

Are Cookies Based on Soybeans and Aren Safe for Autistic Children?

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Abstract—1) Background: Children with Autism Spectrum Disorder (ASD) have indigestion conditions, so diet in children with ASD is gluten-free and casein-free diet. Gluten-free and casein-free food products tend to be low in protein. Soy flour with a high protein content is expected to increase the nutritional value (protein) of gluten-free cookies and casein. The authors innovate by adding natural sugar sweeteners using palm sugar in addition to palm sugar has a low glycemic index value. Nutrients in natural sugars also help the process of assimilation into the body. **2) Purpose:** This study aims to develop and analyze the nutritional value of soybean flour cookies and palm sugar. **3) Method:** This research and development refers to the research and development model of Borg & Gall (1983), consisting of seven steps namely (1) identification and establishing problem solving, (2) conducting preliminary studies and needs analysis, (3) establishing product specifications, (4) developing initial product models, (5) expert trials, (6) review of revised products, and (7) suggestions of utilization, dissemination, and further product development. **4) Results:** The results showed that the results of organoleptic tests of soy flour cookies and palm sugar are preferred cookies with a ratio of 50%:50%. The results of the analysis of the nutritional content of selected cookies are 520.07 kcal total energy, 44.58 g carbohydrates, 13.98 g protein, 32.05 g fat, 0.36 g fiber, 0.96 g iron, 6.73 g moisture content, and 2.65 g ash content. **5) Conclusion:** Cookies can be consumed autistic children because it is gluten-free and casein-free. Cookies can be served snacks alternative snacks for autistic children according to the needs of the body.

Keywords: Cookies, Soy, Aren, Autistic

1. INTRODUCTION

Autism Spectrum Disorder (ASD) is a series of barriers to social behavior, communication, and language as well as a variety of interests and activities that are unique to individuals and performed repeatedly. ASD begins in childhood and lasts into adolescence and adulthood. In most cases, the condition is evident in the first five years of life.

Autistic children often experience other accompanying conditions, including epilepsy, depression, anxiety, and Attention Deficit Hyperactivity Disorder (ADHD) and autistic children are more susceptible to chronic and non-communicable diseases due to behavioral risk factors, such as poor physical activity and eating habits and a greater risk of violence, injury, and abuse [1]. Autistic children also have difficulty accessing the necessary health care [2].

It is estimated that worldwide 1 in 160 children have autism. This number represents the average number and reported prevalence varies substantially throughout the study. However, some well-controlled studies report much higher numbers. The prevalence in many low-income countries is so far unknown. According to epidemiological studies conducted in the last fifty years, the prevalence of ASD is increasing globally [1]. The prevalence of autistic children in the world currently reaches 15-20 cases per 10,000 children or 0.15-0.20%. The birth rate in Indonesia is six million per year and the number of autistic people in Indonesia increases by 0.15% or 6,900 children per year with the prevalence of boys three to four times greater than that of girls [3]. In 2000 the number of autistic people in Indonesia is estimated at 1: 5000 children [4]. In 2003 1:10,000 children, while in 2004 it was estimated that 1 in 150 children suffered from autism. In 2006 it is estimated that the number of autistic children in Indonesia reached 150-200 people [3]. In Indonesia in 2010 it is estimated that the number of people with autism reached 2.4 million, and an increase of about 500 new people each year and this shows the number of children with autism in Indonesia shows an increase [5]. In East Java in 2009 there were 93 inclusion schools with 1,476 students with special needs and 15% of them were autistic children [4]. In Canada and Japan this increase has reached 40% since 1980. In California in 2002 there were nine cases of autism every day. In early 2002, the incidence of autism in the UK increased rapidly and it is thought that 1 in 10 children suffer from autism [6].

Data from 2000-2014 from the *Center for Disease Control and Prevention* (CDC) showed that the prevalence of children with autism in the United States increased from 1:150 in 2000 and 2002 to about 1,125 in 2004, increased to 1 in 110 children in 2006, increased to 1:88 children in 2008, increased to 1:69 in 2010 and 2012, and increased again to 1:59 in 2014 identified with ASD [7].

The increasing number of autistic children in various countries is inseparable from the emergence of various problems, especially nutritional problems [8]. Autistic children have a risk of malnutrition caused by several factors, including strict diet therapy, eating disorders, limited eating intake, parental nutritional knowledge, and the influence of drugs [9]. The behavior possessed by people with autism, namely *picky eater* behavior or food picky behavior. This behavior makes children accustomed to choosing foods so that it can lead to a lack or excess intake of nutrients that can affect their nutritional status [10]. In autistic children there are also often difficulties in eating caused by three factors, namely loss of appetite, eating disorders in the mouth, and psychological influences [11]. In people with autism the most common causes are appetite disorders and eating disorders. Therefore, the author makes a companion meal for autistic children or snacks that are favored by autistic children, namely *cookies*. The criteria for healthy *cookies* snacks for autistic children, namely *casein free* and *gluten free*, enough protein, and sweeteners are not made from granulated sugar.

