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Organoleptic Acceptability and Nutritional Value of Yogurt Corn Pudding as an Alternative Snack for Toddlers

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ABSTRACT

Background: Improving people's nutritional status is the second indicator of the Sustainable Development Goals (SDGs), which are realized by working towards ending hunger, achieving food security and good nutrition, and promoting sustainable agriculture. Safe and healthy snacks for toddler that fulfill nutrition adequacy are very important in supporting the growth and development of toddlers. Snacks in the form of yoghurt corn pudding are expected to be an alternative to supplementary feeding for underweight toddlers. This study aimed to analyze the nutritional content and acceptability of yogurt corn pudding.

Methods: This research is an experimental study with a design using a Randomized Block Design (RBD) of 1 factor and 3 levels of treatment, with 3 repetitions. This formulation of corn and yogurt used were F1 (80% corn and 20% yogurt); F2 (60% corn, and 40% yogurt); F3 (50% corn, and 50% yogurt). Organoleptic test included colour, aroma, taste and texture using hedonic scale test form to 35 moderately trained panelists. Proximate nutrient content analysis was conducted in the Food Technology laboratory of Gorontalo State University. Data analysis of organoleptic results using Kruskal-Wallis Test.

Results: Statistical test results show that there were significant differences ($p < 0.05$) for all parameters in the hedonic test. Yogurt corn pudding formula 1 was the best formula and acceptable to the panellists. The proximate nutrient content of the yogurt corn pudding was carbohydrates 22.85%, fat 1.43%, protein 7.85%, water content 66.40 %, ash content 1.47%, total sugar 28.57%, calcium 25.03%, energy 136.03 kcal.

Conclusion: The nutritional content of pudding formula 1 that meets 10% of the toddler Nutrition Adequacy Rate is carbohydrates, protein, energy. Those that did not meet the 10% of the toddler Nutrition Adequacy Rate were fat and calcium. The sugar content is quite low. Corn Yogurt Pudding can be used as an alternative supplementary food for toddlers



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INTRODUCTION

Improving the nutritional status of the community is the second indicator of the second Sustainable Development Goals (SDGs) which is realized by working towards ending hunger, achieving food security and good nutrition, and improving sustainable agriculture. By 2030, these efforts are expected to have achieved success in solving various kinds of nutritional problems related to food availability by eliminating all forms of hunger or malnutrition and ensuring access for all people, especially the poor and people in vulnerable conditions to safe, nutritious and sufficient food ([Lolan & Sutriyawan, 2021](#)).

Over the past few decades, changes in the food environment have been accompanied by changes in dietary patterns. Snacks are defined as meals in between main meals but their contribution to energy intake is increasing. In the US between 1977 and 2003 the percentage of the population consuming snacks increased from 71% to 97%. In the UK, energy from snacking is estimated to account for 16%-36% of total energy intake ([Marty et al., 2021](#)). In Africa more than a billion people cannot afford healthy food, and about 30% of children are stunted due to malnutrition ([Gooding et al., 2024](#)).

The results of monitoring the nutritional status (PSG) of toddlers in 2017 by the Ministry of Health, that toddlers who experience nutritional problems reached 17.8%, including cases of malnutrition 3.8% and undernutrition 14% ([Sani & Annisa, 2019](#)). The results of the Indonesian Nutrition Status Survey (SSGI) in 2021 show that the prevalence of stunting in Indonesia is 24.4%. The prevalence of stunting in 2021 has decreased when compared to 2019 which amounted to 27.67% ([Ahmad, Dulahu, & Aulia, 2023](#)). Meanwhile, the stunting rate in Gorontalo Province in 2021 was 29% ([Liputo, Bait, & Limonu, 2023](#)).

Nutrition is an important factor in realising a healthy Indonesia. Malnutrition in infants and toddlers is caused by inappropriate patterns of complementary feeding, ignorance about how to feed infants and habits that are detrimental to health. These are the main causes of malnutrition in children, especially under 2 years old. Undernourished children grow small, thin and short, which leads to lower cognitive abilities and intelligence, as well as lower productivity. To overcome the malnutrition that occurs in the under-five age group, Supplementary Feeding (PMT) is necessary. PMT is intended as an addition, not as a substitute for the main daily food and contain nutritional values that are in accordance with the needs of the target. The main purpose of PMT is to improve the nutritional condition of the children suffering from malnutrition to achieve optimal nutritional status ([Pujiyanto, 2019](#)).

