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The Effect of Adding a Large Red Chili Puree (*Capsicum annuum* L.) on the Physicochemical Characteristics of Yogurt

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ABSTRACT

Milk is a liquid obtained from milking dairy cows, one of the processing of milk that is to be yogurt, in general yogurt is consumed as a dessert and also as an additional food such as salad dressings, generally made by adding fruit or vegetables as a dye, flavoring and also to add benefits, one of which is the addition of a large red chili puree (capsicum annuum L) where the manufacture of yogurt with the addition of large red chili puree aims as a diversification of food products and the development of processed yogurt as a complement to foods such as sauces. The research used is experimental research using a Complete Randomized Design with five treatments and 2 times the study, then analyzed physical and chemical properties (color, viscosity, pH, antioxidant capacity and total Lactic Acid Bacteria) in yogurt addition of large red chili puree with the formula of adding 2, 4, 6, 8, and 10 percent, the total percentage of addition of large red chili puree obtained from the total main raw material in the form of milk. The data of the study results in statistical tests using ANOVA and Duncan's Multiple Range Test (DMRT). The results of the analysis showed that the addition of a large red chili puree had a noticeable difference to the color, viscosity, pH, antioxidant capacity, and total LAB. Yogurt with the addition of a large red chili puree can be used as a diversification of processed yogurt products in lieu of sambal, sauces and other complementary foods that have high benefits and can be used to add to the diversity of Indonesian cuisine.

I. Introduction

Milk is a liquid that is perceived from milking dairy cows, where natural content has not received any treatment (Anjarsari, 2010). According to data from the Central Bureau of Statistics (BPS) in 2017 milk production in east Java is quite high, one of which is Malang district where Malang district in 2017 was able to produce cow's milk as much as 142,966,104 kg. Milk as a food source that has a lot of nutrients but high nutrients in milk is susceptible to bacterial growth that reduces the benefits of milk so that milk quickly damaged if not handled properly (Yudonegoro, 2014). To overcome the damage of milk needs to be done processing and preservation, one of the popular ways used is by fermenting milk into *yogurt* (Wahyudi, 2006).

Yogurt is one of the products produced from the fermentation process of milk that is quite popular around the world. The shape of *yogurt* is similar to porridge or ice cream with sour taste (Fatmawati et al., 2013). *Yogurt* is a functional food that is often consumed due to its high digestibility benefits and proteolytic activities (Yu et al., 2014). *Yogurt* is enriched with micronutrients (iron, zinc, iodine and vitamin A) (Sazawal et al., 2013). *Yogurt* added flavor will increase the fondness/acceptance by consumers (Wulandari & Putranto, 2010). One of *the yogurt* products is with the addition of spices (Kang et al., 2018). One of the spices or spices that can be used is chili.

Chili peppers can be used as a natural food coloring (Saadah et al., 2018). Carotenoids are compounds that give color to chilies. Carotenoids that give a red hue e.g. capsanthin, Kasparian &capantin-5,6-opoxide while orange hue origin based on α & β-carotene, xanthin, lutein & β-kryptoxanthin. The content of carotenoids in chili is approximately 8797 mg/kg d.wt. up to 13.208 mg/kg d.wt. (Gómez-García & Ochoa-Alejo, 2013). Chili contains important levels of pigments (i.e.,

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chlorophyll, anthocyanin, and lutein) with potential health benefits; it also contains additional outstanding health-promoting chemical compounds, such as vitamins, minerals, flavonoids, carotenoids, and capsaicinoids, in general. And capsaicin, the major active compound responsible for the pungent taste of these species has been proven to have a positive role in health (Hernández‐Pérez et al., 2020). Antioxidant compounds contained in large red chilies include vitamin C, vitamin K, vitamin E, phytosterols, beta carotene, and beta *cryptoxanthin* (Warisno & Dahana, 2010). Total antioxasis and large red chilies using DPPH test reached 55,960 % (Anggraito et al., 2018).

The purpose of this study was to analyze the effect of the addition of red chili puree on physical characteristics that include color and viscosity as well as chemistry that includes pH, antioxidant capacity, and total lactic acid bacteria with the addition of red chili puree by 2%, 4%, 6%, 8%, 10%.

II. Method

This study is an experimental study using experimental design in the form of Complete Randomized Design (RAL) with the treatment of red chili *puree* addition, the treatment of red chili *puree* addition as much as 5 treatments namely the addition of 2% (C1), the addition of 4% (C2), the addition of 6% (C3), the addition of 8% (C4), the addition of 5% (C5), each treatment is done 2 repetitions.