Cookies (cookies) are biscuits made from wheat flour (contains gluten). Wheat flour is flour or powder derived from wheat seeds. The advantage of wheat flour compared to other flours is its ability to form gluten when given water [12]. Gluten is a protein component (80%) in wheat which consists of a mixture of gliadin and gluten proteins. Gluten can cause the onset of a gluten intolerance disease known as *celiac disease*. The condition is characterized by inflammation of the intestinal mucosa that makes the intestines unable to function normally. To avoid the consumption of gluten, other products derived from rice, corn, soybeans, sunflower seeds, and oats that are not contaminated with gluten [13]. Therefore, the author replaces wheat flour with soy flour as the raw material for making *cookies* for autistic children.

Cookies on the market are mostly *cookies* that are supplemented with milk (containing casein). Casein is a component of protein contained in milk. In milk contained casein cheese-forming ingredients and *wey* protein contained in the form of waste liquid cheese making. Casein is found in all milk derived from dairy-producing livestock, such as cows, goats, horses, buffaloes, camels, and sheep. In

casein there are two variants group, namely casein A (A1 and A2) and B. Variant A1 is suspected to cause many problems, such as being the cause of sudden infant death *syndrome*, *ischemic heart disease*, and autism [13]. Therefore, the author does not give additional milk to the ingredients of making *cookies* for autistic children.

Autistic children need a proper diet called the *Casein Free Gluten Free* (CFGF) Diet. This diet can help cure intestinal disorders and reduce hyperactive behavior. Some research suggests that 68.24% of autistic children may lower their hyperactivity levels after undergoing a CFGF diet. Hyperactive behavior is excessive behavior and difficult to control. In general, the hyperactive behavior of autistic children can be demonstrated through difficult behaviors of silence, a lot of unclear and excessive movement, as well as a lack of ability to control their behavior [14]. Gluten and casein should not be consumed by autistic children because it can cause an increase in intestinal permeability (*leaky gut*), thus allowing peptides from casein and gluten uneven to come out of the intestinal wall and into the bloodstream [15]. Many children experience rapid development in social and communication skills after undergoing CFGF therapy (*Casein Free and Gluten Free*) [16].

Gluten-free and casein-free children's snacks tend to have less protein nutritional value [17]. Meanwhile, protein is important for autistic children. *Glutathione* is a small protein composed of three amino acids, namely glycine, cysteine, and glutamate acid. *Glutathione* is very important because it has several functions in the body [18]. These proteins are the body's main defense against mercury, toxic metals, and toxic chemicals, so if *glutathione* production is low, toxins in the body will be higher [19]. *Glutathione* plays a role in the detoxification process so that glutathione deficiency can lead to a build-up of environmental toxins and heavy metals [20]. If this happens at the beginning of a child's development, the expression of genes that function to regulate nerve development may be affected. In autistic children, plasma *glutathione* levels are reduced, generally 20-40% lower than normal children [18]. *Glutathione* levels are low in autistic children due to abnormalities in their methionine pathways [19].

Increasing the nutritional value of protein in gluten-free and casein-free foodstuffs needs to be done to maintain protein adequacy in ASD children, so that by implementing the *Casein Free Gluten Free* (CFGF) diet daily nutritional needs remain met [17]. Protein content in *cookies* containing gluten and casein is 2.1 g and the protein content in *cookies* that are gluten-free and casein only 1 g. Therefore, the

author makes innovations cookies *casein free gluten free* containing a considerable amount of protein, namely *cookies* with soy base ingredients. Soybeans (*Glycine max*) is the third most important food crop commodity after rice and corn. Soy serves as a very important source of vegetable protein to improve people's nutrition because it is safe for health and cheap. Soybeans can be processed as food industry ingredients, such as tofu, tempeh, soy sauce, soy milk, taoco, *snacks*, and so on [21]. Soy can give rise to an unwelcome unpleasant aroma. The aroma can be overcome by adding or modifying other food ingredients, namely sugar to neutralize the aroma of unpleasant.

Sugar that is commonly used as an additional food ingredient in *cookies* is granulated sugar. Nevertheless, autistic children are allergic to granulated sugar. Therefore the author replaces granulated sugar with palm sugar. Palm sugar has a lower glycemic index value, which is 35, while granulated sugar has a glycemic index of 58 [22]. If autistic children consume too much granulated sugar, hyperglycemia will occur that can harm their brains [23]. Granulated sugar (white sugar) also does not contain antioxidants, does not contain compounds that are beneficial for health, and is not safe to consume every day [22]. Therefore, the author makes *cookies casein free gluten free* with the addition of palm sugar. Aren (*Arenga pinnata Merr*) is a type of palm plants that have a high content of fructose and sucrose. Palm trees have male flowers and female flowers that can be tapped his nira from the age of three years. However, it is the male flower that is always tapped because it has a more satisfactory amount and quality of results than female flowers. Male flowers can be tapped when they have removed stamens [22].

