



Combination of Tolo and Soy Bean Ice Cream as an Alternatif Snack for Autistic Children

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Abstract. Prevalence of Autism is increase and child autism need variation GFCF food one frequent food consumed child autism is ice cream. Please and soya bean is peanuts that can processed Becomes milk vegetable as replacement milk cow, where milk vegetable then developed Becomes ice cream vegetable. Destination study this knowing level favorite and knowing protein content and calcium ice cream. Making product started with making milk peanut fool combination soy-beans, continued with making ice cream peanut fool with 3 formulations. Ice cream next in the test try to 4 panelists expert, next to 35 panelists no expert. Method analysis with analysis descriptive and test friedman via SPSS. Results data analysis shows there is difference on color parameter and texture (p -value 0.00) and no there is difference by significant on the aroma and taste parameters (p -value > 0.05). Results test highest protein content that is formulation E_3 and results test calcium highest formulation E_1 . Panelists many like product formulation E_1 . Panelists more like color and texture formulation E_1 . Amount tolo used take effect to protein content and calcium ice cream.

Keywords: Autism Spectrum Disorder · Gluten Free Casein Free · Tolo Beans

1 Introduction

Autism is a complex disorder that includes disorders of social behavior, communication and language as well as various interests and activities unique to the individual and carried out repeatedly. Symptoms of autism usually appear in childhood or in the first five years of life. There are several accompanying symptoms such as epilepsy, depression, anxiety, and Attention Deficit Hyperactivity Disorder (ADHD) [1]. The pathophysiology in autistic children is still unclear, there are several hypotheses, namely central nervous system abnormalities or metabolic system abnormalities, autoimmune, placental dysfunction in pregnancy, maternal infections, increased stress and the presence of genetic factors that cause brain cells to not develop properly [2, 3]. There are various kinds of autistic children, namely Asperger's Syndrome, autistic mindblinness disorder, childhood disingrative disorder (CDD), and Autism Spectrum Disorder.

Globally number Autism Spectrum Disorder always increased, according to 2018 Center for Disease Control and Prevention data state amount sufferer autism increase from 1 per 150 population in 2000 to by 1 per 59 in 2014 [4]. Along increase amount

residents in 2018 can estimated person with autism in Indonesia as many as 3.1 million people with increase of 500 people/ year [5]. In Java East no there is official data amount child autism, this because amount sufferer autism no certain every year [6].

Autistic children is not matched by an increase in the variety of foods that are friendly to the diet of autistic children. The recommended diet for autism is a gluten free, casein free diet. This diet is carried out because of intestinal leakage in children with autism (leaky gut syndrome) [7], resulting in the production of peptides and exorphins. Peptides can enter the bloodstream and binds to the brain and can cause autism symptoms [8, 9]. Besides that implementation of a gluten -free diet and free casein this could help nanny in control Hyperactivity in autistic children. The application of a gluten-free and casein-free diet. Strictness has a negative impact, namely children with autism are at risk for nutritional deficiencies both macro and micro [10]. The impact of gluten free is prone to protein deficiency, because gluten is the main protein reserve. While the casein free diet can cause calcium deficiency so that it can affect bone density [11]. In line with Cornish's research (1998) in Bjørklund (2019), inadequate nutritional intake in terms of nutrition, namely protein, vitamin C, iron, vitamin D, niacin, riboflavin, vitamin B6, calcium and zinc is caused by the type of food that can be consumed. Consumed by children with autism is still limited [12]. Autistic children also have an eating disorder called picky eater or picky eating behavior, so this will have an impact on an imbalance between consumption and absorption of nutrients [1]. As stated by [13] that the imbalance. Between consumption and absorption of nutrients in the body causes nutritional problems both more and less. Therefore, in this study, the nutritional content of protein and calcium was tested on the tolo bean ice cream product with the combination of soy beans as gluten-free casein-free ice cream.