A. Material

Ingredients used in the manufacture of yogurt addition of large red chili puree is fresh cow's milk, large red chili puree, sugar, skimmed milk, starter bacteria (*Lactobacillus bulgaricus and Streptococcus thermophilus).*

B. Formula

The formula of making yogurt in addition to red chili puree can be seen in Table 1.

Table 1. Chili Yogurt Making Formula

Material	F1	F2	F3	F4	F5
Cow's Milk (ml)	100	100	100	100	100
Skimmed Milk (gr)	3	3	3	3	3
Sugar (gr)	3	3	3	3	3
Bacterial Starter (ml)	3	3	3	3	3
Great Red Chili Puree (gr)	2	4	6	8	10

C. Tool

Tools used in this study include pots, stoves, measuring glasses, incubators, thermometers, basins.

D. Yogurt Making Process Addition of Large Red Chili Puree

Yogurt making starts from heating milk that has been added with sugar and skimmed milk to reach a temperature of 90 °C and stirred and maintained the temperature for 10 minutes, then cooled to a temperature of 43 °C. Then coupled with red chili puree according to the formula, furthermore added starter bacteria Lactobacillus bulgaricus and Streptococcus thermophilus) with a ratio of 1:1 at a temperature of 43-45 °C as much as 2.5-3% of the volume of milk, then milk has been inoculated with starter bacteria filtered and inserted into the cup that has been sterilized first, milk that has been inoculated with starter bacteria then inserted into the incubator (temperature 45 °C) for 4-6 hours.

E. Data collection

Analysis covering color using method *Color reader Minolta* (Nielsen, 2017), iscosity using Viscometer method (Nielsen, 2017), pH using pH meter method, antioxidant capacity using DPPH method (Kedare & Singh, 2011), and LAB (Lactic Acid Bacteria) using Colony Counter method.

F. Data analysis

The data obtained is then analyzed with ANOVA then continued with DMRT test using SPSS 26.

III. Results and Discussion

The results of color analysis, Viscosity, pH Antioxidant Capacity and total Lactic Acid Bacteria (LAB) are presented in Table 2.

Table 2. Results of Physicochemical Research on Yogurt With The Addition of Red Chili Puree

Concentration of red chili puree	color			viscosity	pH	Antioxidant Capacity	LAB
	L	a*	b*				
2%	73,59[a]	14,63[a]	24,12[a]	6000[a]	3,59[a]	88,594[a]	4,2[a]
4%	65,85[b]	20,01[b]	31,84[b]	6500[b]	4,10[b]	83,858[b]	3,8[b]
6%	60,04[c]	23,31[c]	36,64[c]	7125[c]	4,23[c]	77,184[c]	3,2[c]
8%	54.90[d]	26.43[d]	34,04[bc]	7550[d]	4.40[d]	70.515[d]	2,9[c]
10%	32.93[and]	28.23[and]	31,49[b]	7925[and]	4.60[and]	65,001[and]	2.6[d]

Description: Different number notations indicate a noticeable difference in each treatment.

A. Color

Based on the results of table 2 research shows that the color notation system that includes L, a*, b* has a noticeable difference. The difference in color in each treatment is the influence of the addition of red chili puree, the level of redness (a+) yogurt addition of red chili puree increases along with the number of red chili puree added to the yogurt that is on the treatment of addition of 10%, but has a decreased brightness (L) compared to other treatments. Yellowish level (b+) in yogurt addition of red chili puree with the highest score is found in the treatment with the addition of red chili puree with an addition of 6%. The level of redness in yogurt with the addition of red chili puree is increasing due to the addition of red chili puree is increasing, large red chili puree contains carotenoid compounds.

According to Gomez-Garcia & Ochoa-Alejo (2013) carotenoids are compounds that color the carotenoid chilies that give red colors such as capsanthin, kasporubin and capantin-5,6-opoxide while the orange color comes from α and β-carotene, xanthin, lutein and β-kryptoxanthin. The addition of red chili puree in formula C3 by 6% has the highest result on color notation (b+) is expected because the more addition of chili puree will result in a redder color and the color (L) will decrease. Based on this, eating the formula of adding red chili puree by 6% has a higher yellowish level value (b+) than other treatments.

B. Viscosity

Based on the results of table 2 research shows that more many formulations of the addition of red chili puree resulted in increased viscosity of yogurt addition of red chili puree. The highest viscosity score is found in the formula of adding red chili puree by 10% which is 7925 cPs. The increasing viscosity value in yogurt the addition of red chili puree is due to the presence of carbohydrate content in red chili peppers.