Based on the above exposure, researchers intend to conduct a study of making *cookies* from soybean flour without additional wheat flour then combined with palm sugar as a substitute for white sugar with a ratio of 50%:50% of the total in the treatment of group 1 and 60%:40% of the total in the treatment of group 2. Researchers made *cookies* from soy flour and palm sugar. *These* cookies are expected to be an alternative food for autistic children. Based on this, researchers are interested in conducting a study with the title "Are Cookies Based on Soybeans and Aren't Safe for Autistic Children?"

2. METHOD

Research and development method or in English called *research and development* is a research method used to produce a particular product and test the product's effective. To be able to produce

a particular product and test the effectiveness of the product used research that is analysis of needs. So, research and development is longitudinal (gradually, can be *multi years*) [24]. Research and development plans are often referred to as research-based development designs. This research and development uses procedural models. A procedural model is a descriptive model that describes the flow or procedural steps that must be followed to produce a particular product. The design of this research trial is research that uses expert validation by conducting a test design to obtain data used in the improvement of the product to be made. The data is obtained from expert validation. Expert validation is needed to assess the initial product so that it can be known the flaws and weaknesses that must be refined by the researchers. The resulting data is data obtained from trained researchers, namely three nutritionists / gastronomists.

In this study there are two types of data. First, qualitative data obtained from criticism or advice from nutritionist / food stylists for product improvement. Second, quantitative data, which is data in the form of numbers that can be processed or analyzed using statistical calculation techniques. Quantitative data was obtained from ordinal-scale organoleptic test questionnaires. Research tools or instruments are tools used in research to retrieve data. Because it is a tool, the instrument can be a *check list* sheet, questionnaire guidelines, interview guidelines, observation guidelines, photo cameras, and other instruments [25]. In this study, the research instrument used was a questionnaire with hedonic scale. The hedonic scale (likeness level) is the scale that the author uses on the favorite test. In the process of analysis, the hedonic scale is transformed into a numerical scale. With numerical data this can be done statistical analysis. The scale used is 5 hedonic scales consisting of very likes (5), likes (4), neutrals (3), dislikes (2), and very dislikes (1). This study will use descriptive statistical analysis method. In descriptive analysis data can be presented with tables, graphs, pie or bar charts, and pictograms. With descriptive statistics the collected data is analyzed with an average calculation so as to describe the average nutritional content of the product. The results of organoleptic tests in this study were presented in quantitative form, then analyzed using friedman test with SPSS version 23.

3. RESULTS AND DISCUSSION

3.1 Nutritional Content of Cookies

Analysis nutritional content of soybean flour and palm sugar *cookies* was conducted in the Central Laboratory of Life Sciences Brawijaya University, Laboratory of Chemistry Polytechnic Health Ministry of Malang, and Nutrition Laboratory Airlangga University. Against *cookies* F1 and F2 and F0 (control formulations) conducted tests of energy, carbohydrates, proteins, fats, fiber, iron, moisture

content, and ash content. In the following table will be presented the results of nutritional content data *cookies* soybean flour and palm sugar

Table 1. Nutritional Content of Products

	Formula 1	Formula 2	Formula 0
Total energy	520,07	527,97	525,44
Carbohydrates (g)	44,58	40,2	67,37
Protein (g)	13,98	15,57	7,53
Fat (g)	32,05	33,73	21,37
Fiber (g)	0,36	0,31	0,3
Iron (g)	0,96	1,18	0,24
Moisture content (g)	6,73	7,69	2,83
Ash content (g)	2,65	2,8	1,12

3.1.1 Energy

Energy is one of the results of the metabolism of carbohydrates, proteins, and fats, which serves as an energy substance for metabolism, growth, temperature control, and physical activity. Excess energy is stored in glycogen form as short-term and long-term energy reserves [26].

The energy value of *cookies* indicates the influence of differences in the concentration of soy flour and palm sugar. The lowest energy value of *cookies* is found in the first formula with a ratio of 50%:50% soy flour and palm sugar, which is 520.07 kcal. The highest energy value of *cookies* is found in the second formula with a ratio of 60%:40% soy flour and palm sugar, which is 527.97 kcal. Energy value can be obtained from carbohydrates, fats, and proteins contained in *these cookies*. Energy intake levels can affect the nutritional status of autistic children. This is supported by other research Wijayanti and Mutalazimah (2018) which shows that there is a relationship between energy intake and nutritional status [11]. A study by Hyman et al (2012) showed that children with ASD consume less energy [27]. Children with autism have a risk of lack of intake caused by several factors, including strict dietary therapy of food behavior disorders (*picky eaters*) such as difficulty receiving new food and very slow chewing movements, limited food intake, parental nutritional knowledge and the influence of drugs.