There are several previous studies that are relevant to this research, namely research conducted by [14] on the Characteristics of Cowpea Milk Ice Cream (*Vigna Unguiculate* L) with Variations in the Amount of Keragenan and Whipping Cream, but in this study the tolo bean ice cream used used is still combined with gluten and casein ingredients. Furthermore, in a study [15] on Organoleptic and Protein Content of Ice Cream With The Addition Of Tolo Beans (*Vigna Unguiculata*) and Purple Sweet Potato Solution As Natural Dyes, in this study ice cream was combined with cow's milk to increase the softness of the texture of the ice cream. Next there is almond milk made by [16] this almond milk is combined with potatoes, the ingredients used are gluten free casein free ingredients, but this product is only in the form of milk and has not been processed into ice cream. Moment this not yet there is product ice gluten free casein free cream consumed by child autistic.

Ice cream is a frozen food product that is very popular in all countries and levels of society from children to adults. Ice cream is one of the foods that are often consumed by children. Autism [17]. But there is still no gluten free casein (GFCE) ice cream which is suitable for autistic children [18]. In general, ice cream is made from cow's milk, but it is possible to make ice cream from vegetable milk, namely tolo peanut milk, a combination of soy beans. Therefore, the author developed a product in the form of ice cream made from tolo bean milk combined with soybeans as gluten-free and casein-free ice cream.

Tolo beans contain protein as well as high fiber and the price is relatively cheap compared to. With other g beans [19]. Tolo beans are useful for controlling blood sugar

Table 1. Formulation of tolo peanut ice cream combination of soybeans.

No	Ingredient Food	Formulation		
		E ₁	E ₂	E ₃
1	Peanut please	83.3 gr	166.6 gr	250gr
2	Peanut Soya bean	250 gr	250 gr	250 gr
3	Sugar Aren	200 gr	200 gr	200 gr
4	Flour Meizen	2 tbsp	2 tbsp	2 tbsp
5	Carob Powder	2 tbsp	2 tbsp	2 tbsp
6	Emulsifier	1 tbsp	1 tbsp	1 tbsp
7	Water	1.5 l	1.5 l	1.5 l

levels, so that suitable for control rate sugar in blood child autistic. Because if rate sugar in blood child autism tall will very dangerous to his brain [1]. In 100 g of beans tolo there is content nutrition protein 24.4 g, carbohydrates 56.6 g, fat 1.9 g, calcium 481 mg, phosphorus 399 mg, phytic acid 2.68 mg. To the excess of peanuts tolo that is have low fat [20, 21]. Content low fat _ on peanut fool make milk peanut fool no could shape emulsion, by because that making milk peanut fool need combined with peanut soybeans. Peanut soya bean is wrong one peanuts that have content fiber, acid fat not fed up and high protein so that good for health society. Content nutrition from peanut soya bean that is 24.9 g of carbohydrates, 40.4 g of protein, and fat as much as 16.7 g and calcium as much as 222 mg. Peanut soya bean this could processed becomes milk soya bean or soy juice, soy juice this as alternative replacement milk cow and good consumed for all type age. Milk soya bean this no contain lactose so that good for consumed by sufferer intolerance lactose. Peanut soya bean and peanut fool You're welcome have content high nutrition, so that if second peanut the combined will Becomes suitable product for child autism [22]. Destination from study this that is knowing quality organoleptic in the form of taste, aroma, texture and color from third formulation ice cream and knowing protein content and calcium highest from third formulation.

2 Method

2.1 Ingredient

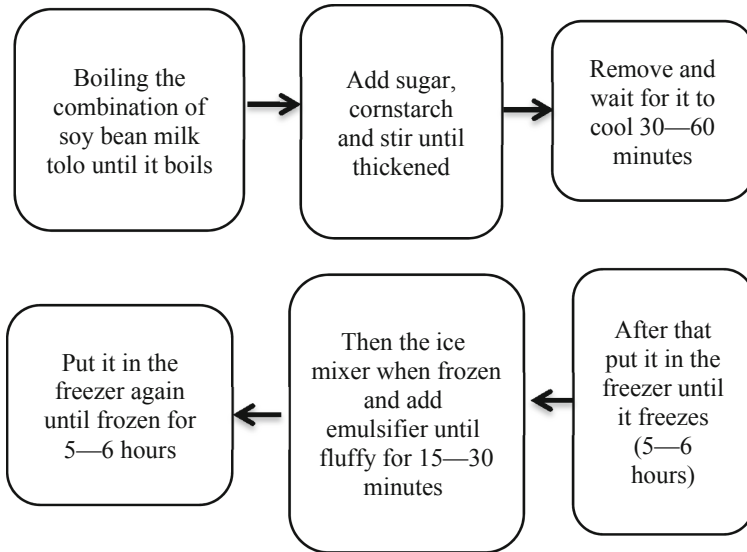
The composition of the ingredients used in the study included tolo beans, soybeans, emulsifier, tapioca flour, palm sugar, pandan leaves, salt and carob powder. The formulation in this study can be seen in Table 1.