Carbohydrates hold an important ingredient in the texture of a food. Based on this, the more red chili puree added to the total carbohydrate meal will increase so that the viscosity value increases. The viscosity produced in this study had high yields and did not match those expressed by Winarno & Fernandez (2007) who suggested that yogurt viscosity ranged from 8.28–13.00 cP. This is possible due to the addition of red chili puree.

C. pH

Based on the results of the study table 2 showed significantly different results. pH yogurt with the addition of red chili puree 2%, 4%, 6%, 8% and 10% increased pH value. The increasing pH value in yogurt the addition of red chili puree is due to the increasing addition of red chili puree. Red chili peppers contain alkaloid compounds including capsaicin, oleoresin, flavonoids and essential oils (Rukmana, 2002).

Capsaicin is a chemical compound that has the highest levels of red chili peppers. According to Marini et al., (2015) capsaicin is a compound that is suspected to inhibit microbial and anti-virulence activity. The increase in pH value in yogurt addition of red chili puree occurs due to the activity of lactic acid bacteria, one of which is streptococcus undergoing the process of inhibition of growth. According to Santos et al., (2012) capsaicin can significantly reduce the formation of biofilms and acid production by streptococcus bacteria so as to increase the pH value of yogurt.

D.Antioxidant Capacity

Based on the results of the study table 2 showed real different results. Many more additions red chili puree then the anti-oxidant compound will be stronger, in addition to chili puree as much as 10% has the highest oxidation inhibition value with an average IC value of$_{50}$ with a value of 65,001 ppm. Based on the results of the study showed that yogurt with the addition of red chili puree as much as 10% has strong antioxidant properties. Antioxidant capacity is influenced by the number of additions to the large red chili puree, this is because red chili peppers contain a chemical compound that is capsaicin.

According to Hafsah & Astriana (2012), Kang et al., (2018), capsaicin is a chemical compound that acts as an antioxidant. Capsaicin content in large red chili peppers is 277–1529 μg 100 g^{-1} dwb when red (Deepa et al., 2007). Other antioxidant compounds in chili peppers are vitamins A, E and C, as well as tannins, flavonoids, saponins, terpenoids, alkaloids, phenolics, and carotenoids (Emmanuel-Ikpeme, 2014). Based on this it is known that the addition of a large red chili puree affects the antioxidant capacity of red chili puree yogurt.

E. Lactic Acid Bacteria (LAB)

Based on the results of the study table 2 showed real different results. Total lactic acid bacteria (LAB) is decreasing due to the inability to digest sucrose in red chili puree by lactic acid bacteria (LAB) but easier to digest lactose which is the natural habitat of LAB i.e. milk (Prayitno, 2006). According to Prayitno (2006) the principle of lactic acid formation in yogurt is that streptococcus bacteria break down lactose milk into glucose and galactose (monosaccharides) then lactobacillus metabolize monosaccharides into lactic acid so that the total lactic acid bacteria will increase.

But different in yogurt with the addition of red chili puree where red chili contains capsaicin compounds that act as antibacterial so as to reduce the formation of biofilms and acid production by streptococcus bacteria (Santos et al., 2012). This leads to a total decrease in lactic acid bacteria in yogurt the addition of red chili puree. Although experiencing a total ingestion of lactic acid bacteria along with the addition of red chili puree is increasing, the total lactic acid bacteria (LAB) in yogurt has a total lactic acid bacteria in accordance with (SNI 01-2981-2009) which is 1X 10^7 CFU/ml.

IV. Conclusion

Based on the results of research and discussion on the influence of the addition of large red chili puree to the physicochemical characteristics of yogurt can be concluded that the addition of large red chili puree as much as 10% has the highest physical properties at the level of redness (a*) is 28.23 but low in brightness level (L) is 32.93 and yellowish level (b*) is 31.49. The addition of red chili puree affects the viscosity of yogurt, the addition of red chili puree by 10% has the highest viscosity result of 7925cPs. The addition of red chili puree as much as 2% has the lowest pH value of 3.59. The addition of a large red chili puree in the manufacture of yogurt affects the antioxidant capacity, the highest antioxidant capacity is found in the formula of adding red chili puree by 10% which is 65,001. The addition of a large red chili puree in the manufacture of yogurt affects the total lactic acid bacteria (LAB) Total lactic acid bacteria is highest found in the formula of adding red chili puree by 2%. Namely 4.2 X 108 kol/g.

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