For decades the main PMT program carried out by the government is still in the form of manufactured foods such as biscuits that have been specially formulated and fortified with vitamins and minerals, even though PMT can also be processed using food ingredients adapted to local snacks in an area for underweight toddlers by paying attention to the content of energy, protein and micronutrients that are balanced at affordable prices ([Hadju, K, Aulia, & Mahdang, 2023](#)). Pudding is a snack made from a mixture of agar powder, sugar and water. In its processing, pudding can be combined with various other ingredients such as fruit, vegetables, milk, nuts, and so on. Pudding has a sweet taste with a soft texture so it is loved by all people, especially by children ([Saijo, 2022](#); [Widodo, 2003](#)).

Corn is classified as a starchy vegetable that is widely used as a staple food source ([Mennella, Ziegler, Briefel, & Novak, 2006](#)). Apart from being a staple food as a source of carbohydrates, corn is also a source of functional food. Corn contains dietary fiber, with a relatively low glycemic index (GI) compared to rice ([Nurhayati, Asmawati, Ihromi, Marianah, & Saputrayadi, 2020](#)). Yogurt is a fermented product obtained from fresh milk with a mixed culture of *Lactobacillus bulgaricus* and *Streptococcus thermophilus* ([Dian Prayanti Sinaga; Risjunardi Damanik, 2023](#)). The benefits of yoghurt for the body include regulating the digestive tract, anti-diarrhea, anti-cancer, increasing growth, helping people with lactose intolerance and regulating cholesterol levels in the blood ([Adfar, Yensasnidar, & Murnawelis, 2022](#)). Yoghurt has relatively better nutritional value benefits than fresh milk. Some experts also consider yogurt as a bacterial "factory" that can produce various vitamins that are indispensable to the body, namely: folic acid, nicotinic acid, pantothenic acid, biotin, vitamin B6, and vitamin B12. The mineral content of yogurt, especially calcium, phosphorus, and potassium, also increases ([Widodo, 2022](#)). Corn which is easily available and is a local Gorontalo food and yoghurt which is affordable is a good food for supplementary food for toddlers as a snack. The purpose of this study was to determine the best pudding formula, the difference between each formula and the nutritional content of yogurt corn pudding with the best formulation.

METHODS

The research design that will be used by researchers in the study is Randomized Block Design with three treatments (F1: 80% Corn + 20% yogurt, F2: 60% Corn + 40% yogurt and F3: 50% Corn + 50% yogurt) and repeated three times. The research sample was corn pudding with corn and yogurt as raw materials. The acceptability test was conducted in the nutrition laboratory of the public health department of Gorontalo State University and the analysis of nutritional content was conducted in the Food Technology laboratory of Gorontalo State University. Organoleptic test data was analyzed descriptively, followed by statistical analysis using Kruskal-Wallis non-parametric test. Kruskal-Wallis test is one of the non-parametric statistical tests used to test the difference between more than 2 variables with ordinal data scale.

This research was conducted in August-September 2024. The research involved human subjects, namely panelists to assess the acceptability of yogurt corn pudding. Panelists were willing to sign informed consent before carrying out the study and the researcher ensured the confidentiality of the panelists identities. This research has obtained ethical approval from the health research ethics commission of Gorontalo State University with number: 123A/UN47.B7/KE/2024.

Yogurt Corn Pudding Making

Tools and materials:

The tools used are knives, cutting boards, gloves, coarse scales, blenders, stirrers, containers, and pans. The ingredients used in making yogurt corn pudding are sweet corn, yogurt, sugar, plain agar and water.

How to make yogurt corn pudding, among others:

1. Select corn with good condition. Clean the corn and separate it from the cob, then boil the corn kernels until cooked.
2. After the corn is cooked, blend it until smooth and then strain. Separate the corn juice and the dregs;
3. Pour the corn juice and milk into a saucepan. Add yogurt and agar-agar into the pot and cook until it does not boil at $\pm 75^{\circ}\text{C}$ while stirring slowly;
4. Pour the mixture into the mold, then place it in the refrigerator to set for a few hours.

