Development of High Antioxidant Yoghurt Made from a Mixture of Cashew (Anacardium occidentale) and Red Roses (Rosa damascena) Juice

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ABSTRACT

Introduction : Lack of antioxidants can be one factor for CHD (Coronary Heart Disease). The antioxidant content is found in cashews in the form of Vitamin E and in red roses in the form of Vitamin C and anthocyanins. Therefore, the functional food of yoghurt products made from cashew yoghurt with red rose flavor addition as a source of antioxidants.
Objective : Knowing nutrients compositions in cashew yoghurt with red rose flavor addition
Methods : Experimental design was using in this research. Yoghurt formulations were analyzed by organoleptic, nutrients composition, antioxidant activity, viscosity, pH, Total Acid and TPC. Data analysis using Anova Test.
Results : Formulation 2 (F2) was the best formulation in organoleptic test. Nutrient compositions were significant differences in water content, fat, protein and carbohydrates. Formulation 3 (F3) had highest antioxidant activity. All formulations were safe to consume based on TPC analyses.
Conclusion : Cashew yoghurt with red rose flavor addition proven was contain high antioxidants.
Keywords: Yoghurt, Cashew Nuts, Red Roses, Antioxidant, Coronary Heart Disease

INTRODUCTIONS

In Indonesia, more than 36 million people die due to non-communicable diseases (63% of all deaths) every year. Cardiovascular diseases such as coronary heart disease (CHD), cholesterol, etc. are among the number one causes of death (Kementrian Kesehatan, 2013). Very closely related to eating habits that are high in fat or hypercholesterolemia. According to previous studies, antioxidant deficiencies can be a factor in CHD (Frohlich & Quinlan, 2014). Therefore it is necessary to develop functional food products such as yogurt to help reduce and overcome this CHD problem.

Yogurt is a fermented milk product, obtained from fermented milk with Lactic Acid Bacteria (LAB), namely Lactobacillus acidhopilus, Lactobacillus bulgaricus and Streptococcus thermophilus (Teguh, Nugerahani, & Kusumawati, 2015). Yogurt has health benefits such as maintaining the digestive system, preventing diarrhea, anti-cancer, can regulate cholesterol levels in the blood (Syainah & Novita, 2014). Yogurt is very suitable to be consumed by lactose intolerant, the content of lactobacilli found in fermented milk or yogurt can hydrolyze milk lactose into glucose and galactose, therefore giving yogurt to patients with lactose intolerant does not cause intestinal disorders (Savaiano, 2014).

Usually yogurt is made from animal milk but can be replaced with vegetable extracts, such as kidney beans, green beans or cashews. Yogurt from vegetable juice can be developed because it also has a nutritional value that is no less high than yogurt made from animal milk (Putriningtyas and Wahyuningsih,2017). The development of this product is by adding cashews and red rose juice which have high nutritional value. The nutritional content of cashews as much as 100gr has a value of unsaturated fats of 25g which has the benefit of reducing total cholesterol and LDL (Low Density Lipid) levels and increasing levels of HDL (High Density Lipids) (Astawan, 2009). In addition, cashews are a source of antioxidants with

Vitamin E content as much as 460 µg / g (Griffin & Dean, 2017) at 100 grams of red rose petals contain antioxidants in the form of vitamin C as much as 214.68 mg and as much as 195 mg anthocyanin and there are flavonoids as anthocyanins (Rahmawati, 2019). When compared with roselle calyx, vitamin C content is only 6.7 mg and there is no anthocyanin content (Juniarka, Lukitaningsih, & Noegrohati, 2011).

MATERIALS AND METHODS

Ingredients Cashew extract, Red rose juice, Pectin, Sugar, Starter yogurt, vanilli flavor and rose flavor. Hexane, H2SO4, catalysts, NaOH, HCl, Methyl red, Methyl blue, Alcohol, Aquades. DPPH ((2,2-diphenyl-1-1-pikrilhidrazil), Aquades, NaOh