2.2 How to Make Milk Tolo Beans Combination Soy Beans

Making tolo peanut milk begins with soaking tolo beans and soybeans in different containers for 12 h or 1 night. The second step is boiling the soybeans for 5–10 min and the tolo beans for 2–5 min. Next, blend the tolo beans and soybeans for 2–5 min. Then

strain using a cloth, and boil the tolo peanut milk with the combination of soybeans for 10–15 min until it boils. During boiling should always be stirred so that the milk does not break.

2.3 How to Make Ice Cream



2.4 Method

This research is a development research, this research was conducted in April 2022 in Malang City. The manufacture of the product was carried out at the Nutrition Laboratory of the Faculty of Sports Science, State University of Malang, then continued with organoleptic testing by 4 trained panelists including food and nutrition experts from the Faculty of Mathematics and Natural Sciences, a culinary expert from the Faculty of Engineering and 2 caregivers for autistic children from the Faculty of Engineering. SLB Laboratory of State University of Malang. After organoleptic testing on trained panelists, product improvements were made according to the advice of trained panelists and organoleptic tests for untrained panelists totaled 35 people, namely school age children 11–12 years old, grade 6 SDN Pisang Candi 1 Malang City with inclusion criteria, namely willing to be panelists, had signed informed consent by parents, healthy (not disabled), not allergic to nuts and has sensitivity to the required assessment. This organoleptic test uses a hedonic scale and a numerical scale including: Very Very Like (5), Very Like (4), Like (3), Somewhat Like (2), and Dislike (1). After the organoleptic test, the protein content test was carried out using the Kjeldahl method and the calcium content test using the AAS method. Making tolo peanut ice cream is modified from

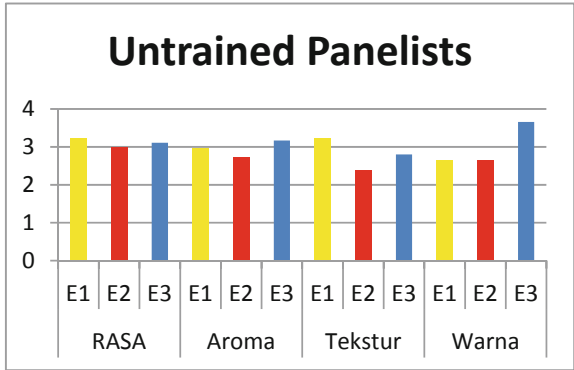


Fig. 1. Organoleptic Test Results Non-Expert Panelists.

Table 2. Differences in organoleptic parameters in 3 formulations of tolo peanut ice cream combination of soybeans.

Parameter	Formulation			p-value
	E ₁	E ₂	E ₃	
Flavor	3.23	3	3.11	0.3
Scent	2.97	2.74	3.17	0.372
Texture	3.23	2.4	2.8	0.00
Color	2.66	2.66	3.66	0.00

research [23]. This research has conduct an ethical test at Poltekkes Kemenkes Malang with Reg.No.:362/KEPK-POLKESMA/2022.

2.5 Processing and Data Analysis

The data analysis used was descriptive analysis to analyze the test data for protein and calcium nutritional content and used the Friedman test to analyze the results of the Organoleptic Test. The Friedman test was carried out through the SPSS application, this test was to see any differences in the product formula.

3 Results and Discussion

3.1 Results

3.1.1 Result Test Organoleptic Untrained Panelist

The organoleptic test on untrained panelists was carried out by 35 students of SDN Pisang Candi 1 Malang City with an age range of 11–12 years. The following is an organoleptic test chart for untrained panelists.

