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The Effect of Skim Milk and Carboxy Methyl Cellulose Concentrations on the Characteristics of Tamarillo Velva (*Cyphomandra betacea*)

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A B S T R A C T

This research aims to determine the effect of skim milk and *Carboxy Methyl Cellulose* (CMC) concentrations and determine the best formulation for making tamarillo Velva. The research used a Completely Randomized Design (CRD) with 2 factors and 2 replications. Data analysis using ANOVA was continued with the Duncan multiple range test (DMRT) at a confidence level of 5%. The 1st factor is the concentration of skim milk (5% (S1), 7.5% (S2), 10% (S3)). The 2nd factor is the CMC concentration (0.25% (C1), 0.50% (C2), and 0.75% (C3)). The parameters observed include analysis of total dissolved solids, vitamin C content, protein content, antioxidant analysis, overrun, melting time, viscosity, and organoleptic analysis, including texture, taste, aroma, and color. The results of the treatment with the concentration of skim milk and CMC had a significant effect on viscosity, overrun, melting time, vitamin C content, total dissolved solids, texture, and color. The best treatment in this study was velva with a concentration of skim milk (10%) and CMC (0.25%) with an antioxidant activity value of 28.20%, vitamin C 16.56 mg/100g, protein 1.60 g, total dietary fiber 14.05%, total dissolved solids 26.9°brix, overrun 15.78%, viscosity 2079 m.Pas, melting time 20.83 minutes, texture scoring test 3.32 (quite soft), and average preference for taste 3.64 (somewhat like), color 3 (somewhat like), aroma 3.6 (somewhat like).

1. INTRODUCTION

1.1. Research Background

Tamarillo (*Cyphomandra betacea*) is a fruit that contains provitamin A, vitamin C, and minerals (potassium, phosphor, magnesium), and is high in fiber and antioxidants. According to [1] demand for tamarillo eggplant continues to increase but it is only consumed as fresh fruit or processed into syrup, juice and jam, so it is very necessary to diversify tamarillo eggplant preparations, one of which is frozen dessert, namely velva.

Velva (frozen dessert) is a processed product made from a frozen mixture of fruit or vegetable puree, sucrose and stabilizers and has a texture like ice cream. Velva products are rich in natural fiber and vitamins, so they have the opportunity to become functional foods that are beneficial for health, have a delicious taste and are liked by many people [2]. According to Ref. [3], the fat content in velva is lower than ice cream, this is due to the use of low-fat skim milk. Good velva has the characteristics of not melting easily, uniform appearance, attractive color, and a taste that suits the type of fruit used as velva material. The main problems with Velva products include rough texture, poor emulsion stability, and relatively fast melting speed, so they require the addition of skim milk and stabilizers.

Skim milk is the part of the milk that remains after the cream has been partially or completely removed. Skim milk contains all the nutrients of milk, especially protein, except fat and fat-soluble vitamins [4]. Milk protein in making ice cream functions to stabilize the fat emulsion after the homogenization process, helps foaming, increases and stabilizes the water binding capacity which affects the viscosity of the ice cream and produces a compact, soft ice cream texture and prevents a mushy appearance [5]. Excessive use of non-fat solid ingredients can cause the formation of a texture that is less soft, such as gritty, as a result of crystallization of milk sugar [6].

The use of stabilizers in making velva serves to produce a soft product texture, reduces the formation of rough ice crystals and can provide good resistance to the melting process. The stabilizer commonly used in Velva products is *Carboxy Methyl Cellulose* (CMC). The addition of CMC can increase the consistency of the mixture in the homogenization and aging process, increasing the viscosity of the material and liquid can avoid the re-coagulation

of fat in the mixture during the cooling and aging steps. CMC can play a certain role in emulsification, and when added to the mixture and stirred it will form very fine bubbles in the overrun process, so that the velva has a smooth and good network, while increasing the product expansion rate [7].

Based on the problems above, research is needed that aims to determine the effect of the concentration of skim milk and *Carboxy Methyl Cellulose* (CMC) on the physicochemical and organoleptic characteristics of tamarillo velva, as well as determining the best formulation for making tamarillo velva.