Table 1. Formula for Making Yogurt Corn Pudding

Raw materials	F1	F2	F3
Corn (grams)	800	600	500
Yogurt (ml)	200	400	500
Full Cream Milk (ml)	200	200	200
Granulated sugar (grams)	10	10	10
Plain agar (grams)	7	7	7
Water (ml)	400	400	400

Organoleptic Acceptability Testing

The organoleptic test included a hedonic test, which was conducted on 35 moderately trained panelists, namely nutrition specialization students majoring in public health at Gorontalo State University who met the criteria of not being color blind, not being in a state of illness, and having previously completed an acceptability test. Yogurt corn pudding samples assessed by panelists were served in 90 ml pudding cup size in each formula. Panelists conducted organoleptic tests on the parameters of color, aroma, texture, and taste to assess the level of consumer acceptance of the food being tested. Hedonic test assessment was determined descriptively using a scale of 1 (very dislike), 2 (dislike), 3 (somewhat like), 4 (like), and 5 (very like).

Content Test Nutrition

Nutritional content testing was conducted on the most preferred yogurt corn pudding formulation. The nutrient content analyzed was moisture content, ash content, carbohydrate,

protein, fat, total sugar, calcium and total energy. Nutrient analysis included moisture content and ash content using the oven method, protein content using the Kjeldhal method, fat content using the Soxhlet extraction method, carbohydrate content using the by difference method, calcium content using the NaEDTA titration method, total sugar content using the luff shorll method and energy value. Energy value was calculated based on the composition of fat, protein, and carbohydrate. Nutritional analysis was conducted at the Food Technology Laboratory, Faculty of Agriculture, Gorontalo State University.

RESULTS

A. Difference in acceptability of F1, F2 and F3

Based on the results of the panellist acceptability test on three yogurt corn pudding formula, the following results were obtained:

Table 2. Distribution of Panellists Level of Preference for the Characteristics of Yogurt Corn Pudding

Characteristics	Preference level										Total		Mean Rank	ρ*
	Liked very much		Like		Somewhat like		Dislike		Strongly dislike					
	n	%	n	%	n	%	n	%	n	%	n	%		
Colour														0.000
F1	22	63	9	26	3	8	1	3	0	0	35	100	72.81	
F2	6	17	20	57	9	26	0	0	0	0	35	100	50.97	
F3	1	3	21	60	8	22	4	11	1	3	35	100	35.21	
Aroma														0.000
F1	17	48	13	37	4	11	1	3	0	0	35	100	69.73	
F2	6	17	13	37	14	40	2	6	0	0	35	100	48.86	
F3	1	3	16	46	18	51	0	0	0	0	35	100	40.41	
Flavour														0.001
F1	20	57	7	20	4	11	3	8	1	3	35	100	70.69	
F2	5	14	13	37	16	46	1	3	0	0	35	100	52.39	
F3	1	3	16	46	18	51	0	0	0	0	35	100	35.93	
Texture														0.000
F1	15	43	14	40	3	8	3	8	0	0	35	100	71.16	
F2	3	8	14	40	16	46	2	6	0	0	35	100	49.67	
F3	1	3	7	20	13	37	14	40	0	0	35	100	38.17	

*Obtained from Kruskal Wallis test results

Based on the results of the Kruskal-Wallis statistical test, it shows that there are significant differences in color ($p=0.000$), aroma ($p=0.000$), taste ($p=0.001$), and texture ($p=0.000$) of the three yogurt corn pudding formulas. It can be seen in Table 2. from several parameters of the acceptability test, most respondents gave a very favorable rating in terms of color, aroma, taste, and texture of the yogurt corn pudding formula 1.

B. Nutrition Content of Yogurt Corn Pudding

Determination of the best formula is obtained by considering the highest favorability results on the hedonic scale. From the average of the highest favorability scores in each parameter, it was found that F1 was the best and most preferred formulation. Panelists generally liked Formula F1 because the proportion of corn was more than the proportion of yogurt, with a ratio of 80% corn and 20% yogurt.

