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Quality Evaluation of Whipping Cream Incorporated with Coconut Cream as an Alternative for Dairy Cream

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***Abstract*—**Whipping cream is widely used in food services and catering. Due to the high and exorbitant expense of milk cream, the replacement of coconut cream reduces the cost. This study aimed to develop a coconut cream-incorporated whipping cream and to determine the quality of composites. The whipping cream was prepared using coconut cream and dairy cream with different proportions as 100 % dairy cream, 100 % coconut cream, 30 % coconut cream + 70 % dairy cream, 10 % coconut cream + 90 % dairy cream. The whipping properties such as whipping time and % overrun, physicochemical properties such as moisture, fat, total solid, solid non-fat and ash content and sensory evaluation was conducted using the nine-point hedonic scale to determine colour, flavour, texture, taste, odour, and overall acceptability. There were significant differences observed in the whipping properties and the physiochemical properties among the treatments. Of which, 30 % coconut cream + 70 % dairy cream sample had 96s whipping time, 108 % overrun, 47.05 % moisture, 52.45 % total solids, 31.40 % solid non-fat and 21.05 % fat content. Whereas, it scored the overall higher values in terms of sensory profile. Therefore, it was selected as the best formulation based on the quality properties including whipping properties, physicochemical properties and sensorial properties. Eventually, the blending of coconut milk and dairy milk improved the whipping properties, physicochemical properties, and sensory properties. Further, coconut cream could be used as a replacer for dairy cream in the whipping cream at a certain level.

***Keywords*—**Coconut cream, physicochemical properties, sensory properties, whipping cream, whipping properties

I. Introduction

Whipping creams are now widely used on puddings, cakes, ice cream, fruit, and pastries, as well as for the bases of cream pies, both commercially and personal use. (Shamsi *et al*., 2002). A very common source of fat is from dairy milk use for the preparation of whipping creams. Whipping cream is a product that is results of the continuous incorporation of air into liquid cream and results in an emulsion featuring the suspension of air in the liquid, which suspension is held stable by the presence of fat (Rojeck, 2015).

With the current trend in public and global well-being mindfulness among the customers, the interest in useful food has expanded. Coconut extract has higher calories and fat which can be used as an alternative to dairy milk (Kate *et al*., 2017). Coconut milk's plant-based saturated fat may provide health benefits not seen in dairy milk's animal-based saturated fat. Coconut milk has supportive in the well-being of the gastrointestinal tract because of its antibacterial activity, hyperlipidemic equilibrating characteristics and helpful for effective applications. Coconut milk is an extensive wellspring of lauric acid It is a medium-chain saturated fatty that upgrades the amount of high thickness lipoprotein cholesterol in the blood (Kate *et al*., 2017).

Due to the high and exorbitant expense of milk in some non-industrial nations has made coconut a more affordable plant item that could be utilized alternative for milk-based products or to increase the utilization of dairy products for adequacy in battling protein hunger (Okon and Ojimelukwe, 2017). Lactose intolerant persons may be affected because of the sensitivities and intolerance of dairy milk products (Rojeck, 2015). Utilizing coconut milk for replacement will decrease the expense of the product. Coconut milk is rich with a sweet taste and wealthy in oil, protein and sugars. The combination of coconut milk with dairy milk (up to 30 %) produces a healthy, wholesome product with good sensory qualities (Okon and Ojimelukwe, 2017). This study aimed to develop whipping cream incorporating coconut cream with dairy cream to cater favourable physiochemical and sensorial properties.

II. Methodology

A. Location

The research was carried out at the Food Science and Technology Laboratory, Faculty of Technology, South Eastern

University of Sri Lanka and the Research and Development unit, Pelwatte Dairy Industry, Pelwatte, Sri Lanka.

B. Procurement of raw materials

The coconut kernels and sugar were bought from the local retail shops in Kalmunai and fresh dairy cream that contain 35 % fat was collected from Pelwatte Dairy Industry, Pelwatte. Xanthan gum was collected from Glorchem Enterprise, Household Chemical Supplier, Colombo.

C. Preparation of coconut cream

The coconuts were scraped by scraper and grated coconut scrapings weighed by analytical balance (AS 220.R2, Poland) and water was added (Coconut 200g : Water 350ml). Then graded coconut scrapings were ground using an electric grinder (TL 865B, China). Further, coconut milk was extracted by using a sieve from the ground coconuts. Then the coconut milk was put in a heavy bottom plastic pan and placed in a refrigerator at 4±1 °C for 24 hours for the separation of cream from the milk. After 24 hours, coconut cream was separated from the upper layer of the coconut milk. Separated cream was placed in a heavy bottom pan and kept under 4±1 °C in the refrigerator until further use.