1.2. Literature review

1.2.1. Velva

Velva is a processed fruit product in the form of a frozen food similar to ice cream but low in fat, because there is no added milk fat. The components that make up Velva consist of fruit or vegetable puree, sucrose or sugar and stabilizers. Puree is crushed fruit that has a concentration like porridge. Usually puree is made from fruit or vegetables that have undergone a sorting process first and then processed until they become puree [8]. The nutritional content of the velva produced is very dependent on the raw materials and has a distinctive taste that differentiates it from similar products. Differences in raw materials will also affect the final product, where Velva has a less soft texture than ice cream [9].

An important quality parameter for Velva products besides taste is texture. Good Velva has a soft texture like ice cream. The degree of fineness of texture depends on the rate of heat transfer during freezing, the percentage of water and dissolved solids in the puree, the proportions, particle size and distribution of insoluble solids. The texture of frozen products is generally also influenced by sugar content, freezing method, type and amount of ingredients [10].

In making velva the following materials are needed:

a. *Carboxy Methyl Cellulose* (CMC)

CMC acts as a stabilizer in Velva products which functions to produce a soft product texture, reduce coarse ice crystals, produce a uniform product and provide good resistance to the melting process [7]. CMC has the advantage of being easily soluble in water, cheap, and does not require a long aging time.

b. Skim milk

The main component of skim milk is protein which plays a role in increasing nutritional value and taste. The protein in skim milk has the function of helping the foaming process by trapping air into the dough and absorbing some of the water in the dough so that a soft dough is obtained [11], and can interact with the stabilizer by binding water and air, forming a sturdy body, giving a savory taste and form a good velva [12].

c. Granulated sugar (sucrose)

Sugar is the main component which functions as a sweetener and forms a smooth and soft velva texture [10].

d. Water

The water content in food ingredients also determines the acceptability, freshness and durability of the ingredients [13].

1.2.2. Velva texture formation

Texture is an important parameter in Velva products. The process of forming the texture in making velva is a series of interconnected processes, starting from the stage of mixing the ingredients. The combination of ingredients used to obtain a homogeneous dough aims to obtain a soft, thick and even mixture texture [14].

In making velva, an aging process is carried out to help provide a good texture and cause high overrun during foaming. Aging is carried out for 4-24 hours at 4°C to increase viscosity and improve the texture and appearance of the product. The changes that occur during aging are the formation of a combination of stabilizers with water in the velva, increasing the viscosity and making the mixture more stable [15].

The most important process in forming the velva texture is the freezing process, because it affects the quality and results of the final product. The freezing point of velva depends on the solubility and constituent components in the product. Freezing temperature can be calculated and determined with fairly good accuracy. Velva has a freezing point of around -2.5°C. The initial freezing point of the velva mixture is highly dependent on the addition of sugar. When latent heat is released from water and ice crystals are formed, a new freezing point is established for the remaining solution as it has become more concentrated with respect to the dissolved components [16]. Finally, there is further hardening or freezing after the product is packaged. The hardening process temperature ranges from -25°C to -30°C.

1.3. Research Objectives

This research aims to determine the effect of the concentration of skim milk and *Carboxy Methyl Cellulose* (CMC) on the physical, chemical and organoleptic characteristics of tamarillo velva.

2. MATERIALS AND METHODS

2.1. Materials and Tools

The materials used in this research were Tamarillo, *Carboxy Methyl Cellulose* (CMC), skim milk, water sucrose, I2, 1% Starch Indicator, 0.01 N Iodine Solution, DPPH (2,2-diphenyl-1-picrylhydrazil), Sodium Chloride 0.9%, Alcohol 96%, Methanol, and Aquades.

The tools used include a UV-Vis spectrophotometer, digital viscometer, thermometer, test tube, Petri dish, Erlenmeyer, 1 ml volumetric pipette, measuring flask, measuring cup, weighing bottle, dropper pipette, stirrer, analytical balance, and sensory assessment equipment.

2.2. Research Design and Analysis

The research design used in this research was a Completely Randomized Design (CRD) with a 2-factor factorial pattern with 2 replications. Factor I is the concentration of skim milk (5%, 7.5%, 10% (w/v)). Factor II is CMC concentration (0.25%, 0.50%, 0.75% (w/v)). Observation data were analyzed using ANOVA at the 5% level and using the Duncan Multiple Range Test (DMRT).