Tools Refrigerator (Samsung Brand), Electric Stove (Philips Brand), Blender (Philips Brand), Ceramic Pot (Bolde Brand), Digital Scales (Krischef Brand), Food Thermometer (Krischef Brand), Filter cloth (cheesecloth), Spatula Spoon, Tissue and Container. are Autoclaves, Ovens, Static Incubators, Lumping, Alu, Spectrophotometers, Erlenmeyer Glasses, Beaker Cups, Measuring Cups, Pipettes, Micropipets, Microtips 0.2 ml and l, Eppendorf Tubes, Spatulas, Desiccators, Scales, Soxhlet Tubes, Beaker Cups, Pipettes, Micropipets, Microtips 0.2 ml and l, Eppendorf Tubes, Spatulas, Desiccators, Scales, Soxhlet Tubes, Beaker Tubes, Pipettes, Micropipets, Microtips 0.2 ml , Spirtus burner, Pumpkin measure, Oxidase test strips, tissue, and Pycnometer Receptacle, Scales, Ostwald Pipes, Centrifuge Tubes, Centrifuge Equipment, Erlenmeyer Cups, Beaker Cups, pH meters, Petri dishes, incubators. Erlenmeyer, spatula, pipette

Methods This is an experimental study using a completely randomized design (CRD) method with two factors, namely cashew nut extract and red rose juice, four levels of treatment with cashew nut ratio: red rose (F0 100ml: 0ml, F1 75ml: 25ml, F2 50ml: 50ml, and F3 25ml: 75ml) and were tested for nutritional analysis, organoleptic (hedonic and hedonic quality), antioxidant activity, viscosity, pH, Total Acid and Total Plate Count (ALT) or Total Plate Count (TPC) with a duplicate or two analyzes. Data analysis using Anova Test and carried out further testing with Duncan Test. Organoleptic test with panelists This test was conducted by 25 semi-trained panelists namely Nutrition Study Program students at Esa Unggul University and 30 consumer panelists, namely the general public with ages ranging from 30 years and above. The parameters tested in the hedonic test and hedonic quality are color, aroma, texture, and taste.

RESULTS AND DISCUSSION

Based on the hedonic test results of 25 semi-trained panelists showed that there were significant differences in the color parameters. And in other parameters no difference can be see in Table 1.

Table 1. Assessment of Yogurt Hedonic Tests by Semi-Trained Panelists

Parameter	Formulation (mean±standard deviatioo)				*Pv*
	F0	F1	F2	F3	
Taste(mm)	46.04±12.222[a]	40.96±19.754[a]	45.60±14.370[a]	42.12±15.765[a]	0.591
Color (mm)	**61.08±12.692[a]**	**60.44±14.266[a]**	**67.20±11.446[ab]**	**70.56±11.288[b]**	**0.012***
Texture (mm)	53.92±16.111[a]	53.96±14.308[a]	51.56±15.430[a]	53.40±17.675[a]	0.945
Scents (mm)	60.48±14.760[a]	54.72±16.599[a]	59.00±12.806[a]	61.12±13.639[a]	0.404
Favorite (mm)	53.32±13.012[a]	47.04±16.767[a]	50.44±13.420[a]	48.04±18.043[a]	0.487

Informations:

[1]Numbers followed by different superscript letters in the same line show significantly different values ($p \leq 0,05$), Values are expressed as means ± standard deviation.

[2] The ABCD mark is Duncan's further test to state the differences in each formula

[3] F0 = 100ml cashew juice: 0ml red rose juice, F1 = 75ml cashew juice: 25ml red rose juice, F2 = 50ml cashew juice: 50ml red rose juice, F3 = 25ml red cashew juice: 75ml red rose juice

[4] Tested on a VAS scale with a rating of 0 (very dislike) - 100 (very like)

Based on the hedonic test results of 25 semi-trained panelists showed that there were significant differences in the color parameters with a p value of 0.012. And in other parameters there is no difference. The average color value of cashew nut yogurt with the

addition of red rose juice is most preferably found in F3 with a mean in semi-trained panelists a mean of 70.56 ± 11.288 (highly preferred) and lowest in F1 60.44 ± 14.266 (preferred).