D. Treatments

T1 – 100 % Coconut cream + Sugar (32g) + Xanthan gum (0.4g)

T2 – 100 % Fresh dairy cream + Sugar (32g) + Xanthan gum (0.4g)

T3 – 30 % Coconut cream + 70 % Fresh dairy cream + Sugar (32g) + Xanthan gum (0.4g)

T4 – 10 % Coconut cream + 90 % Fresh dairy cream + Sugar (32g) + Xanthan gum (0.4g)

E. Preparation of whipping cream

Fresh dairy cream, coconut cream, sugar (8 % W/W) and xanthan gum (0.1 % W/W) were added to the cream mixture according to the treatment plan and mixed well. Afterwards, it was pasteurized at 85 °C for 5 minutes and cooled down up to 35 °C. After cooling down the cream was refrigerated for 24 hours at 4±1 °C. Then the cream was whipped by using a hand-mixer (HM878W, China) at medium speed (950 - 1130 rpm).

F. Sample Analysis

1) Whipping properties:

a) Whipping time : The samples were whipped at medium speed (950 - 1130 rpm) using a hand mixer (HM878W, China) and Whipping time was measured at 15s intervals to reached maximum overrun in less than 2.5 min until achieving the maximum torque value (Bruhn and Bruhn, 1988; Dhungana *et al*., 2020).

b) Overrun: The cream volume was measured before whipping. Then, the cream was whipped by using a hand mixer with medium speed (950 - 1130 rpm). After whipping the cream, the volume of the whipped cream was evaluated according to the following equation (Gafour and Aly, 2020).

$$Overrun(\%) = \frac{V_1 - V_2}{V_1} \times 100 \quad (1)$$

V_1 : Volume of unwhipped cream (cm^3)
V_2 : Volume of whipped cream (cm^3)

G. Physicochemical properties

The moisture of the whipping cream was evaluated according to Oven Dry method (AOAC, 2005). Moisture cans were cleaned and dried to a constant weight in hot air oven at 100 °C and cooled in a desiccator and weighed (W1). Then 5.0g of the sample were introduced into dry crucibles of known mass (W2). The moisture cans that contain the sample were kept in the oven at 105 °C for 3 hours. The samples were weighed using an electronic analytical balance after cooling in a desiccator. The whole procedure was repeated, and they were returned to the oven for more drying, cooling, and weighing until they reached a consistent weight (W3). Moisture content was calculated according to the following equation,

$$Moisture\,Content(MC)\% = \frac{M_1 - M_2}{M_1} \times 100 \quad (2)$$

M_1: Weight of the initial sample (g)
M_2: Weight of the dried sample (g)

The total solid percentage of the whipping cream was determined according to AOAC, (2005). The total solid of the samples were measured using the following equation,

$$Total\ Solid(\%) = 100 - MC\% \quad (3)$$

The Gerber technique was used to determine the fat content. (AOAC, 2005). Initially, 10 ml of sulphuric acid was mixed with 10.75 ml of cream samples gently by the side of the butyrometer. Further, 1 ml. of amyl alcohol was poured with a tilt measure. With the use of a lock stopper and a regulating pin, the butyrometer was stoppered. After that, a tube is thoroughly stirred until a mahogany red color is achieved. After that, place the butyrometer in a hot water bath until it reaches 15-21 °C, then centrifuge it for 4 minutes at 1100 rpm. After that, placed the butyrometer in a warm water bath (65 °C) for a while. Solid non-fat (SNF) was measured using the following equation,

$$SNF(\%) = 100 - (MC - Fat)\% \quad (4)$$

The ash content was evaluated using to the dry ash method (AOAC, 2005). Moisture cans were cleaned and dried to a constant weight in hot air oven at 100 °C and cooled in a

desiccator and weighed (W1). Then 5 g of the sample were into dry crucibles of known mass (W2). The crucibles that contain the sample were kept in an oven at 100 °C for 3 hours. The samples were cooled in a desiccator and weighted using an electronic analytical balance.