Table 1. Combinations of treatments studied

Skim milk concentration	CMC concentration		
	C1	**C2**	**C3**
S1	S1C1	S1C2	S1C3
S2	S1C2	S2C2	S2C3
S3	S1C3	S3C2	S3C3

Information:

S1C1 = Skim milk concentration 5% and CMC 0.25%

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S1C2 = Skim milk concentration 5% and CMC 0.50%
S1C3 = Skim milk concentration 5% and CMC 0.75%
S2C1 = Skim milk concentration 7.5% and CMC 0.25%
S2C2 = Skim milk concentration 7.5% and CMC 0.50%
S2C3 = Skim milk concentration 7.5% and CMC 0.75%
S3C1 = Skim milk concentration 10% and CMC 0.25%
S3C2 = Skim milk concentration 10% and CMC 0.50%
S3C3 = Skim milk concentration 10% and CMC 0.75%

2.3. Research Implementation

2.3.1. Making tamarillo puree

Ripe tamarillo fruit is sorted by separating it from the fruit stalk (characteristics of ripe fruit: the skin of the fruit is red throughout). After that, wash using clean water. A total of 1 kg of fruit is blanched at 80°C for 10 minutes. Then cut it into two parts and separate the flesh from the skin using a spoon. Then put the tamarillo flesh into a blender and add water in a ratio of 2:1. The crushing process is carried out to produce pulp or fruit puree, and filtered to separate the seeds.

2.3.2. Making tamarillo velva

Preparation of ingredients for making velva (200 ml tamarillo puree, 50 g sucrose, skim milk according to treatment (10 g, 15 g, 20 g), CMC according to treatment (0.5 g, 1 g, 1.5 g). Next , mixing ingredients I include 200 ml tamarillo puree, 25% sucrose (w/v), skim milk according to treatment (5%, 7.5%, 10% w/v), and CMC according to treatment (0.25% , 0.50%, 0.75% w/v). Then homogenization is carried out until completely dissolved using a mixer. Once homogeneous, the velva goes into the aging process at a temperature of ± 5°C for 12 hours. Then stir the velva mixture which has been frozen using an Ice Cream Maker (ICM) for 30 minutes. After that, packaged in ice cream cups with a volume of 500 ml. Velva is placed in the freezer (± 5°C) for 24 hours.

2.4. Observation

2.4.1. Raw material analysis

The raw material used is tamarillo puree. The analysis carried out was antioxidant activity (%) and vitamin C levels (mg/100g).

2.4.2. Chemical analysis

Analytical parameters include analysis of antioxidant activity (%), vitamin C content (mg/100g, protein content (%), and total dissolved solids (°brix).

2.4.3. Physical analysis

Analysis parameters include overrun analysis (%), viscosity (m.Pas), and melting time (minutes).

2.4.4. Sensory analysis

Organoleptic testing was carried out on tamarillo velva samples. In this organoleptic test, 25 panelists assessed the texture, aroma, color, and taste of velva. The analysis is continued with an effectiveness index test to determine the best treatment based on physical, chemical and organoleptic properties. Then the best treatment would be to analyze the food fiber content.

3. RESULTS AND DISCUSSION

3.1. Raw Material Analysis

Preliminary analysis of tamarillo puree includes analysis of antioxidant activity using the DPPH method and vitamin C levels which can be seen in Table 2.

Table 2. Raw material analysis results

Parameter	Raw material	
	Tamarillo puree	Literature
Antioxidant activity (%)	59.26 ± 0.9	69.78
Vitamin C (mg/100g)	28.53 ± 0.8	35.31

Based on the data in Table 2, there are differences between the results of raw material analysis and the literature used. Tamarillo puree has an antioxidant activity value of 59.26% and a vitamin C level of 28.53 mg/100g. The results obtained are lower than Ref. [17], where the antioxidant activity of tamarillo fruit is 69.78% and the vitamin C content is 35.31 mg/100g. The differences in the results of the initial analysis of Tamarillo were caused by differences in the processing process to make puree. This is supported by Ref. [18], that the age at which the fruit is harvested, the climatic conditions where it is grown, how to care for and harvest the fruit, post-harvest fruit storage and process technology influence the chemical composition of the material. In addition, factors that can influence the final analysis data include sample preparation, instruments used, the analyst performing the test, calibration, analysis conditions, chemicals and other consumables.