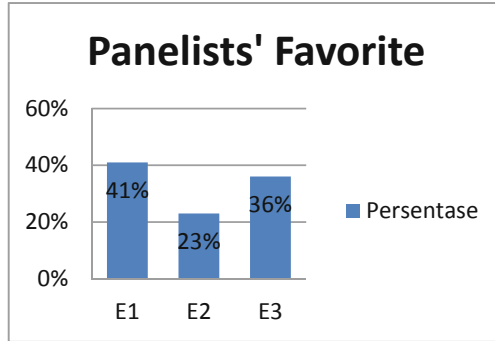


Fig. 2. Panelists' favorite products.

Flavor Based on Fig. 1, which means that the formulation with the highest average value is the formulation E₁ with a value of 3.23 and the formulation with the lowest average value is the formulation E₂ with a value of 3, even though both formulations have an average value. Different but both have the same range that is like. The Friedman test was conducted to determine whether or not there was a difference in taste from the three formulations. Based on Table 2, the results of the Friedman test stated that there was no significant difference in the three formulations.

Scent Based on Fig. 1, it can be seen that the formulation with the highest value is formulation E₃ of 3.17 and the formulation with the lowest value is E₂ with a value of 2.74. Although both have different average values, they are both in the same range, namely likes. In the results of the Friedman test, Table 2 states that there is no significant difference in the three formulations in the aroma parameter.

Texture In Fig. 1 it can be seen that the highest average value for the texture parameter is E₁ of 3.23 in the like range and the lowest average value in the E₂ formulation with 2.4 or in the moderate range. In Table 2 it can be seen that the results of the Friedman test state that there are differences in the texture parameters of the three formulations.

Color In Fig. 1, it can be seen that the formulation with the highest average value in the color parameter is E₃ with a value of 3.66 or in the very like range. The higher the mean value, the formulation that is preferred by the panelists in terms of color. Formulations with low values are at E₁ and E₂ with a value of 2.66 in the like range. Based on the results of the Friedman test in Table 2, it states that there are differences in terms of color from the three formulations.

3.1.2 Panelist Favorite Formulation

After the panelists made an assessment of the three samples, the panelists were asked to write down which sample they liked the most. From Fig. 2, it can be seen that the panelists chose the most, namely formulation E₁ with a percentage of 41%. The least formulation chosen by panelists as the most preferred formulation is formulation E₂.

Table 3. Total protein content.

Sample Name	Protein Level grams/100 g	SNI Standard
E ₁	4.66	2.7g/100g
E ₂	4.69	
E ₃	4.98	

Table 4. Total calcium levels.

Sample Name	Calcium Level mg/100 g	SNI Standard
E ₁	7.54	123mg/100g
E ₂	16.53	
E ₃	16.22	

3.1.3 Result Test Nutrition

Protein Protein content was tested by the Kjeldahl method. In this study, the three formulations met the standard of SNI Number 01-3713-1995 based on protein content. Intake of ice cream in 1 cup (100 g) can meet 8.47%–18.64% (E₁), 8.52–18.76% (E₂), and 9.054%–19.96% of protein requirements school-age children, namely 25–55 g/day for girls and 9.32%–18.64% (E₁), 9.38%–18.76% (E₂) and 9.96%–19, 96% (E₃) of the protein needs of school-age children, which is 25–50 g/day for boys, this is based on the 2019 RDA (Table 3).

Calcium The calcium content in this study was obtained by the AAS method. In this study, the three formulations did not meet the standards of SNI Number 01-3713-1995. Intake of 1 cup (100 g) ice cream can fulfill 1.46%–6.49% (E₁), 1.37%–6.12%(E₂) and 1.35% –6.6%(E₃) of the calcium needs of children, which is 270–1200 mg/day, this is based on the 2019 RDA (Table 4).

