

## Panelist acceptance level on milk chocolate bar with cinnamon (*Cinnamomum burmannii*) powder addition

INTAN NISA RASULUNTARI, DIMAS RAHADIAN AJI MUHAMMAD, DANAR PRASEPTIANGGA<sup>✉</sup>

Department of Food Science and Technology, Faculty of Agriculture, Universitas Sebelas Maret. Jl. Ir. Sutami 36 A Kentingan, Surakarta 57126, Central Java, Indonesia. Tel.: +62-271-637457, Fax.: +62-271-637457, ✉email: dpraseptiangga@yahoo.com

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**Abstract.** Rasuluntari IN, Muhammad DRA, Praseptiangga D. 2016. Panelist acceptance level on milk chocolate bar with cinnamon (*Cinnamomum burmannii*) powder addition. *Nusantara Bioscience* 8: 297-300. Among confectionery products, milk chocolate bar is the most popular product. The development of Indonesian cocoa agroindustry and chocolate signature with special characteristics are required since Indonesia is the third largest cocoa producing country in the world. The effects of cinnamon powder addition in milk chocolate and its impact on the consumer acceptance of milk chocolate were evaluated in this study. Cinnamon-enriched milk chocolates were formulated by completely randomized design (CRD) with one factor which was concentration of cinnamon powder (5%; 10%; and 15%). Sensory evaluation (color, aroma, taste, appearance, overall) were determined by hedonic test with scoring method. The results showed that the level of panelist acceptance decreased with increasing concentrations of cinnamon powder added. Milk chocolate bar with the addition of 5% of cinnamon powder had the highest level of acceptance and preferences for some of the sensory attributes evaluated.

**Keywords:** Cinnamon powder, milk chocolate, sensory attributes

### INTRODUCTION

Indonesia is the third largest producer of cocoa (*Theobroma cacao* L.) in the world after Côte d'Ivoire and Ghana. Production of the cocoa pods continuously increases which were 740.513 tonnes, 777.539 tonnes, 817.322 tonnes in 2012, 2013, and 2014 respectively (Directorate General of Estate Crops 2014). Meanwhile, International Cocoa Organization (2015) reported that Indonesia produced 370.000 tonnes cocoa beans in 2014. It indicates that Indonesia has a great opportunity to be the centre of cocoa agroindustry in the world. An effort to build cocoa agroindustry can be carried out by developing derivative products which has higher added value than the beans.

Among the confectionary products, milk chocolate is much more popular than either white or dark chocolate in most countries (Beckett 2008). Milk chocolate contains solid particles (cocoa, milk powder, and sugar) dispersed in cocoa butter that construct a complex rheological system (Pajin et al. 2013; Glicerina et al. 2015). During chocolate manufacturing, refining and conching determine the particle size and suspension consistency and viscosity for specific textural and sensory qualities (Konar 2013).

Although the market of milk chocolate has been well established, some studies is still conducted to improve the quality and functionality of the chocolate. The effect of milk powder addition to physical and sensory properties of milk chocolate has been reported by Liang and Hartel (2004). Meanwhile Aidoo et al. (2010) and Glicerina et al. (2015) reported the effect of raw materials substitution and the effect of manufacturing process on the quality attributes of milk chocolate, respectively. Controlling fat bloom

formation on milk chocolate has been reported by Sonwai and Rousseau (2010). Dried fruit enrichment dried influenced on the consumer acceptability of milk chocolate (Komes et al. 2013). Cinnamon powder enrichment has been conducted in previous researches (Albak and Tekin 2014a,b, 2015). However, the effect of cinnamon powder addition in milk chocolate, particularly on consumer acceptability, is not well studied. This study aimed at determining the influence of cinnamon powder addition in milk chocolate on the consumer acceptance.

### MATERIALS AND METHODS

#### Materials

Cocoa liquor and cocoa fat derived from Forastero beans. The beans are harvested from Kaliwining Jember. Full cream milk powder (Indomilk), sugar, lecithin are provided by the Indonesia Coffee and Cocoa Research Institute (ICCRI), Jember, Indonesia. Cinnamon bark powder (*Cinnamomum burmannii*) was obtained from Surabaya Herbal Drug Stores (Jember, Indonesia).