3.1.2 Protein

Protein is a food substance that is very important for the body because in addition to functioning as fuel in the body, protein also serves as a building agent and regulatory substances such as enzymes [28]. Protein is a source of amino acids containing elements C, H, O, and N that are not

owned by fats or carbohydrates [29]. The level of protein consumption can affect the nutritional status of autistic children. This is supported by research Nareswara & Anjani (2016) which shows that there is a relationship between protein consumption levels and nutritional status of autistic children [30]. This is in accordance with opinion Lombardo (2020) which states that protein is important for autism [31]. In ASD children, the type of protein consumed should be considered because ASD children react to certain types of proteins. Proteins that should be avoided by ASD children are gluten and casein, which are proteins found in wheat flour and cow's milk and processed products. Gluten-free and casein-free diets in ASD children can show improved behavior in children [30].

Protein is a long chain consisting of amino acid units. However, in ASD children, the digestion of proteins is imperfect so that a short chain of amino acids called peptides is formed. In ASD children, there is often a disorder of the enzyme *Dipeptidylpeptidase IV* (DPP IV) which serves to decompose the bonds of peptides so that the digestion of proteins is disrupted. Proteins that are difficult to digest and often absorbed as peptides are gluten and *casein*. Peptides are bioactive components and have an impact on children's autism symptoms. Autistic children experience abnormal urinary peptides, it occurs due to digestive imperfections of gluten and *casein* proteins as a result of the metabolism of the ENZYME DPP IV. The metabolic process of peptide partly goes to the brain caused by *leaky gut syndrome* due to unbalanced bacteria and fungi. This causes various macromolecules of cow's milk proteins or toxic substances to pass through the walls of the gastrointestinal tract to the blood causing disruption of the composition and function of the brain that ultimately affects behavior, developmental disorders, and learning process disorders [31].

The lowest levels of soy flour and palm sugar protein *cookies* are found in the first formula (F1) with a ratio of 50%:50%, while *cookies* with the highest protein content is the second formula (F2) with a ratio of 60%:40%. The more soy flour is added, the higher the protein content of *cookies*. This is in accordance with the opinion of Cahyani, Nuswantara, & Subrata (2012) that soybean flour has a high protein content, which is 37.7%. Protein levels obtained from both formulas in accordance with the standard protein *cookies* set in SNI 2973:2018, which is at least 4.5% [32].

3.1.3 Fat

Fat is the main energy store in the body and fat is a source of essential nutrients [8]. Intake of fat derived from food, if less, will affect the intake of

calories or energy in the process of activity and metabolism of the body. Low fat intake followed by reduced energy in the body will cause changes in body mass and tissues as well as impaired absorption of fat-soluble vitamins [33].

The lowest fat content of soy flour and palm sugar *cookies* is found in the first formula (F1) with a ratio of 50%:50%, which is 32.05 grams, while the highest fat content is found in the second formula (F2) with a ratio of 60%:40%, which is 33.73 grams. The more soy flour is added, the higher the fat content of *cookies*. The fat content obtained is in accordance with the standard fat *cookies* set in SNI 2973:2018, which is at least 9.5%. The level of fat intake can affect the nutritional status of autistic children. This is supported by the results of the study Majidah et al. (2017) which states that there is a relationship between fat intake and the nutritional status of children ASD [8]. In the study Tamiji and Crawford (2010) also stated that fat intake proved effective in improving hyperactivity associated with autism. Imbalances and abnormalities of fat metabolism have been shown to play a role in the pathology of psychiatric disorders, including ADHD disorders, dyslexia, dyspraxia, bipolar disorder, and schizophrenia [34]. Insufficient fat intake and abnormal fat metabolism can lead to nervous system imbalances, behaviors, and the development of autism. Imbalances and abnormalities of fat metabolism have been shown to play a role in the pathology of psychiatric disorders, including ADHD disorders, dyslexia, dyspraxia, bipolar disorder, and schizophrenia. This is also in accordance with the opinion of Usui et al. (2020) which indicates that there is a relationship between fat metabolism and ASD. Fat intake can improve symptoms in ASD such as social communication [35].

3.1.4 Carbohydrates

Carbohydrates or hydrate charcoal is a nutrient whose main function is as an energy producer. Each gram of carbohydrates produces 4 calories. Carbohydrate sources are grains or serelia, tubers, and sugar. The processed products of these ingredients are vermicelli, noodles, bread, flour, jam, syrup, and so on [36]. Carbohydrates have an important role in determining the characteristics of foodstuffs, such as taste, color, texture, and others [37].

Carbohydrate levels in soybean flour cookies and palm sugar indicate that the difference in the concentration of soy flour and palm sugar can have an influence. Carbohydrate content is calculated *in carbohydrate by difference*. The calculation of this method is strongly influenced by the content of other nutrients, such as water, ash,

fiber, protein, and fat. The lowest carbohydrate *content* of cookies is in the comparison of soy flour and palm sugar 60%:40%, which is 40.2 grams and the highest is in the comparison of soy flour and aren sugar 50%:50% which is 44.58%. In research Puteri, Nugraheni, & Aruben (2018) stated that the diet in children, especially autistic children, must contain the amount of nutrients, especially carbohydrates to meet physiological needs during growth and development [38]. It is also in accordance with research Zhang et al (2018) which shows that carbohydrates can cure oxidative stress and physiological stress in ASD children [39].