3.2. Chemical Analysis

Chemical analysis of tamarillo velva with the influence of the concentration of skim milk and Carboxy Methyl Cellulose (CMC) consisted of antioxidant activity, vitamin C content, protein content, and total dissolved solids.

3.2.1. Antioxidant activity

Antioxidants are inhibitors that work to inhibit oxidation by reacting with reactive free radicals to form unreactive free radicals which are relatively more stable. Based on the results of the analysis, it can be seen that there is no real interaction ($p \geq 0.05$) between the concentration of skim milk and CMC on the antioxidant activity of tamarillo velva. However, the skim milk concentration treatment had a significant effect on the antioxidant activity produced, whereas the CMC concentration treatment did not. The results of the antioxidant activity analysis can be seen in Table 3.

Based on the results of the analysis, it can be seen that the treatment with a concentration of 10% skim milk and 0.75% CMC had the highest antioxidant activity value, namely 29.78%, while the treatment with a concentration of 5% skim milk and 0.25% CMC produced the lowest value of 25.55%. . The higher the concentration of skim milk, the greater the antioxidant activity of the velva produced. This is because skim milk is a cryoprotectant which functions as a protective component due to freezing so that the higher the concentration of skim milk, the better the stability of antioxidant activity in the velva. The higher the CMC concentration, the higher the antioxidant activity of tamarillo velva, but not significantly different. This is because CMC does not contain antioxidant compounds. The use of CMC

in making velva cannot increase the antioxidant content. Still, it can prevent antioxidant damage so that a product's decrease in antioxidant activity is not significant [19].

Table 3. The result of chemical analysis of tamarillo velva

Chemical analysis	Treatment								
	S1C1	**S1C2**	**S1C3**	**S2C1**	**S2C2**	**S2C3**	**S3C1**	**S3C2**	**S3C3**
Antioxidant activity (%)	25.55 ± 0.1[a]	25.73 ± 0.1[a]	26.11 ± 0.1[a]	27.49 ± 0.1[b]	27.66 ± 0.1[b]	27.54 ± 0.1[b]	28.20 ± 0.1[b]	28.59 ± 0.1[b]	29.78 ± 0.1[c]
Vitamin C (mg/100g)	13.39 ± 0.1[a]	13.94 ± 0.0[b]	14.20 ± 0.1[c]	15.37 ± 0.0[d]	15.98 ± 0.0[e]	16.10 ± 0.0[e]	16.56 ± 0.0[f]	16.81 ± 0.0[g]	16.97 ± 0.0[h]
Protein (%)	1.37 ± 0.1[a]	1.41 ± 0.1[a]	1.44 ± 0.1[a]	1.52 ± 0.1[b]	1.53 ± 0.1[bc]	1.57 ± 0.1[bcd]	1.60 ± 0.1[cd]	1.61 ± 0.1[d]	1.64 ± 0.1[d]
Total dissolved solids (°brix)	21.20 ± 0.4[a]	22.25 ± 0.4[b]	23.70 ± 0.3[c]	24.70 ± 0.3[d]	25.25 ± 0.4[d]	25.70 ± 0.3[e]	26.90 ± 0.0[f]	27.00 ± 0.0[f]	28.25 ± 0.4[g]

Note: Average values accompanied by the same letter mean they are not significantly different at p≥0.05

3.2.2. Vitamin C

The results of the analysis of vitamin C levels in tamarillo velva with the influence of skim milk concentration and CMC ranged from 13.39-16.97 mg/100g. The results of the analysis can be seen in Table 3.

Based on the results of the analysis, it can be seen that the treatment with a concentration of 10% skim milk and 0.75% CMC had the highest levels of vitamin C, namely 16.97 mg/100g, while the treatment with a concentration of 5% skim milk and 0.25% CMC produced the lowest levels of vitamin C. 13.19mg/100g. The higher the concentration of skim milk, the higher the velva vitamin C levels. Skim milk has glucose and lactose components as energy sources and lipoproteins, which function as protective components against freezing. Skim milk has a vitamin C content of 1.0 μg [20]. In addition, increasing the CMC concentration used resulted in increased velva vitamin C levels. This is because CMC can maintain the vitamin C contained in the velva of tamarillo. Because CMC is hydrophilic and soluble in water and acts as a protective colloid that protects vitamin C in CMC gel beads [21].