The whole procedure was repeated, and they were returned to the oven for more drying, cooling, and weighing until they reached a consistent weight (W3). The ash content of the samples was measured using the following equation,

$$Ash\ content\ (\%) = \frac{M_3 - M_1}{M_2 - M_1} \times 100 \qquad (5)$$

M_1: Weight of the empty crucible (g)
M_2: Weight of the initial sample + crucible (g)
M_3: Weight of the dried sample + crucible (g)

1) Sensory analysis: Sensory evaluation was carried out by 20 untrained panellists using the nine-point hedonic scale with 1 responding dislike extremely and 9 like extremely. The samples were presented in a random pattern and the parameters evaluated included; colour, flavour, texture, taste, odour, and overall acceptability (Wang *et al*., 2020).

H. Statistical analysis

The data were analysed with one-way analysis of variance (ANOVA) to find significant differences and means were separated using Tukey's range test at 1 % significant level using SPSS (IBM SPSS Statistic 25).

III. Results and Discussion

A. Whipping properties

According to the study, the whipping time of composites was ranged between 96 to 147 s and significant deference (p<0.01) was observed between treatments for whipping time. The whipping time was increased when the quantity of coconut cream increased, which may be due to the large amount of water in coconut milk (Saesue and Puechkamu, 2015). The overruns of the formulations were ranged from 88 to 132 %. There was significant difference (p<0.01) was observed between treatments for overruns. Of which, the pure dairy cream recorded a higher overrun percentage after whipping compared to coconut cream. The higher fat content of the dairy cream is attributed to the stabilization of the air incorporated into the cream which resulted in the overrun (Allen *et al*., 2008). Further, the overrun of the composite creams increased with the increment of the dairy cream proportion (Table I).

Table I: Whipping properties of formulations

Treatments	Whipping time (seconds)	Overrun (%)
T1	146.67±6.67^{a}	88±0.02^{a}
T2	113.33±6.67^{b}	132±0.03^{b}
T3	96.67±3.33^{b}	108±0.01^{c}
T4	118.33±4.41^{b}	93±0.01^{d}
F, (DF)	14.47, (3,8)	1482.53, (3,8)
P value	0.000	0.001

Values are mean ± Standard Error of the replicates, a-d different superscript letters in the same indicate differences among samples. ($p < 0.01$).

Table II: Physicochemical properties of formulations

Treatments	Moisture (%)	Fat (%)	Total Solid (%)	SNF (%)	Ash (%)
T1	64.06±0.69^{a}	26.52±0.14^{a}	36.54±0.08^{a}	10.02±0.54^{a}	0.78±0.02^{c}
T2	53.61±0.26^{b}	16.21±0.01^{b}	46.66±0.24^{b}	30.45±0.38^{b}	0.97±0.01^{d}
T3	47.05±0.54^{c}	21.05±0.03^{c}	52.45±0.13^{c}	31.40±0.27^{b}	0.58±0.01^{b}
T4	52.11±0.06^{b}	18.66±0.2^{b}	47.80±0.13^{b}	29.14±0.26^{b}	0.38±0.02^{a}
F, (df)	243.92, (3,8)	20342.11, (3,8)	1841.71, (3,8)	299.65, (3,8)	328.09, (3,8)
P value	0.00	0.00	0.00	0.00	0.00

Values are mean ± Standard Error of the replicates, a-d different superscript letter in the same indicate differences among samples. ($p < 0.01$).

B. Physicochemical properties

Table II shows the physicochemical properties of the whipping cream. The moisture content of the whipping cream was ranged from 47.05 to 64.06 % and significant difference (p<0.01) was observed between treatments for moisture content. Of which, 100 % coconut cream had a higher amount of moisture content compared to the other formulations. The fat content of the formulations ranged from 16.52 to 56.60 %. The fat contents of the formulations were significantly different (p<0.01) within the treatment. Normally dairy cream contains 30 to 40 % of fat content (Gafour and Aly, 2020). According to Lakshanasomya *et al*. (2011), the fat content of the coconut cream was around 20 to 23 %. The total solid content (TS) of the whipping cream was ranged from 36.54 to 52.45 % which is significantly different (p<0.01) among the treatments. Mixing of coconut cream with dairy cream increased the TS of the resulting formulations. Coconut milk contains higher total solids than dairy milk (Hamad *et al*., 2016). SNF of the samples was significantly different (p<0.01) among the treatment and ranged between 10.02 to 31.41 %. The ash content of the whipping cream was ranged from 0.38 to 0.97 %. The ash content was highest in dairy milk and lower in coconut milk (Hamad *et al*., 2016). Therefore, T3 was observed as the best formulation based on the quality properties including moisture, total solids content, solid non-fat and fat content.