Table 2. Assessment of Hedonic Yogurt Quality Tests by Semi-Trained Panelists

Parameter	Formulation (mean±standard deviatioo)				*Pv*
	F0	F1	F2	F3	
Taste (mm)	**47.12±20.179[a]**	**52.92±16.485[ab]**	**55.48±18.978[ab]**	**61.24±14.970[b]**	**0.049***
Scents (mm)	**31.20±21.484[a]**	**63.80±14.051[b]**	**67.68±14.619[bc]**	**75.80±15.055[c]**	**0.001***
Color (mm)	**13.56±12.780[a]**	**60.84±13.984[b]**	**70.04±12.756[c]**	**79.32±11.086[d]**	**0.001***
Texture (mm)	37.16±18.305[a]	40.88±14.260[a]	47.76±20.671[a]	38.56±18.612[a]	0.175
Whole (mm)	56.32±16.134[a]	59.84±14.559[a]	58.84±16.499[a]	57.30±16.492[a]	0.869

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[4] Tested on a VAS scale with a rating of 0 (very dislike) - 100 (very like)

After the Duncan test, it is known that the taste, aroma and color of yogurt have real differences so it can be concluded that the highest assessment is in the F3 formulation because it has the highest mean. While the Duncan test on texture and overall there is no real difference.

Table 3. Rating of Yogurt Hedonic Test by Consumer Panelists

Parameter	Formulation (mean±standard deviatioo)				*Pv*
	F0	F1	F2	F3	
Taste (mm)	**56.57±22.188[a]**	**56.57±13.436[a]**	**64.03±18.97[a]**	**45.80±14.97[a]**	**0.005***
Scent (mm)	**61.17±18.105[a]**	**61.97±13.213[a]**	**70.33±14.61[b]**	**72.43±15.05[b]**	**0.012***
Color (mm)	51.93±14.229[a]	51.93±13.668[a]	56.97±12.75[a]	55.40±20.289[a]	0.608
Texture (mm)	60.13±15.556[a]	60.27±9.684[a]	63.13±20.67[a]	62.30±15.139[a]	0.799
Favorite (mm)	59.77±13.853[a]	57.97±11.892[ab]	62.00±16.49[ab]	52.67±17.403[a]	0.092

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[4] Tested on a VAS scale with a rating of 0 (very dislike) - 100 (very like)

This is in line with the results of hedonic tests on semi-trained and consumer panelists. While the parameters of texture, aroma and preference showed no difference.

Color is one of the important parameters to determine the quality of a food product. A food product is very good to be consumed if it has the right color (Triana, Angkasa, & Fadhilla, 2019). Good color in a food product can be seen from the mixing of ingredients for that product. The color of cashew juice is white and the color of red rose juice is red. As for the color of white to dark pink yogurt, it depends on the addition of the red rose juice contained in the yogurt.

In this yogurt that is as a natural coloring for yogurt is the content of red rose juice. Red rose contains anthocyanin which can be an alternative natural coloring of a food product (Priska, Peni, Carvallo, & Ngapa, n.d.).

The aroma is a parameter that appears by chemical stimuli smelled by olfactory nerves that are in the nasal cavity (Negara et al., 2017). Aroma is an important parameter to determine the level of consumer acceptance of a food product. The study of yogurt with the addition of noni fruit which states that the addition of food can affect the aroma of a food product and can increase the level of consumer preferences for these food products.

In this study, the aroma of yogurt is influenced by the addition of red rose extract. Red roses can affect the color of food in addition to the aroma of a food product (Priska et al., n.d.).

The aroma of roses is caused by volatile acidic volatile or volatile acids that can affect the aroma of a product (Rahmawati, 2019). In addition, there is a little aroma of cashews because cashews contain glutamic acid and aspartic acid which gives a distinctive aroma (Handayani, 2010).

Table 4. Nutritional Content of cashew yoghurt with red rose flavor addition

Parameter	Formulation (mean±standard deviatioo)				*Pv*	SNI
	F0	F1	F2	F3		
Measure Content (g)	**90.35±0.021[a]**	**91.66±0.123[b]**	**94.60±0.120[c]**	**93.57±0.601[d]**	**0.001***	-
Ash content (g)	0.0025±0.001[a]	0.0020±0.001[a]	0.0018±0.001[a]	0.0011±0.001[a]	0.333	Maks. 1
Fat (g)	**2.51±0.014[c]**	**2.73±0.001[d]**	**1.45±0.009[a]**	**1.75±0.023[b]**	**0.001***	**0.6-2.9**
Protein (g)	**1.94±0.001[c]**	**1.50±0.001[d]**	**1.14±0.001[a]**	**1.25±0.001[b]**	**0.001***	**Min. 2.7**
Carbohidrat (g)	**7.68±0.001[d]**	**6.67±0.173[c]**	**4.23±0.001[a]**	**5.15±0.001[a]**	**0.001***	-

