENCES

[1] Anpar, M. A., Tehrani, N. S. and Khomeiri, M. (2017). Optimization of new formulation of ice cream with native Iranian seed gums (Lepidium perfoliatum and Lepidium sativum) using response surface methodology (RSM). Journal of Food Science and Technology, 54(1): 196-208.

[2] Ayudiarti, D. L., Suryanti and Oktavia, D. A. (2020). The Effect of Different Types and Gelatin Concentrations on Ice Cream Quality. E3S Web of Conferences.

[3] Chellappan, D. R., Joseph, J. and Balasubramanian, P. (2011). Pharmacognostical, antioxidant and antiulcer screening of Cyclea peltata roots. Brazilian Journal of Pharmacognosy, 21(6).

[4] Choo, S. Y., Leong, S. K. and Henna, L. F. (2010). Physicochemical, sensory properties of ice cream formulated with virgin coconut oil. Food science Technology international, 16(6): 523-541.

[5] Erkaya, W. B., Dagdemir, E. and Sammy, G. M. (2012). Influence of Cape gooseberry (Physalis peruviana L.) addition on the chemical and sensory characteristics and mineral concentrations of ice cream. Food Research international, 45(1): 331-335.

[6] Mariod, A. A. and Adam, H. F. (2013). Review: Gelatin. Source, Extraction and Industrial. Acta Sci. Pol., Technol. Aliment., 12(2): 135-147.

[7] Murtaza, M. A. (2004). Quality Evaluation of Ice Cream Prepared with Different Stabilizers/Emulsifier Blends. International Journal of Agriculture & Biology, 6(1): 65-67.

[8] Nasir, S. S. & Hameed, A. S., (2018). Preliminary Pharmacognostic and Physico-chemical Evaluation of Root and Leaves of (Cyclea peltata)(Lam).Hook.F& Thoms. International Journal of Ayurveda and Pharma Research, 6(7).

[9] Sayed, Q. A., Anwer, S., Shukat, R. and Zahoor, T. (2018). Effect of different ingredients on texture of ice cream. Journal of Nutritional Health & Food Engineering, 8(6).

[10] Silva, V. M. d. (2014). Study of the preception of consumers in relation to different ice cream concepts. Food quality and preference, 36: 161-168.

[11] Siriwardhana, P., Somasiri, S. C., Edirisinghe, M. and Vithanage, M. (2018). Formulating a gelatin-free set yoghurt with Cyclea. African Journal of Food Science and Technology, 9(3): 48-51.

[12] Sukanya, B. and Bhat, P. (2019). Phytochemical, antimicrobial, antioxidant and immunomodulatory studies of leaf extracts of Cyclea peltata (Lam.) Hook. f. and Thomson. GSC Biological and Pharmaceutical Science, 9(1): 52-53.

[13] Thaiudon, S., Singchan, K. and Saeli, T. (2008). Comparison of commercial stabilizers with modified tapiaca starches on foam stability and overrun of ice cream. Asian journal of Foodv and Agro-Industry, 1(1): 51-61.