3.2.3. Proteins

Protein has an important role in forming the texture of the velva. Based on the results of the analysis, it can be seen that there is no significant interaction (p≥0.05) between the concentration of skim milk and CMC on the protein levels of tamarillo velva. However, the skim milk concentration treatment really affected the protein levels produced, whereas the CMC concentration treatment did not. The results of the analysis of tamarillo velva protein levels ranged from 1.37-1.64%. The results of the analysis can be seen in Table 3.

Based on the results of the analysis, it can be seen that the treatment with a concentration of 10% skim milk and 0.75% CMC had the highest protein content, namely 1.64%, while the treatment with a concentration of 5% skim milk and 0.25% CMC produced the lowest protein content of 1.37%. . The higher the concentration of skim milk, the higher the velva protein levels produced. This is because the protein content of skim milk is relatively high, so the higher the concentration of skim milk added, the higher the protein content of tamarillo Velva. Skim milk powder contains 35.6 g of protein/100 g of skim milk [6]. The higher the CMC concentration, the higher the velva protein content of tamarillo eggplant but not significantly different. CMC is a product of cellulose derivatives and does not contain protein [22]. CMC functions in Velva products as a thickener, preventing retrogradation and syneresis, as well as texture.

3.2.4. Total dissolved solids

Total dissolved solids is an important factor in Velva products. The results of the analysis of total dissolved solids of tamarillo velva with the influence of skim milk concentration and CMC ranged from 21.20-28.25°brix. The results of the analysis can be seen in Table 3.

Based on the results of the analysis, it can be seen that the treatment with a skim milk concentration of 10% and CMC 0.75% produced the highest total dissolved solids, namely 28.25°brix, while the treatment with a skim milk concentration of 5% and CMC 0.25% produced the lowest total dissolved solids 21 .20°brix. The higher the concentration of skim milk used, the total dissolved solids of tamarillo velva increased. This is because skim milk contains soluble solids such as lactose, protein and minerals. Total dissolved solids come from the breakdown of proteins into simple, water-soluble molecules such as amino acids and peptones [23]. The CMC concentration used also influences the increase in total dissolved solids produced. CMC is a hydrophilic colloidal solid that can bind large amounts of free water so that it can increase total dissolved solids and increase viscosity to the velva [24].

3.3. Physical Analysis

Physical analysis of tamarillo velva with the influence of skim milk concentration and *Carboxy Methyl Cellulose* (CMC) consisting of overrun, viscosity and melting time.

3.3.1. Overrun

Overrun is a collection of air in the velva dough which causes an increase in the dough volume during the freezing process. The results of the overrun analysis of tamarillo velva with the influence of skim milk concentration and CMC ranged from 13.43-18.79%. The results of the overrun analysis can be seen in Table 4.

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Table 4. The result of the physical analysis of tamarillo Velva

Physical analysis	Treatment								
	S1C1	S1C2	S1C3	S2C1	S2C2	S2C3	S3C1	S3C2	S3C3
Overrun (%)	18.79 ± 0.1[a]	18.09 ± 0.1[a]	17.25 ± 0.1[b]	16.81 ± 0.2[c]	16.31 ± 0.0[d]	16.33 ± 0.5[d]	15.78 ± 0.6[d]	14.49 ± 0.3[e]	13.43 ± 0.3[f]
Viscosity (m.Pas)	1106 ± 2.8[a]	1167 ± 1.4[b]	1381.5 ± 2.1[c]	1251.5 ± 0.7[d]	1582 ± 2.8[e]	1787.5 ± 2.1[f]	2079 ± 1.4[g]	2250 ± 2.8[h]	2343.5 ± 0.7[i]
Melting time (minutes)	12,10 ± 0.0[a]	13.78 ± 0.4[b]	14.47 ± 0.1[b]	14.63 ± 0.5[b]	15.82 ± 0.5[c]	16.81 ± 0.4[d]	20.83 ± 0.4[e]	20.93 ± 0.5[e]	21.35 ± 0.3[e]