3.1.5 Coarse Fiber

Fiber is a structural part of plants and is found in all plants, vegetables, fruits, whole grains, and legumes. The fibers tested in this study were coarse fibers. Coarse fiber is a foodstuff that cannot be hydrolyzed by chemicals used to analyze is coarse fiber, such as H₂SO₄ and NaOH. Fiber food is a foodstuff that cannot be hydrolyzed by digestive enzymes. The value of coarse fiber is smaller than that of food fiber because digestive enzymes have a lower ability to hydrolyze foodstuffs than sulfuric acid and sodium hydroxide [28].

The lowest fiber content of soybean flour and palm sugar *cookies* is found in the second formula (F2) with a ratio of 60%:40%, which is 0.31 grams, while the highest crude fiber content is found in the first formula (F1) with a ratio of 50%:50%, which is 0.36 grams. The fiber content obtained is in accordance with the standard of fiber *cookies* set in SNI 2973:2018, which is a maximum of 0.5%. The level of fat intake can affect the nutritional status of autistic children. This is supported by the results of Nareswara and Anjani (2016) which states that the more adequate fiber intake in autistic children, the more normal the frequency of defecation and the consistency of feces is getting softer (type 4 and 5) and volume making it possible to decrease transit *time* in the colon [30]. Normal defecation patterns in autistic children can have a good impact on the ability to concentrate, emotional stability, detoxification process, and metabolism of nutrients in digestion.

3.1.6 Iron

Iron has several essential functions in the body, namely as a means of transporting oxygen from the lungs to body tissues, electron transport in cells, and as an integrated part of various enzyme reactions in the body's tissues. Iron deficiency can cause disruption or inhibition to growth, both body cells and brain cells, even decreased endurance. In addition, iron deficiency can also lower hemoglobin levels [40].

Iron content *cookies* soybean flour and palm sugar is the lowest contained in the first formula (F1) with a ratio of 50%:50%, which is 0.96 grams while the highest iron content is found in the second formula (F2) with a ratio of 60%:40%, which is 1.18 grams.

3.1.7 Moisture Content

Moisture content is the amount of water contained in the material expressed in percentage. Moisture content is also one of the important characteristics in foodstuffs because water can affect the appearance, texture, and taste of foodstuffs [41].

The lowest moisture content of soybean flour and palm sugar *cookies* is found in the first formula (F1) with a ratio of 50%:50%, which is 6.73 grams, while the highest moisture content is found in the second formula (F2) with a ratio of 60%:40%, which is 7.69 grams. The moisture content of *cookies* produced is influenced by the moisture content of raw material *cookies* in the form of soybean flour and palm sugar.

3.1.8 Ash Content

Ash content is a mixture of inorganic components or minerals contained in a foodstuff. Foodstuffs consist of 96% inorganic substances and water, while the rest are mineral elements. Elements are also referred to as organic substances or ash content. Ash content can indicate the total minerals in a foodstuff [42]. Minerals are very important in children with autism because they are considered very beneficial [27]. Mineral intake is very beneficial in improving the nutritional and metabolic status of autistic children, as well as their symptoms. Mineral intake is generally found to be well absorbed and metabolically active and produces improvements in oxidative stress in autistic children [43]. According to Wijayanti & Mutalazimah (2018) that in autistic patients themselves minerals are needed to repair tissues [11].

Ash content *cookies* soybean flour and palm sugar is the lowest contained in the first formula (F1) with a ratio of 50%:50%, namely 2.65 grams, while the highest ash content is found in the second formula F2 with a ratio of 60%:40%, which is 2.8 grams. The

more soy flour is added, the higher the ash content of *cookies*. The amount of ash content of *cookies* is influenced by the large amount of minerals contained in the material. This is in accordance with the opinion Fatkurahman et al (2012) that the amount of ash content in a food product depends on the amount of mineral content of the ingredients used [12].

3.1.9 Comparison with Control Formulation Cookies (F0)

Cookies soy flour and palm sugar have a higher nutritional value when compared to *cookies* control formulations. In 100 grams of *cookies* soy flour and palm sugar there is a protein content twice as high as commercial *cookies*. The value of fat, fiber, moisture content, and ash content in soy flour and palm sugar *cookies* are also higher, except the content of carbohydrate because the carbohydrate content of *cookies* is calculated by *difference* and influenced by other nutritional components, namely protein, fat, water, and ash content. It is in accordance with the opinion Fatkurahman et al (2012) that carbohydrates are calculated by *difference* and influenced by other nutritional components, namely protein, fat, water, and ash. More is high in other nutritional components, the lower the carbohydrate content. In turn, when other nutritional components are lower, carbohydrate levels are higher [12].