C. Sensory properties

The blending of coconut cream and fresh dairy cream made difference in sensory properties. So significant differences were observed in the colour, texture, and overall acceptability (p<0.01). The T3 (30 % Coconut cream and 70 % Fresh dairy cream) was favoured by the panellists in terms of colour, flavour, taste, odour, and overall acceptability

compared to other formulations (Figure 1). According to Saesue and Puechkamu, (2015), liking scores of all the attributes of whipped cream produced with coconut cream, were around 'like moderately'.

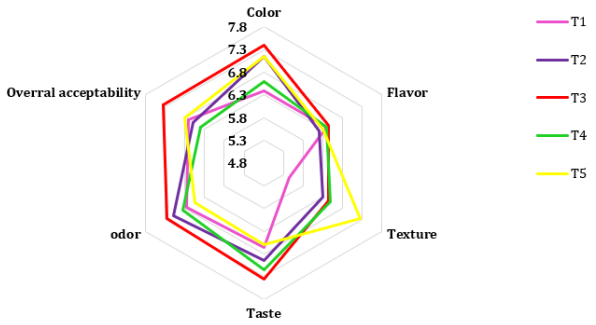

Figure 1: Sensory profile attributes of coconut cream-based whipping creams

IV. Conclusion

The coconut milk is a dairy alternative widely used by several people. The incorporation of coconut cream of 30 % with the dairy cream achieved favourable physiochemical and sensory properties for the whipping cream. Therefore, coconut cream could be used as a replacement to the dairy cream to reduce the cost and increase the consumer preference over traditional dairy-based whipping cream.

References

Allen, K. E., Murray, B. S., & Dickinson, E. (2008). Development of a model whipped cream: Effects of emulsion droplet liquid/solid character and added hydrocolloid. *Food Hydrocolloids, 22*(4), 690-699.

AOAC (2005) Official method of Analysis. 18th Edition, Association of Officiating Analytical Chemists, Washington DC, Method 935.14 and 992.24. Bruhn, C. M., & Bruhn, J. C. (1988). Observations on the whipping characteristics of cream. *Journal of Dairy Science, 71*(3), 857-862.

Dhungana, P., Truong, T., Bansal, N., & Bhandari, B. (2020). Effect of fat globule size and addition of surfactants on whip ability of native and homogenised dairy creams. *International Dairy Journal, 105*, 104671.

Gafour, W., & Aly, E. (2020). Organoleptic, textural and whipping properties of whipped cream with different stabilizer blends. *Acta Scientiarum Polonorum Technologia Alimentaria, 19*(4).

Hamad, M., Ismail, M., El-Kadi, S., & Shalaby, M. (2016). Chemical Composition, Sensory Evaluation, Starter Activity and Rheological Properties of Cow and Coconut Milk. *Journal of Food and Dairy Sciences, 7*(6), 295–298. https://doi.org/10.21608/jfds.2016.43009

Kate P. E., Rao K.J., Deshmukh G. P., Datir R.P & Tambade P.B (2017). Utilisation of coconut extract in the preparation of flavoured milk. *International Journal of Current Advanced Research, 6*(9). 6073-6078.

Lakshanasomya, N., Danudol, A., & Ningnoi, T. (2011). Method performance study for total solids and total fat in coconut milk and products. *Journal of Food Composition and Analysis, 24*(4-5), 650-655.

Okon, E., Ojimelukwe, P. (2017). Potentials of Coconut Milk as a Substitute for Cow Milk in Cheese Making. *Journal of Advances in Microbiology, 4*(2), 1–9. https://doi.org/10.9734/jamb/2017/34537

Rojeck, U. (2015). Patent Application Publication Pub. No.: US 2015 / 0344882 A1. 1(19).

Saesue, U., Puechkamu, Y. (2015). Production of Coconut Milk Mixed Whipped Cream for Food Services and Catering. *Journal of Science and Technology, Ubon Ratchathani University, 17*(3), 41-47.

Shamsi, K., Che Man, Y. B., Yusoff, M. S. A., Jinap, S. (2002). A comparative study of dairy whipping cream and palm oil-based whipping cream in terms of FA composition and foam stability. JAOCS, *Journal of the American Oil Chemists' Society, 79*(6), 583–588. https://doi.org/10.1007/s11746-002-0526-2

Wang, W., Chen, H., Ke, D., Chen, W., Zhong, Q., Chen, W., Yun, Y. H. (2020). Effect of sterilization and storage on volatile compounds, sensory properties and physicochemical properties of coconut milk. *Microchemical Journal, 153*, 104532.