Note: Average values accompanied by the same letter mean they are not significantly different at p≥0.05

Based on the analysis results, it can be seen that the treatment with 5% skim milk concentration and 0.25% CMC produces the highest overrun value, namely 18.79%, while the treatment with 10% skim milk concentration and 0.75% CMC produces the lowest overrun, namely 13.43%. The higher the concentration of skim milk and CMC used, the lower the overrun will be. This is because skim milk and CMC contain high total solids, causing the velva dough to become thicker so that the resulting velva will be more difficult to expand. Water bound in the molecular structure causes the dough to become thicker, as a result it is difficult for air to penetrate the surface of the dough and the product is more difficult to rise. Air bubbles can be maintained because they are covered by a layer of fat globules [25].

3.3.2. Viscosity

Viscosity is the resistance of a fluid to flow. The results of the viscosity analysis of tamarillo velva with the influence of skim milk concentration and CMC ranged from 1104-2344 m.Pas. The results of the viscosity analysis can be seen in Table 4.

Based on the analysis results, it can be seen that the treatment with 10% skim milk concentration and 0.75% CMC produces the highest viscosity value, namely 2344 m.Pas, while the treatment with 5% skim milk concentration and 0.25% CMC produces the lowest viscosity, namely 1106 m.Pas. The higher the concentration of skim milk and CMC used causes the viscosity of the velva to increase. Added skim milk and CMC can affect the viscosity of velva, because there is an interaction between milk casein and CMC through electrostatic forces so that it can increase viscosity. According to Ref. [26], casein (in skim milk) contains amino acids that have electron groups (-NH2) which accept protons from oxonium, namely oxygen, which has 3 protons (H3O+), producing amino acids that have positive groups (-NH3+). Between the bonds of protein cations (-NH3+) and CMC anions (-COO-) an electrostatic force occurs, resulting in an attractive force. The attractive force between protein and CMC can increase the viscosity of the velva.

3.3.3. Melting time

Melting power is the time needed for velva to melt completely. The results of the analysis of the melting time of tamarillo velva with the influence of skim milk concentration and CMC ranged from 12.10 to 21.35 minutes. The results of the melting time analysis can be seen in Table 4.

Based on the results of the analysis, it can be seen that the treatment with a concentration of 10% skim milk and 0.75% CMC had the highest melting time, namely 21.35 minutes, while the treatment with a concentration of 5% skim milk and 0.25% CMC had the lowest melting time, namely 12.10 minutes. The higher the concentration of skim milk and CMC used, the longer the velva melting time will be. The increase in melting time is related to the viscosity of the velva, where the greater the viscosity, the longer the melting time of the velva produced. Overrun and melting time in velva have a related correlation, where the lower the overrun value, the longer it takes to melt, this is due to the amount of solids contained in the velva dough.

Good quality ice cream has a melting time of between 10-25 minutes [27]. The results of the analysis showed that all treatments had a melting time of more than 10 minutes, which indicated that the tamarillo velva produced had good quality in terms of its melting power.

3.4. Sensory analysis

To determine the effect of skim milk concentration and *Carboxy Methyl Cellulose* (CMC) treatment on the sensory properties of tamarillo velva by distributing questionnaires to 25 panelists using the scoring test method for texture parameters and hedonic tests for aroma, color and taste parameters.

The scoring test on the texture of tamarillo velva treated with skim milk concentration and CMC obtained an average value of between 3.32-4.28. The treatment with 7.5% skim milk concentration and 0.75% CMC got the highest score with an average value of 4.28 (soft), while the treatment with 10% skim milk concentration and 0.25% and 0.75% CMC got the lowest score. with an average value of 2.77 (not soft). The concentration of skim milk and CMC used had a real influence on the texture of the tamarillo velva produced. The addition of skim milk can help form a compact and soft texture and prevent a soft appearance on the velva texture [4]. Apart from that, the addition of a stabilizer such as CMC also functions to prevent the growth of ice crystals due to temperature fluctuations during storage so that the texture of the velva will be soft.