3.2 Organoleptic Panelist Expert Test Results

The overall results of organoleptic tests on soy and aren cookies by three trained panelists. Organoleptic test consists of four assessment parameters, namely color, aroma, texture, and taste as well as five scales of favor levels, namely very like, like, neutral, dislike, very dislike. Organoleptic testing by expert panelists is the first step to get criticism and advice related to the development of soy and aren cookies. In this step, the researchers made 3 samples of *cookies*: 2 samples of *cookies*, namely F1 with a comparison of soybean flour and palm sugar 50%:50% and F2 60%:40% and 1 sample as a comparison with commercial *cookies*, namely F0 (control formula). The following are presented the results of the trial of expert panelists.

3.2.1 Color

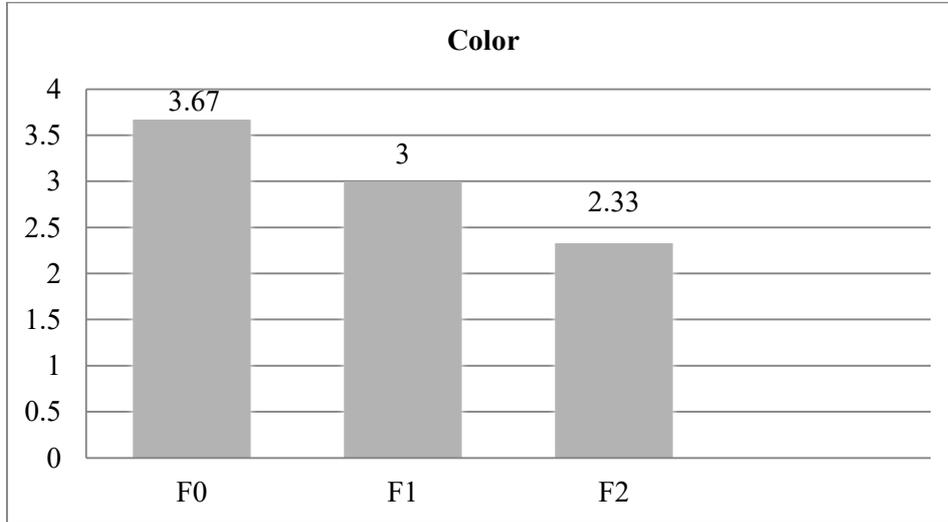


Figure 1 Organoleptic Test Panelists Trained Color Parameters

Based on figure 4.1 it can be known that from the assessment of three expert panelists on cookies, it was found that the control formula (F0) is the most preferred formula with an average value of 3.67 or is in a neutral range and likes. The second formula (F2) is the formula with the lowest average value, which is 2.33 or is in the range of dislike.

The panelists' favorability levels were tested to show whether or not there was a difference between the three formulas using friedman tests. Based on friedman's test obtained a p-value value of $0.529 > 0.05$ which showed that there was no significant difference in the panelist's acceptance of the three formulations.

3.2.2 Aroma

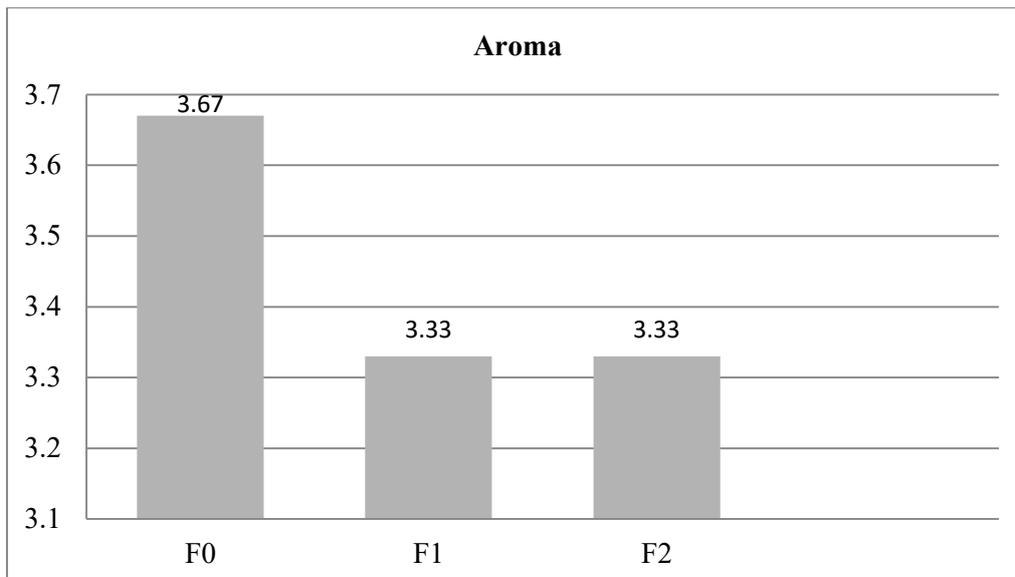


Figure 2 Organoleptic Test Panelists Trained Aroma Parameters

The data shows that the control formula (F0) is the formula with the highest average value, which is 3.67 or is *in* a neutral range and likes. The first formula (F1) and the second formula (F2) are formulas with an average value of 3.33 or are in a neutral *range*. According to the panelists, the first formula (F1) and the second formula (F2) with the addition of soy flour have a very sharp unpleasant aroma.