3.2 Discussion

3.2.1 Flavor

Taste is the main aspect in panelist acceptance in a food product [24]. Based on the results of the Friedman test, the p-value > 0.05 means that there is no significant difference between the three formulations. Panelists can accept the taste of tolo peanut ice cream. The average value resulting from the organoleptic test in terms of taste is in the like range. Tolo bean ice cream has a sweet taste, this sweet taste is influenced by the composition of the ingredients used. In line with research [23, 25] on tolo bean ice cream with natural red spinach leaf coloring, the sweet taste of tolo bean ice cream is obtained from natural sweeteners and also from the carbohydrate content of tolo beans themselves. The natural sweetener used in this study was obtained from palm sugar, the three formulations in this

study used 200 g of palm sugar. Palm sugar contains glucose so that it gives a sweet taste and is useful for cleaning the kidneys from Sapari, 1994 in [26, 27]. This is supported by research [28] that palm sugar contains many vitamins such as riboflavin, thiamin, niacin, ascorbic acid, and calcium, where these nutrients are very important for children with autism.

3.2.2 Scent

Aroma is one of the components that affect panelists' tastes in food products. In this study, the three formulations had a p-value > 0.05 , which means that there was no significant difference in terms of aroma. Based on the average value generated from the statistical test, it was stated that the aroma of the three formulations was acceptable to the panelists and was in the preferred range. Tolo beans can affect the aroma of ice cream. Because tolo beans have an unpleasant aroma, but in the manufacture of tolo bean milk, the combination of soy beans is added with pandan leaves and also in serving frozen food products can remove the unpleasant aroma from tolo beans. This is in line with research [15] that the unpleasant aroma of peanut tolo ice cream disappears after becoming ice cream. Likewise with research [23] on tolo bean ice cream with natural dyes of red spinach leaves, the resulting ice cream has a delicious aroma, no unpleasant aroma from tolo beans.

3.2.3 Texture

The texture of the tolo peanut ice cream in this study had a significant difference based on the results of the Friedman test. The E_1 formulation has a slightly soft texture and has a value of 3.23 or in the like range, the E_2 and E_3 formulations have a moderately favorable range with an average value of < 3 . In the E_1 formulation with a composition of 83.3 g of tolo beans and 250 g of soybeans. The texture of ice cream is influenced by the fat content in each formulation. The fat ingredient in this ice cream product is soybeans which are processed into soy milk. Tolo beans have low fat, so the more tolo beans content affects the texture of the ice cream. This is in line with research [15] on tolo bean ice cream with the addition of purple sweet potato solution as a natural dye that ice cream with a soft texture is found in the formulation with a little tolo beans. In a study [14] it was stated that tolo peanut milk cannot form an emulsion, so that the more tolo bean content in the ice cream dough will make the texture of the dough a little runny / runny.

3.2.4 Color

The level of preference in food products is influenced by color parameters, foods with attractive colors are more easily accepted and liked by consumers [29, 30]. In this study the color of the ice cream produced from each different formulation can be seen in Figs. 3 and 4, after the addition of carob powder there was a color change in each formulation, formulation E_1 got a slightly pale light brown color, E_1 produced a light brown, and formulation E_3 has a dark brown color. The E_3 formulation contains the most tolo beans, so the resulting color is darker than the other formulations. There are

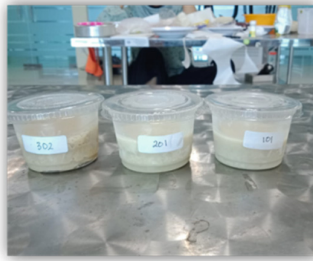


Fig. 3. Products before revision.



Fig. 4. Product after revision.

5 factors that affect the color of food products, namely pigments, oxidation reactions, maillard reactions, caramelization reactions and dyes [31]. The brown color of tolo bean ice cream is obtained from the natural pigments in tolo beans, the more tolo bean content in each formulation, the more brown the color of the ice cream will be. This is in line with research [32] on product development in the form of tolo bean getuk which states that the more tolo bean content, the more brown the color of getuk is Anthocyanin pigments which are dark red-brown in color are found in tolo beans, this pigment is what gives color to tolo bean ice cream [32]. Apart from the pigment from tolo beans, the brown color is produced from carob powder. Carob powder is a friendly substitute for natural food coloring for autistic children, because it does not contain caffeine like ordinary cocoa powder [33]. Carob has a flavor that is almost the same as chocolate and contains many active compounds that act as anti-inflammatory and antidiabetic [34].