Table 5. Average scoring test for tamarillo velva texture

Treatment	Texture
S1C1	3.72 ± 0.9[a]
S1C2	4.00 ± 0.7[b]
S1C3	4.08 ± 0.8[c]
S2C1	3.52 ± 0.8[a]
S2C2	3.88 ± 0.8[b]
S2C3	4.28 ± 0.7[d]
S3C1	3.32 ± 1.0[a]
S3C2	3.76 ± 0.9[a]
S3C3	3.32 ± 1.0[a]

Note: Average values accompanied by the same letter mean they are not significantly different at p≥0.05. Scale 1: very not soft; 2: not soft; 3: moderately soft; 4: soft; 5: very soft

Table 6. Average hedonic test value of tamarillo velva

Treatment	Aroma	Color	Taste
S1C1	3.6 ± 0.9	3.96 ± 0.7	3.84 ± 0.9
S1C2	3.6 ± 0.8	4.04 ± 0.6	4.00 ± 0.9
S1C3	3.56 ± 0.8	3.92 ± 0.8	4.12 ± 0.8
S2C1	3.60 ± 0.7	3.68 ± 0.9	3.56 ± 0.9
S2C2	4.08 ± 0.8	3.52 ± 0.6	3.64 ± 0.7
S2C3	3.44 ± 0.8	3.32 ± 0.8	3.84 ± 0.9
S3C1	3.60 ± 0.7	3.00 ± 0.9	3.64 ± 0.9
S3C2	3.04 ± 0.9	2.96 ± 0.9	3.56 ± 0.9
S3C3	3.24 ± 0.9	3.08 ± 0.9	3.40 ± 0.9

Note: The higher the score, the more the panelists like it

From Table 6 it is known that the treatment with a skim milk concentration of 7.5% and CMC 0.50% produced the highest value for liking the aroma, namely 4.08 (like), while the treatment with a skim milk concentration of 10% and CMC 0.50% produced the lowest value, namely 3.04 (somewhat like it). It is thought that the concentration of skim milk and CMC treatment did not provide significant aroma changes to the velva of tamarillo. On average, the researchers considered that the aroma produced from the velva still characterized the main ingredient, namely tamarillo.

From Table 6, it is known that the treatment with 5% skim milk concentration and 0.50% CMC produces the highest color liking value, namely 4.04 (like), while the treatment with 10% skim milk concentration and 0.50% CMC produces the lowest value, namely 2.96. (do not like). This is caused by mixing white skim milk with bright red tamarillo fruit so that the color of the tamarillo fruit fades. The higher the concentration of skim milk, the more faded (pink) the tamarillo velva produced will be.

From Table 6, it is known that the treatment with 5% skim milk concentration and 0.75% CMC produces the highest taste preference value, namely 4.12 (like), while the treatment with 10% skim milk concentration and 0.75% CMC produces the lowest value, namely 3.4 (kind of like it). The higher the concentration of skim milk, the lower the panelists' preference for the taste of ice cream. It is thought that the CMC concentration cannot really influence the level of preference for the taste of ice cream. CMC is a hydrocolloid that has no taste, but CMC has many carboxyl groups and is easily hydrolyzed.

Based on the results of the effectiveness index test on the physical, chemical and organoleptic characteristics of tamarillo velva, the best treatment results were obtained with a concentration of 10% skim milk and 0.25% CMC. The best treatment results were then continued with testing the food fiber content. Based on the results of the analysis of the total food fiber content of tamarillo velva with the best treatment, it was 14.05%. Where 1.41% is water soluble food fiber and 12.64% is water insoluble food fiber.

4. CONCLUSION

The concentration treatment of skim milk and *Carboxy Methyl Cellulose* (CMC) significantly affected vitamin C levels, total dissolved solids, overrun, viscosity, melting time, texture, and color. And there was no real interaction with the antioxidant activity, protein content, aroma and taste of tamarillo velva. The best treatment in this research was tamarillo velva with a concentration of 10% skim milk and 0.25% CMC with an antioxidant activity value of 28.20%, vitamin C content of 16.56 mg/100g, protein content of 1.60%, total soluble solids 26.9°brix, overrun 15.78%, viscosity 2079 m.Pas, melting time 20.83 minutes, texture scoring test 3.32 (quite soft), and average liking value for aroma 3.6 (somewhat like), color 3 (somewhat like), taste 3.64 (somewhat like), and total dietary fiber content 14.05%.

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