The panelists' favorability levels were tested to show whether or not there was a difference between the three formulas using friedman tests. Based on friedman's test obtained a p-value value of $0.368 > 0.05$ which showed that there was no significant difference in the panelist's acceptance of the three formulations.

3.2.3 Texture

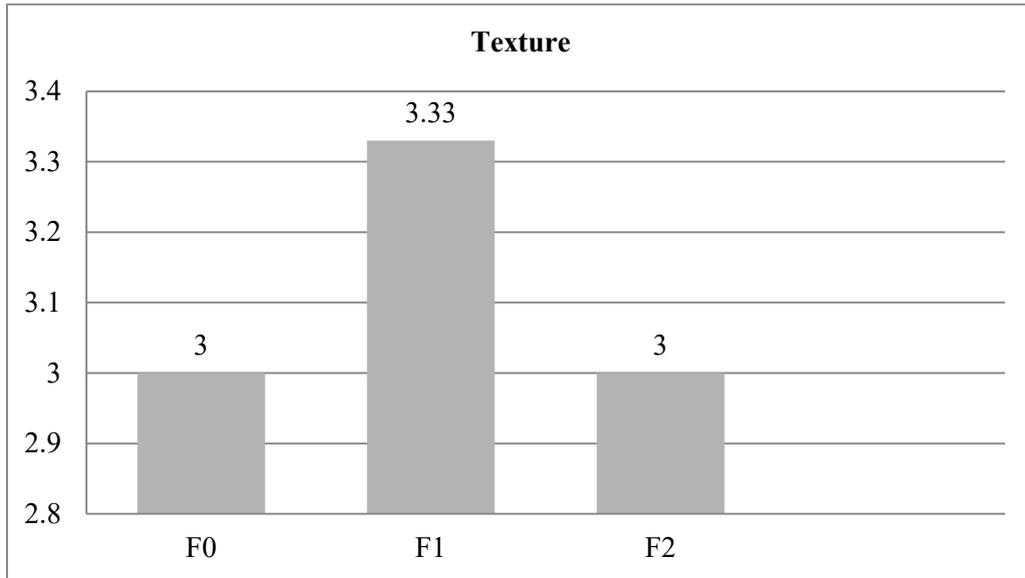


Figure 3 Organoleptic Test Panelists Trained Texture Parameters

The texture that expert panelists prefer most is the first formula (F1) with an average value of 3.33 or is *in* a neutral range and likes. Meanwhile, the average value of the control formula (F0) and the second formula (F2) are 3 or are in a neutral *range*.

Based on result test Friedman obtained a p-value value of $0.905 > 0.05$ which showed that there was no significant difference in the panelist's acceptance of the three formulations.

3.2.4 Taste

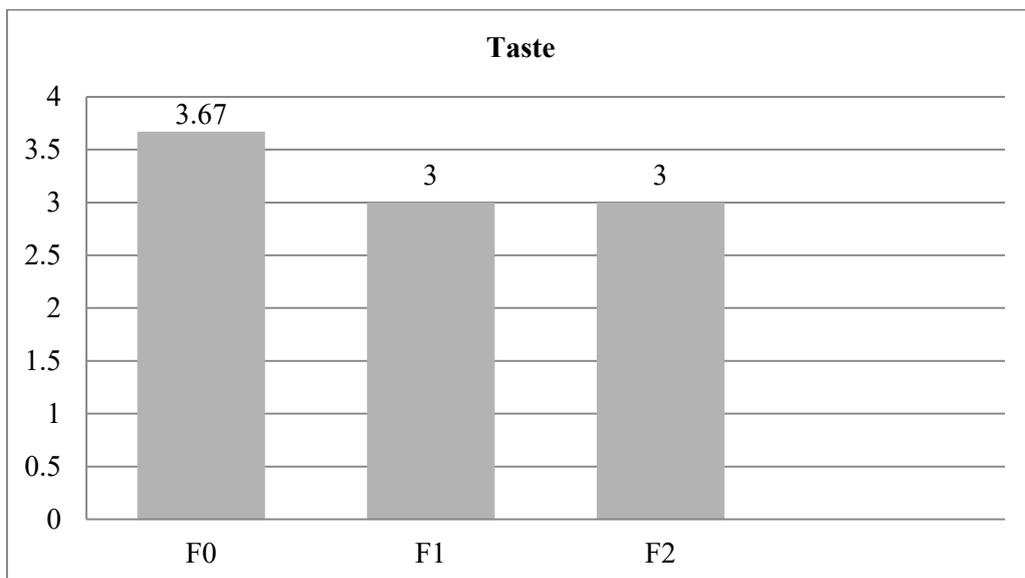


Figure 4 Organoleptic Test Panelists Trained Taste Parameters

In the taste parameters, the control formula (F0) with an average value of 3.67 or is in a neutral range and likes to be the most preferred cookies by panelists. The average value of the first formula (F1) and the second formula (F2) with the addition of soybeans and aren 3. Panelists mentioned that in the

first formula (F1) and the second formula (F2) there is still a taste of soy unpleasant.