#### Methods

##### *Preparation of chocolates*

Cinnamon-enriched milk chocolate was prepared based on previous studies (Liang and Hartel 2004; Indarti 2013) with some modifications. Briefly, 496.5 g/500 g (consisting of 125 g/500 g of cocoa paste, 137.5 g/500 g of cocoa butter, 112.5 g/500 g of milk powder and 121.5 g/500 g of sugar), and the additional ingredients of 3.5 g/500 g (consisting of 1.5 g/500 g lecithin, 1.5 g/500 g of soda, and

0.5 g/500 g of vanilla) were used to produce milk chocolate. Cocoa liquor, cocoa butter, milk powder, sugar, soda, vanilla were mixed in a mixer, then 0.3% lecithin was added. The mixture was then refined in a ball miller refiner for 21h to gain particle size up to 20  $\mu\text{m}$ , then followed by the conching at 60° C for 16 h. This process was conducted to evaporate the water content and off-flavour compound, such as acidic flavour. The second refining step was conducted to mix the cinnamon powder (5%, 10%, 15% (w/w)) into milk chocolate mixture, thus a homogeneous mixture will be gained. This process was performed using a horizontal cylinder with smoothing ball (ball miller) aimed at eliminating the grittiness due to the addition of cinnamon powder into milk chocolate. Afterwards, the chocolate was tempered on a marble table with scrapper and knife in order to form  $\beta$  crystals. Tempering process was conducted at room temperature. Approximately 2/3 of the melted chocolate mixture (45°C) was then poured on the marble table, flattened, and inverted by using a scrapper and a chocolate knife until the chocolate dough temperature was stabilized at 25°C. Once stabilized, the dough tempering results poured back into the bowl containing 1/3 the untempered dough, then stirred for a few minutes until the dough temperature stable at  $\pm 30^\circ\text{C}$ , and then followed by moulding into chocolate plastic moulds. After 20 minutes, the moulded chocolates were de-moulding and were wrapped in the aluminium foil and stored at refrigerator temperature until used for further analysis.

#### Sensory evaluation

Cinnamon-enriched milk chocolates were evaluated using Hedonic methods (Kartika et al. 1988). The experimental chocolates were subjected to sensory evaluation by panellists, comprising 30 selected panelist members varying in age between 18-22 years. Five attributes (color, aroma, taste, appearance, overall acceptability) were evaluated. Three samples of chocolates with different codes were presented in a single serving plate with crackers and mineral water for rinsing between samples. Panelists were asked not to compare the samples with other samples. The sensory attributes were presented on a 5-point scoring scale which 1) extremely dislike, 2) dislike, 3) neither like nor dislike, 4) like, 5) extremely like.

#### Statistical analysis

The experimental design of *Completely Randomized Design* (CRD) with one factor was used in this study. There are three formulas of F1, F2, and F3 for the addition of cinnamon powder into milk chocolates as the production of cinnamon milk chocolate bar. Data from the sensory evaluation were statistically analysed using *One-Way ANOVA*. If there was a difference, *Duncan's Multiple Range Test* (DMRT), with a significance level of  $\alpha = 5\%$  was conducted.

## RESULTS AND DISCUSSION

Sensory analysis can be considered to be an interdisciplinary science that uses human panelists sensory

perception related to thresholds of determination of attributes, the variance in individual sensory response experimental design to measure the sensory characteristics and the acceptability of food products, as well as many other materials (Singh-Ackbarali and Maharaj 2014). Preference test or hedonic test aims to identify the level of preference and acceptance of a product (Setyaningsih et al. 2010). Hedonic testing is often used to determine consumers' attitude towards the food by measuring a degree of acceptance of a new product or improving the existing food product (Muresan et al. 2012). The preference test result with a scoring method on milk chocolate bar with the addition of cinnamon powder is shown in Table 1.