Informations:

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[2] The ABCD mark is Duncan's further test to state the differences in each formula

[3] F0 = 100ml cashew juice: 0ml red rose juice, F1 = 75ml cashew juice: 25ml red rose juice, F2 = 50ml cashew juice: 50ml red rose juice, F3 = 25ml red cashew juice: 75ml red roses juice

a. Measure content

Based on the analysis of water content shows that there are significant differences in the water content between formulas with a p value of 0.001. The highest results obtained in the F2 formulation are with a mean value of 94.60 ± 0.120 and the lowest at F1 91.66 ± 0.123.

This research is in line with (Triana et al., 2019) which says that the water content is significantly different from the statistical tests on each formula and can be influenced by the food contained in the yogurt. In yoghurt cashew juice and red rose juice are influenced by the addition of red rose juice.

At an average irregular water content between formulations this may be caused by food and during the fermentation process of yogurt. The content of water content in food products can affect the shelf life, acceptability of the product and the quality of the food product (Winarno, 2002).

b. Ash Content

In the analysis of ash content, there is no significant difference between formulas with a p value of 0.333. The highest results were found at F0 with a mean value of 0.0025 ± 0.001 and the lowest at 0.0011 ± 0.001.

This shows the less content of cashew nut extract in each formula will decrease in ash content so that it shows a decrease in mineral content in yogurt in each formula so that the fewer mineral sources, the ash content will be less, this is reinforced that ash content is influenced by milk or essence content vegetable contained in yogurt.

The results of this study are inversely proportional to (Anggrek, Kiranawati, & Mariana, 2018) yogurt added tolo nuts and cow's milk because in his research the food added to each formula had a high mineral content so that the ash content increased. Can be seen from the ash content value of all formulas fulfilling SNI (SNI 2981-2009), namely max. 1.0.

c. Fat

Based on the results of the analysis shows that there are significant differences between formulas where the p value is 0.001. The results of the highest fat content in cashew nut juice and red rose juice are in F1 with a mean value of 2.73 ± 0.001 and the lowest fat content in F2 with a mean value of 1.45 ± 0.009. Based on these results that the four formulas of cashew nut juice yogurt with the addition of red rose juice meet SNI (SNI 2981-2009).

This research is in line with (Failasufa, Sunarto, & Pratjojo, 2015) states that the results of the fat content in its products meet SNI (SNI 2981-2009) and are in line with (Triana et al., 2019) states the food used for his research contained little fat so that it had no effect on the total fat in yogurt. In this yogurt study, the fat content in 100g of cashew nuts is only 25g in the form of unsaturated fat and in 100g red roses is only 0.1g, so that the fat content in this yogurt is small.

d. Protein

Based on the results of the analysis showed that there were significant differences between formulas for protein content with a p value of 0.001. and found the highest protein content at F0 with a mean value of 1.9.9 ± 0.001 and the lowest at F2 with a mean value of 1.14 ± 0.001. Based on the results above is not in line with research (Triana et al., 2019) because protein content in cashew nut juice and red rose juice does not meet SNI (SNI 2981-2009), namely min. 2.7g. This is also not in line with (Anggrek et al., 2018). Which in his research the greater the protein content in the ingredients of yogurt, the higher the protein content in yogurt, this is not in line because the ingredients in making yoghurt cashew juice with the addition of red rose juice has a protein content that slightly results in a low protein content in yogurt.

In addition, this may also be due to the fat and carbohydrate content of cashew nut yogurt with the addition of low red rose juice, which causes protein levels to be low.

Protein content in fermented beverages such as yogurt, is influenced by the number of bacteria, where bacteria will affect the enzymes used to break down proteins into peptides which will then be hydrolyzed into amino acids (Failasufa et al., 2015).

e. Carbohidrat

Based on the results of the analysis shows that there are significant differences between formulas where the p value is 0.001. and the results of carbohydrate content with the highest mean value in formulation F0 7.68 ± 0.001 and the lowest mean value in formulation F2 4.23 ± 0.001.