Based on result test Friedman obtained a p-value value of $0.717 > 0.05$ which showed that there was no significant difference in the panelist's acceptance of the three formulations.

3.2.5 Overall Favorites

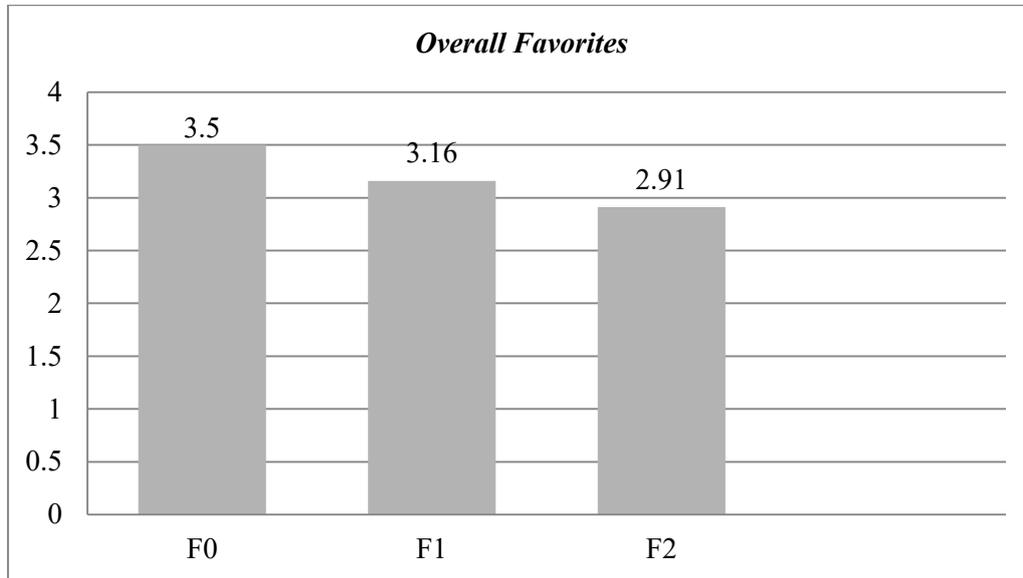


Figure 5 Organoleptic Test Panelists Trained Overall Products

Based on the overall assessment of the product can be concluded that the control formula (F0) gets the highest average overall score of the product than other formulas. Meanwhile, the second formula (F2) gets the lowest overall score, which is 2.91 or is on the displeased scale. Cookies with control formulas are the best formulations for trained panelists.

Soybeans were chosen because soy has a high protein content [44]. Soy also contains fats, carbohydrates, and fiber [45]. (Winarsi, 2010:25). While aren chosen because aren have a high content of fructose and sucrose. In the palm there is a large amount of antioxidants and a high iron content. Aren also having low glycemic index values [22].

The panelists' favorability level of product overalls was tested to show whether or not there was a difference between the three formulations using friedman tests. Based on friedman's test obtained a p-value value of $0.893 > 0.05$ which showed that there was no significant difference in the panelist's acceptance.

Organoleptic test results of panelists' acceptance of all three formula cookies based on four organoleptic parameters (color, aroma, taste, and texture) showed that all formulas were received with an average value of 2.91-3.5. This is reinforced by statistics that show that there are no meaningful differences from the three formulas based on the parameters of color, texture, taste, and aroma. The first Formula (F1) with a ratio of soy flour and palm sugar to 50%:50% had a higher scoring score than the second formula (F2).

4. CONCLUSION

The development of soy flour cookies and palm sugar is intended to obtain a formula of cookies that have a high nutritional value. Cookies are made from a mixture of soy flour, palm sugar, margarine, egg yolk, cornstarch, water, and salt with a certain comparison so that a high nutritional value is obtained. Consideration or selection of foodstuffs in these cookies is done so that the nutritional content interacts with each other and complements the deficiencies and advantages of each food.

Based on the research that has been done can be concluded that obtained two formulations in the manufacture of cookies soybean flour and palm sugar. In the first formulation, the addition of soybean flour and palm sugar with a ratio of 50%:50%, while in the second formulation 60%:40%. Each formulation is combined with 200 g of margarine, 2 eggs, and 10 g of cornstarch. The overall results of organoleptic tests showed that the best formula was a formula with a ratio of soy flour and palm sugar to 50%:50% (F1),

with an average value of 3.16 or being in the neutral and like category. The nutritional value contained in selected *cookies* is 520.07 kcal total energy, 44.58 g carbohydrates, 13.98 g protein, 32.05 g fat, 0.36 g fiber, 0.96 g iron, 6.73 g moisture content, and 2.65 g ash content.

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