Table 3. Nutrition Content of Yogurt Corn Pudding

Sample Type	% Nutrition Content per 100 grams	
Pudding Corn Yogurt	Carbohydrate	22.85
	Fat	1.43
	Protein	7.85
	Water	66.40
	Ash	1.47
	Total Sugar	28.57
	Calcium	25.03
	Energy	136.03 kkl

Based on Table 3, it can be seen that the nutritional content of yogurt corn pudding is carbohydrate, fat, protein, water, ash, total sugar, calcium, and energy.

DISCUSSION

Color

Color is the first parameter that determines the level of consumer acceptance of a product. Color in food is very important because it affects the appearance of food products, so it can increase the attractiveness data ([Asmaraningtyas, 2014](#)). The Kruskal Wallis test results showed a p-value of $0.000 < 0.05$, meaning that there was a significant difference in pudding color between formula 1, formula 2, and formula 3. Based on table 2. 63% of panelists stated that they really liked the color of pudding formula 1.



Figure 1. Physical Differences of Yogurt Corn Pudding (from left to right) with a ratio of F1=80% :20%, F2 = 60% : 40%, F3 = 50% : 50%.

The color of formula 1 pudding is brighter than formula 2 and 3 yoghurt pudding, which makes it look more attractive and appetizing. Color makes food products attractive. The level of panelists' liking for the color of F1 pudding can be influenced by the natural color of the raw material which comes from a larger proportion of corn so that it is bright yellow compared to formula 2 and formula 3. Objective color measurement is essential because for food products, color is the main attraction before consumers get to know and like other properties ([Asmaraningtyas, 2014](#)).

This study is in line with research conducted by Christina Erawati Capable (2021) with the results of Friedman's statistical test showing p value < 0.05 , do the panellists' acceptance of the colour of biscuits in each treatment is significantly different ([Khasanah & Mumpuni, 2021](#)). This shows that the role of color in the acceptability of a food product is very important before any other aspect or property of the food.

Aroma

Aroma can be defined as something that can received by the senses odor. To be able to process odour, odour substances must be able to evaporate, slightly soluble in water, and slightly soluble in fat ([Febriana, Dian Rachmawanti A, & Ir Choirul Anam MS, 2014](#)). Based on the results

of the Kruskal Wallis test show a p-value of $0.000 < \alpha 0.05$, meaning there is a significant difference in the aroma of the pudding between formula 1, formula 2, and formula 3 produced. In organoleptic parameters, food aroma is one of aspects that influence the taste of food ([Anggraeni, Ronitawati, & Hartati, 2017](#)). The highest level of liking for the aroma of pudding is found in F1, which is 48% of panelists stated that they liked the aroma of F1, followed by the aroma of F2, and F3.

Sweet corn and yogurt are two food ingredients that have their own distinctive aromas that are very different from each other. The addition of different corn compositions produces different aromas in each treatment. If in a treatment the proportion of sweet corn used is more than that of yogurt, the aroma produced in the sample will tend to be more sweet corn flavored, and vice versa. In F1, the distinctive aroma of corn was very dominating. Sweet corn has a distinctive aroma, the aroma-forming compounds in corn are mostly tridecane, tetradecane, benzothiazole while in F2, the aroma of yogurt dominates due to the increased proportion of yogurt. Panelists preferred F1 treatment because the sour aroma of yogurt was less pronounced, replaced by the distinctive aroma of corn which was more accepted by the panelists. Fruity aromas are more suitable for snacks, this is in line with research conducted by Dash Mihaylova which states that fruit aroma can be used as component of desserts both fresh and dry ([Mihaylova et al., 2021](#)).

Flavour

Flavour is the result of a combination of food ingredients that can be felt by the five human senses, namely the sense of taste. Sweet, salty, bitter and sour are four basic flavours ([Rukmana Indah Wahyunij, 2022](#)). The Kruskal Wallis test results showed a p-value of $0.001 < 0.05$, meaning that there was a significant difference in the organoleptic properties of taste in each treatment. The results of the organoleptic test of the taste parameters showed that the F1 treatment had the highest level of liking, namely 20 panelists stated that they really liked it (57%), while the results of the lowest level of liking in the F3 treatment were only 1 panelist who stated that they really liked it (3%). The taste of yoghurt pudding formula 1 is dominated by the taste of corn so that the natural sweetness of corn is more prominent than the sour taste of yoghurt. Meanwhile, yoghurt pudding formulas 2 and 3 were dominated by the sour taste of yoghurt. The process of breaking down lactose in milk into lactic acid with the help of lactic acid bacteria causes the flavor in yoghurt to become sour ([Borneo, Wanniatie, Qisthon, & Riyanti, 2022](#)).