3.2.5 Protein

The highest protein content of tolo bean ice cream is formulation E₃ (tolo beans: soybeans = 1:1) which is 4.99% or equivalent to 2.49 g and the lowest protein content is in formulation E₁ (tolo beans: soybeans = 1:3) of 4.66% or equivalent to 2.33 g. The difference in the amount of protein in each formulation depends on the percentage ratio between tolo beans and soybeans. The right amount of comparison between tolo beans

and soybeans produces high protein. Because protein levels are caused by protein degradation by the activity of protease enzymes in seeds into amino acids from Sudarmanto, 1992 & Sutardi, 1996 in [19]. There are several other factors that affect the protein content, namely the process of making tolo bean milk in combination with soybeans in the soaking process, boiling process and refining process. Immersion results in the release of protein structure bonds so that protein particles are dissolved in water from Suhaidi, 2003 in [35]. Heating and grinding causes protein denaturation. Protein denaturation is the loss of more complex structural properties, causing the bonds between amino acids to break and the biological properties of molecules to be lost [36]. Therefore, the process of making products must be considered to maintain the nutritional content of food ingredients. The results of this study are in line with research [37] related to yogurt with a combination of cow's milk and tolo peanut milk which states that the more tolo beans used, the more protein content.

Autistic children have imperfect protein digestion, often there is an enzyme disorder that functions to break down peptide bonds so that protein digestion is disrupted. Whereas protein in autistic children is very useful for the body's defense against mercury, toxic metals and toxic chemicals [38]. In addition, in autistic children, protein affects zinc absorption which can affect hair health of autistic children, protein greatly affects the nutritional status of autistic children [39]. Because the function of protein itself plays a role in growth, formation of structural components, transport and storage of iron [40].

3.2.6 Calcium

The highest calcium content of tolo bean ice cream is formulation E₁ (tolo beans: soybeans = 1:3) which is 17.54 mg and the lowest calcium content is formulation E₃ (tolo beans: soybeans = 1:1) of 16,22 mg/100. The difference in the amount of calcium in each of these formulations comes from the mixture of ingredients for making ice cream. Nuts contain phytate or phytin compounds, these compounds are inositol hexaphosphoric acid or phytic acid that binds calcium, magnesium or potassium. This compound causes a decrease in the availability of minerals from food products containing nuts, therefore phytic acid is referred to as an antinutrient in foodstuffs. So that the more tolo nuts in the ice cream, the less calcium content. The heating method is considered ineffective to reduce phytin, because it can damage other nutrients such as protein. An effective way to reduce phytin is by germination and fermentation [41]. This is in line with research [42] on the Effect of Tolo Bean Type, Production Process and Inoculum Type on Changes in Nutrients in Tolo Bean Tempe Fermentation that Tolo Bean Tempe fermentation is caused by tempeh fungus and produces phytase enzymes which will decompose phytic acid which can bind some minerals into phosphorus and inositol. The content of phytate or phytic acid in soybeans ranges from 1 to 1.47 g per 100 g of dry weight. Tolo beans are one of the beans with the highest phytic acid value, which is 2.676 [43]. Phytic acid in nuts plays a role in protecting oxidative damage to grains during the storage process, is an antioxidant and can reduce the nutritional value of protein because if phytic acid binds to protein it will form complex compounds that make protein insoluble. This insoluble phytate is considered nutritionally unfavorable, because it becomes difficult for the body to absorb [44].

4 Conclusion

The most preferred product by the panelists was formulation E₁. According to the expert panelists, there was no significant difference in terms of taste, aroma, texture and color of the three ice cream formulations. Based on non-expert panelists, the texture and color parameters showed significant differences and the aroma and taste parameters did not show significant differences. The highest protein content is in the E₃ formulation of 2.49 g/50 g, the more tolo beans in the ice cream, the more protein content. The highest calcium level was in the E₁ formulation, which was 17.54 mg/100 g, the more tolo beans used in the formulation, the lower the calcium. It is recommended that when serving tolo bean ice cream the combination of soy beans can be added toppings or other combinations to increase the nutritional value of calcium and can be tested for the fiber content of tolo bean ice cream combined with soy beans for further research.

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