#### Color attributes

Determination of food product quality in general depend on several factors, including color attribute. Color plays an important role in determining the preferable taste of panellist to a product. Milk chocolate bar has a light brown color that can instantly give the impression of creamy and sweet on the products. Due to the addition of milk into chocolate milk provide an attractive brown coloring (Mulato and Edy 2014). From the sensory analysis (Table 1), it is known that F1, F2, and F3 have the same letter notation. It means that the variation of the addition of cinnamon powder into milk chocolate (5%, 10%, 15%) did not significantly influence to panelist acceptability on the samples. The level of F1 was 4.52, while the level of F2 and F3 were 4.30 and 4.33, respectively. Based on these figures, it can be seen that the level of acceptance of the panellists on the three samples is quite high because the numbers are in the range of 4-5 scores. F1 is the most preferred sample compared to the two other samples. It has the lowest concentration of addition of cinnamon powder (5%) and the influence on the color of milk chocolate bars will also be very low. The chemical compounds in the additional materials will interact chemically, and produce the specific flavour and color in the final product (Mulato and Edy 2014). The addition of cinnamon powder can cause darkening the color of milk chocolate, but the analysis result showed that a variation of the addition (5%, 10%, 15%) of cinnamon powder still not affected the level of darkness on milk chocolate bar. Moreover, the darkening of the color of milk chocolate can also be caused by the Maillard reaction between the protein group in chocolate composition with lactose in milk powder as one of milk chocolate ingredients. The dark color can arise due to the Maillard reaction between the amino groups of proteins with carbonyl groups of reducing sugars (Winarno 2004).

#### Aroma attributes

In general, the aroma received by the nose and more by the brain is a mixture of fragrant, sour, rancid, and burnt. Aroma or flavour of food much determine the delicacy of foodstuffs (Winarno 2004). Food industry consider the smell test is very important, since it can quickly provide results regarding consumer preferences towards product. The evaluation of aroma attributes expected a result that is the panellists could detect the scent of cinnamon in milk chocolate with the addition of a formula of cinnamon

**Table 1.** Level of panelists acceptance of *milk chocolate* with cinnamon powder addition

The addition of cinnamon powder	Attributes				
	Color	Aroma	Taste	Appearance	Overall
5% (F1)	4.52 <sup>a</sup> ± 0.67	3.88 <sup>a</sup> ± 0.86	4.21 <sup>c</sup> ± 0.89	4.39 <sup>a</sup> ± 0.75	4.27 <sup>b</sup> ± 0.80
10% (F2)	4.30 <sup>a</sup> ± 0.98	3.94 <sup>a</sup> ± 0.86	3.58 <sup>b</sup> ± 1.15	4.15 <sup>a</sup> ± 0.87	3.91 <sup>b</sup> ± 0.81
15% (F3)	4.33 <sup>a</sup> ± 0.85	3.64 <sup>a</sup> ± 0.96	3.00 <sup>a</sup> ± 1.28	4.06 <sup>a</sup> ± 0.83	3.27 <sup>a</sup> ± 1.04

Note: Samples with same letter in the same column are not significantly different from each other. Hedonic scale: 1) extremely dislike, 2) dislike, 3) neither like nor dislike, 4) like, 5) extremely like

powder (5%, 10%, 15%) and described by a score based on the level of preference panel. The result showed that the variations of the addition of cinnamon powder into milk chocolate could lead to less distinctive cinnamon aroma, so there are no real difference to their aromas. In addition, the aroma of cinnamon is still covered with milk chocolate scent that gives the impression of a sweet and creamy. Sample with 10% addition of cinnamon powder (Table 1) is the most preferred milk chocolate than the other two (5% and 15% addition). According to Haryadi and Supriyanto (2012), the aroma of chocolate is the result of chemical reactions which are very complex, including amino acids, peptides, sugars and compounds of flavonoids during roasting as well as the degradation of the amino acid derived from aldehyde volatiles, which is one of the main ingredients to form precursors aroma of chocolate.

