MELTING PROPERTIES OF COCOA BUTTER-BASED ICE CREAM WITH VARIOUS CONCENTRATIONS OF RED DRAGON FRUIT (*HYLOCEREUS POLYRHIZUS*) PUREE

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ABSTRACT – *The melting properties of ice cream is influenced by its composition; therefore, the objective of the current study was to investigate the effect of red dragon fruit puree concentrations on the melting properties of cocoa butter-based ice cream. Ice creams were prepared by incorporating vary concentrations of red dragon fruit puree (20, 30, 40, 50 and 60%) and analysed for their melting properties (first dripping time, meltdown and melting rate). Increasing the concentrations of red dragon fruit puree were not significantly affecting the first dripping time of the ice cream; however, its reduced the meltdown and melting rate of the cocoa butter-based ice cream.*

Key words: Melting properties, cocoa butter, ice cream, red dragon fruit

INTRODUCTION

Red dragon fruit (*Hylocereus polyrhizus*) is rich in fibres, vitamins (A, B_1, B_2, B_3, C) and minerals such as potassium, calcium, zinc and iron (Mohd Adzim Khalili et al., 2006; Nurul and Asmah, 2014). The red-violet of the flesh is attributed by a water-soluble pigment known as betacyanin (Wybraniec et al., 2001; Wybraniec and Mizrahi, 2002; Vaillant et al., 2005; Wybraniec et al., 2007; Rebecca et al., 2010; Tenore et al., 2012) which has antioxidant properties to protect against certain oxidative stress-related diseases (Rebecca, et al., 2010; Lim, 2012; Liaotrakoon et al., 2013; Nurul and Asmah, 2014). Due to the nutritive value and health benefits of the red dragon fruit, it has been used to develop cocoa butter-based red dragon fruit ice cream (Chin and Nor Haslita, 2019).

Meltdown behaviour is an important parameter to gauge the quality of an ice cream formulation for which it affects the consumption perception and is used as a research tool to predict some physical properties, such as melting rate and shape retention, or to compare the effect of various formulation and processing condition on microstructure (Goff and Hartel, 2013). However, there is no in-depth study on the melting behaviour of red dragon fruit cocoa butter-based ice cream. Therefore, the aim of the current study was to explore the melting properties of the cocoa butter-based ice cream that formulated with various concentrations of red dragon fruit puree.

MATERIALS AND METHODS

MATERIALS

Ripe red dragon fruits, sugar, skim milk powder, fresh skim milk, salt and vanilla were purchased from the local supermarket. Deodorised cocoa butter was procured from the local cocoa grinder. Stabilizer and emulsifier were obtained from Danisco Malaysia Sdn. Bhd.

METHODS

Preparation of Red Dragon Fruit Puree
The cleaned red dragon fruits were cut into two halves using a knife and peeled off the skin to obtain the flesh. The flesh was then diced into small cubes and pureed using a blender (Brand: Philips; Model: HR2105).

Production of Cocoa Butter-Based Red Dragon Fruit Ice Cream (CBRDFIC)
The production of CBRDFIC is shown in **Figure 1**. The mixture of the red dragon fruit puree and fresh skim milk with the ratio of 20:80; 30:70; 40:60; 50:50 and 60:40 respectively was heated to 50^{o}C before incorporating the dry ingredients (26%) that consist of sugar, skim milk powder, salt, and mixture of stabilizer and emulsifier. The ice cream mixes were stirred until homogenous prior to pasteurization at 69^{o}C for 20 minutes using a batch pasteurizer (Brand: Taylor; Model: CH02, United State of America). Molten deodorized cocoa butter was added to the pasteurized ice cream mixes followed by homogenization at 5000 rotation per minutes (rpm) for 20 minutes (Brand: Silverson; Model: L5M) prior to aging at 5^{o}C for 20 hours in a chiller. Vanilla was added to the aged ice cream mixes prior to freezing process (12 minutes) using

a counter top batch freezer (Brand: Taylor by Frigomat; Model: C122, United State of America). The frozen ice creams were deposited into ice cream plastic containers (1 kilogram) and stored at -20°C prior to analyses.

Melting Properties Analysis

The meltdown test (drip-through test) of ice cream was quantified according to the method described by Bolliger et al. (2000). The frozen ice cream with the weight of 70 g was removed from the ice cream cup (100 ml) and placed on a wire screen (9 holes/ 1 cm^2) on top of a funnel (**Figure 2**). The test was carried out under controlled environment at temperature of 25°C. The first dripping time as well as the drip-through weight were recorded every 10 minutes for up to 60 minutes. The meltdown is defined as the mass of the drip loss divided by the total mass of the ice cream sample and plotted against time, and the highest gradient in the ascending meltdown curve indicates the maximum meltdown rate (Koxholt et al., 2001).