The small carbohydrate content of cashew nut yogurt and red rose juice may be caused by the addition of red rose juice in each formula increasing so that cashew juice becomes much less.

The nutritional value of cashew nuts and 2.5 nutritional content of red rose that the carbohydrate content / 100g of cashew nut extract is much greater than that of red rose. So that the highest mean is obtained at F0 because there is no addition of red roses juice.

This is reinforced by research (Triana et al., 2019) which states that the carbohydrates in each formulation can be influenced by how much the ratio of ingredients and many nutritional content of carbohydrates in each 100gr material.

Table 5. Antioxidant Contents of cashew yoghurt with red rose flavor addition

Formulation	Sample (gram)	AEAC Score (mg Vit.C/100gsample)	*Pv*	IC50 Score (mg/ml)
F0	7.5371	13.59±9.25[a]	0.001*	1042.10
F1	7.5161	129.05±13.97[b]	0.001*	32.86
F2	7.5322	177.69±107.77[bc]	0.001*	17.43
F3	7.5181	245.95±73.36[c]	0.001*	15.51

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[3] F0 = 100ml cashew juice: 0ml red rose juice, F1 = 75ml cashew juice: 25ml red rose juice, F2 = 50ml cashew juice: 50ml red rose juice, F3 = 25ml red cashew juice: 75ml red roses juice

Based on the results of the statistical test analysis of antioxidant values in table 5, there are significant differences between the formulas where>> (0.05) with a p value of 0.001. Based on the results of the AEAC (Ascorbic acid Equivalent Antioxidant Capacity) value, the highest value in the F3 formulation with a mean value of 245.95 ± 73.36 and the lowest value in the formulation of F0 with a mean value of 13.59 ± 9.25.

IC50 calculation is performed then the antioxidant properties are determined, the highest yield is found in the F3 formulation which is 15.51 µl / mL (very high) and the lowest is in the F0 formulation which is 1042.10 µl / mL (low). This is due to the F0 formulation there is no addition of red rose juice so that the antioxidant content is very low, in F1 formulation there is a 25 ml content of red rose juice, in the F2 formulation there is a 50 ml

red rose pollen and finally in the F3 formulation there is a content of red rose extract as much as 75ml. There was a significant difference in antioxidant content between the formulations of cashew nut extract with the addition of red rose juice, and the results of the AEAC (Ascorbic acid Equivalent Antioxidant Capacity) value with the highest value found in the F3 formulation and the lowest value in the F0 formulation.

The antioxidant test uses DPPH (1,1-Diphenyl-2-Pikrilhidrazin) method to determine the 50% IC50 or Inhibition Concentration level in cashew nut yogurt and red rose juice. IC50 is an extract concentration value that can inhibit and reduce half the free radicals. Based on Table 5, the highest IC50 results were obtained in the F3 formulation and the lowest in the F0 formulations. So in F3 only 15.51 µl / mL of yogurt is needed to inhibit 50% of free radicals while in F0 it takes 1042.10 µl / mL to be able to inhibit 50% of free radicals. Based on the above results, it can be ascertained that the cashew nut yoghurt product with the addition of red rose juice contains very high antioxidants.

Table 6. pH levels in the cashew yoghurt with red rose flavor addition

Samole	Formulation				*Pv*
	F0	F1	F2	F3	
cashew yoghurt with red rose flavor addition	4.06	4.11	3.90	3.96	Min.3.00-4.00

Based on table 6. The highest pH value in formulation F0 is 4.06 and the lowest pH value in formulation F2 is 3.90. Based on these results it states that the pH levels in the cashew nut yogurt and red rose juice have fulfilled the SNI ie min.3.00-4.00. This research is in line with (Al-Baarri, 2013) in the yogurt drink study with the addition of star fruit which said a decrease in pH can be influenced by BAL (Lactic Acid Bacteria) which breaks lactose into lactic acid, then lactic acid is produced as a result of sugar metabolism.

This is related to the number of lactic acid bacteria that use lactose. The more sugar levels broken down by BAL, the faster the pH decrease. Streptococci bacteria will reduce the pH to 5.00, then will be followed by Lactobacilli bacteria until the pH reaches 4.50.