#### *Taste attributes*

Taste is a chemical reaction of a combination of various foodstuffs and creates a sensation perceived by the tongue. The taste is also an important organoleptic in a food product because it can serve as a determinant of good or the worst of a food product (Juanda et al. 2011). At this parameter, the panelists are expected to perceive and distinguish flavours of cinnamon as an effect of the addition of cinnamon powder (5%, 10%, 15%) into milk chocolate, then described by a score based on the level of preference panel. Three samples of milk chocolate with the addition of 5%, 10% and 15% of cinnamon powder have a different notation (Table 1). It means that panelists can clearly distinguished taste based on the formulation of the addition of cinnamon powder to the milk chocolate. The 5% addition of cinnamon powder was the highest acceptance level of panelists, and the level of acceptance and/or preference for cinnamon milk chocolate is quite good. The addition of powdered cinnamon bark as much as 2% into dark chocolate has also reported with an assessment scores lower than 7 for the parameter sweetness, aroma, and texture (Albak and Tekin 2014a). Many factors influence the formation of the flavor of chocolate products. The flavour of milk chocolate can be affected by the quality of the raw materials used such as the quality of milk powder that were used in the milk chocolate's ingredient (Liang and Hartel 2004). The more cinnamon addition in milk chocolate decreases panelists acceptability. Li et al. (2013) reported that cinnamaldehyde is the main compound in cinnamon. The sensitivity of the olfactory and taste sensors of the panelists on the

cinnamaldehyde compound limited the acceptability to the products.

#### *Appearance attributes*

In order to get information of shiny level of cinnamon milk chocolate, melting point, and blooming appearance on the surface of the cinnamon milk chocolate, panelists were asked to evaluate the appearance attributes. The sample of 5% addition of cinnamon powder in milk chocolate showed the best value of appearance according to the panelists (Table 1) although they are not significantly different from each other. In general, the level of acceptance by panelists on appearance attributes is good with a range scale of 4-5. Tempering process is a determining factor for high and low level of acceptance of the panelists on this parameter. The tempering influenced on the quality of the chocolate brown glossy display (glossy), good snap, increase the melting point, and increase the shelf life of chocolate (Afoakwa et al. 2008; Indarti et al. 2013). The use of milk fat as a partial substitute for cocoa butter in the chocolate manufacturing process can help to prevent fat blooms (Baldino et al. 2010). The addition of cinnamon powder into milk chocolate can increase the particle size of milk chocolate, but the mixing of cinnamon powder using a refiner can help cinnamon powder mixed well into milk chocolate and to prevent an increase in the particle size milk chocolate. The smaller particle size will prevent the formation of visual bloom on the chocolate surface (Kuehn 2012).

#### *Overall attributes*

Based on Table 1, in overall attributes, sample with the highest level of acceptance from panelists is milk chocolate bar with the addition of 5% of cinnamon powder. According to panelists, from five parameters that were analyzed, three samples on the parameters of color, aroma, and appearance showed no significant difference with the highest acceptance level of sample with 5% of powdered cinnamon addition in color and appearance attributes. However, in the evaluation of taste attributes, among samples with the addition of (5% and 10%) of cinnamon powder showed significantly difference to the sample of 15% of cinnamon powder addition. Moreover, sample with the addition of 5% of cinnamon powder has the highest acceptance level of panelists. Thus, it can be concluded that in overall attributes, the sample with the highest level of acceptance from panelists is milk chocolate bar with the addition of 5% of cinnamon powder.

To conclude, this study evaluated the potential of producing milk chocolate bar with cinnamon powder addition by measuring the level of panelists' acceptance using preference test. In terms of sensory attributes, milk chocolate with the addition of 5% of cinnamon powder has the highest level of panelist' acceptance. Among the others, taste is the most affecting attributes that influences panelists' acceptability on milk chocolate, since the panelists' acceptability in color, aroma, and appearance were not significantly different at addition 5% to 15% of cinnamon powder. The results provided additional information in developing Indonesian chocolate agroindustry, particularly in development of milk chocolate with an addition of cinnamon powder.

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