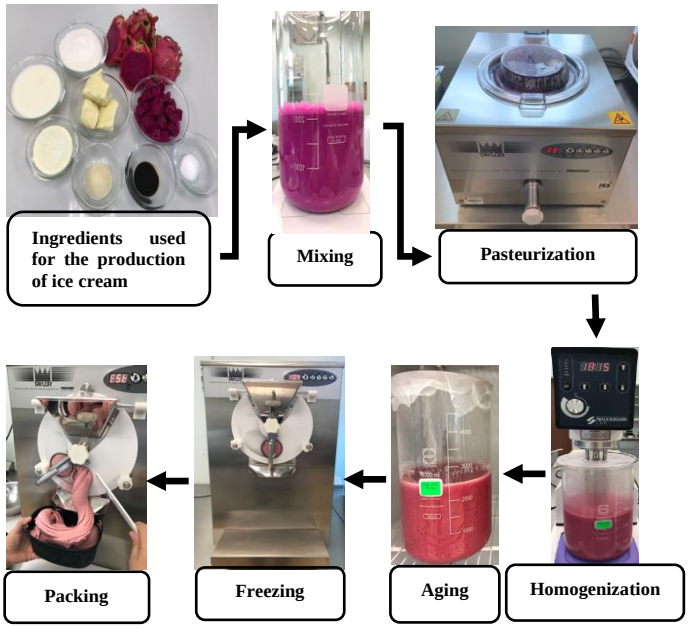

Figure 1: Production of Cocoa Butter-Based Red Dragon Fruit Ice Cream

Figure 2: Meltdown Test for Cocoa Butter-Based Red Dragon Fruit Ice Cream

Statistical Analysis

Data were collected in triplicate and statistically analysed by analysis of variance (ANOVA) and mean separation was by least significant difference at $p<0.05$ using Minitab®17 (Minitab Inc., United States of America).

RESULTS AND DISCUSSIONS

The first dripping time, meltdown and melting rate for the cocoa butter-based ice cream with various concentrations of red dragon fruit puree are shown in Table 1, Figure 3 and 4 respectively.

Addition of red dragon fruit puree does not significantly ($p>0.05$) affected the first dripping time for the cocoa butter-based ice creams (Table 1). The first dripping time for all treated ice creams were ranged from 22.5 ± 2.1 to 25.5 ± 3.5 minutes.

The meltdown of the cocoa butter-based ice creams treated with various concentrations of red dragon fruit puree are depicted in Figure 3. Increase concentration of red dragon fruit puree had reduced the meltdown of cocoa butter-based ice cream. A significant reduces in meltdown was observed when the concentration of red dragon puree reached 60%.

The melting rate with regards to concentration of red dragon fruit puree is shown in Figure 4. Ice cream contains 20% of red dragon fruit puree had the fastest melting rate of 6.36 ± 0.71 % meltdown per minute. Basically, the melting rate of ice cream decrease slightly when the concentrations of red dragon fruit puree increase from 20% to 60%. Nevertheless, incorporation of 60% red dragon fruit puree had significantly ($p<0.05$) affecting the melting rate of the ice cream sample, where it was observed at much slower rate of 1.65 ± 1.15 % meltdown per minute. This phenomenon might be due to the higher presents of the dragon fruits seeds in the ice cream sample when its concentration was increased, causing percent of meltable portions in ice cream formulation was reduced, and consequently reducing its meltdown portion.

Table 1: First Dripping Time for the Cocoa Butter-Based Ice Cream with Various Concentrations of Red Dragon Fruit Puree

Concentration of Red Dragon fruit Puree (%)	First Dripping Time (minutes)
20	22.5 ± 2.1[a]
30	25.5 ± 3.5[a]
40	24.5 ± 0.7[a]
50	24.0 ± 0.0[a]
60	23.5 ± 0.7[a]

Mean values with same alphabet are not significantly different (p>0.05)

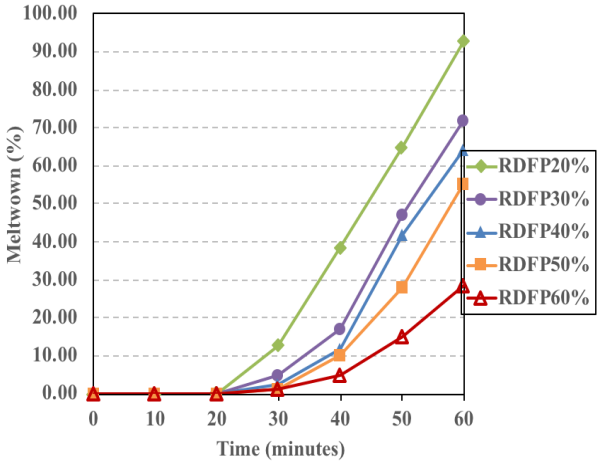

Figure 3: Meltdown of the Cocoa Butter-Based Ice Cream with Various Concentrations of Red Dragon Fruit Puree

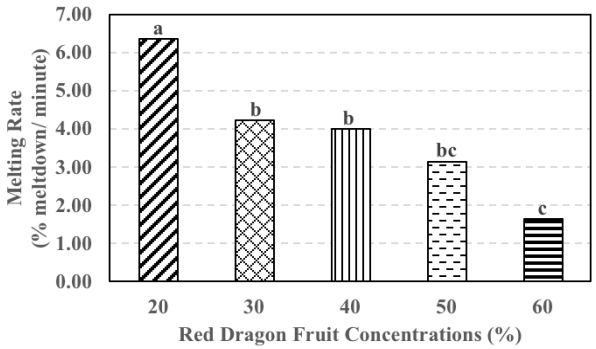

Figure 4: Melting Rate of the Cocoa Butter-Based Ice Cream with Various Concentrations of Red Dragon Fruit Puree

CONCLUSIONS

The melting behaviour of the cocoa-butter based ice cream was greatly affected by the concentration of red dragon fruit puree used in the formulation.

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