Giving snacks to children must pay attention to various aspects including one of them is the taste of food and the role in this is the parents. According to Nadia Corsini (2010) giving food by parents affects eating behaviour and food intake of children ([Corsini, Wilson, Kettler, & Danthiir, 2010](#)) so it is important for parents to be more selective in giving food/snacks for their toddlers. The dominant sweet flavour but not excessive is the advantage of pudding formula 1 so that it is easily accepted by panelists. This study is in line with research conducted by Safirah Awanis (2023), which concludes that a sweet taste and attractive shape can increase children's desire to eat, thus making the acceptance of pudding in children quite good ([Syafitri Awanis, 2023](#)).

Texture

Food texture is the result of the *tactile sense* response to the form of stimulation physique when there is contact between the parts in the oral cavity and food ([Sari & Yohana, 2015](#)). The results of the Kruskal-Wallis test show a p-value of $0.000 < \alpha 0.05$, meaning that there were significant differences in the organoleptic properties of texture in each treatment.

Based on the organoleptic test results, the texture parameter shows that 15 respondents (43%) stated that they really like the texture of the pudding formula 1. The addition of more solid ingredients than liquid ingredients can make the food's texture firmer. The F1 treatment with less yogurt composition produced a denser texture compared to the F2 and F3 treatments. Panelists preferred F1 treatment because the texture produced was denser and softer. This research is in line with research conducted by Arysanti et al. that in terms of texture, panelists will prefer a pudding texture that does not contain too much water to produce a dense pudding texture ([Arysanti, Sulistiyani, & Rohmawati, 2019](#)).

Food texture plays an important role in influencing consumer liking and preference for food texture varies from one type of food to another ([Ardian, Puspareni, Fauziyah, & Ilmi, 2022](#)). According to Brenda Lundy (1998), texture can contribute to an individual's food acceptance and preference. Infants and toddlers are able to discriminate the texture of the food they consume, they may show preference or rejection of food because of its textural properties rather than just its taste or aroma ([Lundy et al., 1998](#))

Contents Nutrition

Nutritious food such as milk, fruit, vegetables and whole grains are needed in a variety of forms to give toddlers the opportunity to build food preference ([Ziegler, Briefel, Ponza, Novak, & Hendricks, 2006](#)). Snacks contribute around 10-15% in fulfilling daily nutritional needs ([Ministry of Health of the Republic of Indonesia, 2019](#)). Based on table 3. it can be seen that in 100 grams of yogurt corn pudding contains 22.85% carbohydrates, 1.43% fat and 7.85% protein. According to the Nutrition Adequacy Rate (AKG) in 2019, children aged 1-3 years need 1350 kcal per day so the pudding with the best treatment F1 can meet 10% of the AKG, while children aged 4-5 years need 1400 kcal, F1 pudding almost meets 10% of the energy needs for 4-5 years of age. The carbohydrate RDA for toddlers aged 1-3 years and 4-6 years is 215 gr / day and 220 gr / day respectively, pudding with F1 treatment can meet 10% of the needs of toddlers (1-6 years). The RDA of protein for toddlers aged 1-3 years is 20 gr/day and 4-6 years is 25 gr/day, pudding with F1 treatment can fulfill >15% of the protein needs of toddlers (1-6 years). The RDA of fat for toddlers aged 1-3 years and 4-6 years is 45 gr/day and 50 gr/day respectively, pudding with F1 treatment has not been able to meet 10% of the fat needs of toddlers (1-6 years). F1 pudding fat content is lower than the toddler fat adequacy rate because it only uses milk as a source of fat, adding coconut milk or eggs can increase the nutritional value of fat.