Table 7. Total Acid Levels in the cashew yoghurt with red rose flavor addition

Sample	Formulation				SNI
	F0	F1	F2	F3	
Cashew yoghurt with red rose flavor addition	0.3798%	0.3186%	0.4147%	0.4190%	0.5-2.0%

Based on the analysis based on Table 7, the highest total acid in cashew nut juice yogurt with the addition of red rose juice is in the F3 formulation with a value of 0.4190% and the lowest in the F1% formulation with a value of 0.3186%. The total acid yield in cashew nut juice yogurt with the addition of irregular red rose juice between formulations.

The total acid in the cashew nut yogurt and red rose juice (in Table 6.) obtained the highest total acid yield at F3 and the lowest in the F0 formulation. Seeing the total acid yield of the four formulas did not meet the specified SNI (SNI 2981-2009), which is 0.5-2.0%.

This is not in line with (Al-Baarri, 2013) the total acid in the product is in accordance with SNI, but it may be that the total acid content in the yoghurt product of cashew nut extract and red rose juice is lower because the amount of LAB is far more than in previous studies. The starter bacteria used in the manufacture of cashew nut yogurt and red rose juice are Lactobacillus bulgaricus, Streptococcus thermophilus and Lactobacillus acidophilus.

Table 8. Viscosity Analysis of Cashew Yoghurt with Red Rose Flavor Addition

Sample	Formulation			
	F0	F1	F2	F3
Cashew yoghurt with red rose flavor addition	16	24	24	24

Viscosity test results can be seen in table 8, the difference for formulation F0> 3cP, while in formulations F1, F2 and F3 is> 11Cp from the limit of the value of the viscosity that should be. Therefore, these results do not meet the viscosity requirements that should be, 8.28- 13.00 cP.

Then the viscosity of this yogurt does not meet SNI. This might be due to the different types of starter cultures and the use of pectin as a stabilizer whereas in yogurt the previous research by (Harjiyanti, Pramono, & Mulyani, 2013) only using two types of starter culture and no addition of pectin so that yogurt meets SNI. The lower the pH of eating yogurt will increasingly thicken. Therefore, it can be possible that the viscosity of yogurt is influenced by low pH levels.

Table 9. Analysis of TPC Content on Cashew Yoghurt with Red Rose Flavor Addition

Sample	Formulation				SNI
	F0	F1	F2	F3	
Cashew yoghurt with red rose flavor addition	$1.1x10^8$	$3.7x10^7$	$6.4x10^3$	$3.5x10^3$	Max. $1x10^8$ *CFU*/ ml

Based on the results from Table 9, it can be seen that the total plate count or total plate count in all formulations of cashew nut and red rose juice products has fulfilled SNI (SNI 2981-2009) because it is below 1x CFU / ml.

The decrease in the number of microbes in each formula might be influenced by the addition of red rose juice in each formulation so that the more the addition of red rose juice the smaller the amount of microbial contamination in the yogurt.

Table 10. Analysis of Calorie Content in Cashew Yoghurt with Red Rose Flavor Addition

Sample	Formulation				USDA
	F0	F1	F2	F3	
Cashew yoghurt with red rose flavor addition	50.21	46.13	28.00	33.54	88

The highest calorie content of yoghurt cashew nut and red rose juice calorie content in formulation F0 and lowest in formulation F2 and the calorie content in yogurt is low calorie when compared to USDA (United States Department of Agriculture).

Based on the analysis of calorie content in table 9, on 100g of cashew nut yogurt with the addition of red rose juice, the highest calorie found in the F0 formulation was 50.21 kcal, and the lowest in the F2 formulation was 28.00 kcal. When compared with the total calories of yogurt-fat according to the USDA (United States Department of Agriculture) explains that this yogurt is low in calories.

CONCLUSION

In the organoleptic test results the most preferred formulation is F2. In the test results of nutrient analysis there are significant differences in water content, fat content, protein content and carbohydrate content. In the antioxidant activity test, the highest yield was found in F3 with an IC50 value of 15.51 (very high). In the chemical properties test, the pH value of yogurt ranges from 3.90-4.11 and meets SNI. In the microbiology test in the form of TPC, it states that all yogurt formulations meet SNI and are safe for consumption.

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