Based on research conducted by Eka Prasetya (2017), there is a relationship between carbohydrate intake and nutritional status in toddlers ([Eka Prasetya, 2017](#)). Carbohydrates are one of the most needed food nutrients for toddlers, as the main source of energy for the body to carry out various activities ([Ginting, Rosidi, & Noor, 2015](#)). Fat has several important functions for toddlers, namely containing essential fatty acids that function in brain development, healthy skin, hair and eyes as well as self-protection from infectious and non-communicable diseases, encouraging fat stores in the body in terms of maintaining body temperature, protecting organs and helping the absorption of vitamins A, D, E, K (fat soluble). Protein in toddlers play a role as substance builder, regulator, assisting the regulatory process body, make enzymes, hormones, antibodies and repair tissues ([Anjar & Ismawati, 2021](#)).

The test results of total sugar content in the best treatment pudding F1 are fairly low at 28.57% per 100 grams. WHO recommends children to reduce daily sugar consumption to less than 10% of total daily energy intake ([WHO, 2015](#)). The total sugar content in F1 yogurt corn pudding was <10% of total daily energy for the energy RDA of toddlers 1-6 years. The low total sugar content in yogurt corn pudding is because the mixture of several ingredients used does not use added sugar. Sweetness is obtained from corn which contains natural sugar and milk contributes through lactose.

The result of calcium content analysis of pudding in the selected formula F1 is 25.03 mg/100 grams. For children aged 1-3 years and 4-6 years, it cannot meet 10% of the needs of toddlers aged 1-3 years as much as 650 mg / day and 1000mg / day. This is because the source of calcium in yogurt corn pudding only comes from milk.

The results of the water content test on the best pudding treatment F1 is 66.4%. Moisture content is related to shelf life, the higher the moisture content will result in faster changes in food ingredients and food ingredients become easily damaged. The water content in F1 pudding is quite high because the pudding material is liquid so that the storage needs to be considered. The test results of ash content in the best pudding treatment F1 is 1.47%. Ash content can be used to evaluate the nutritional value of food, the higher the ash content, the worse the quality of food. Based on the test results, the quality of F1 treatment pudding can be said to be quite good because of the low ash content obtained.

A similar study examining the nutritional content of pudding formulations with moringa and orange ingredients showed that 100 g of moringa and orange pudding contained 65.44 kcal of energy, 0.61% protein, 0.88% total fat, 0.14% ash content, and 84.60% water content. When compared to the results of the study, the nutritional content of yogurt corn pudding is higher in protein and fat content, and less water content so that the shelf life can be longer (Muthmainah & Sugiatmi, 2024). Another study analyzed the nutritional content of the selected formulation of red bean pudding and found that it contained 107.7 Kcal of energy (per 100 grams), 2.32% protein, 0.46% fat, 23.58% carbohydrate. The results of the nutritional content test of red bean pudding are less nutritious than yogurt corn pudding (see table 3) (Afiska, Rotua, Yulianto, Podojoyo, & Nabila, 2021).

This study has several limitations, including the organoleptic test conducted by panelists is subjective, so the results can be influenced by differences in the sense of taste of each panelist. In addition, the nutrient content test only included macronutrient proximate analysis, needing to further analyze the micronutrients (except calcium) contained in the pudding. Furthermore, post-hoc tests can be conducted to further explore group differences in more detail.

CONCLUSION

Based on the results of the study, it is concluded that the yogurt corn pudding formula 1 (80% corn composition: 20% yogurt) is the best formula and was preferred by the panelists because in terms of good taste, sweet corn aroma, bright yellow color, and has a soft texture. In addition, there were differences in color ($p=0.000$), aroma ($p=0.000$), taste ($p=0.001$), and texture ($p=0.000$) of yogurt corn pudding formula 1, 2 and 3. The nutritional content of yogurt corn pudding formula 1 was carbohydrate 22.85%, fat 1.43%, protein 7.85%, water content 66.40%, ash content 1.47%, total sugar 28.57%, calcium 25.03%, energy 136.03 kcal. The nutritional content of formula 1 that meets 10% of the RDA for toddlers is carbohydrates, protein, and energy. Those that did not meet the 10% RDA of toddlers were fat and calcium. The sugar content of the pudding is quite low.

Yogurt corn pudding can be used as an alternative snack for toddlers. To meet the needs of snacks, it can be modified by adding eggs or coconut milk to increase the nutritional value of fat.

Author Contribution Statement: Vidya Avianti Hadju: Research ideas and concepts, preparation of research proposals, administration, processing results research, and preparation of draft cost budget. Zul Fikar Ahma: computing, supervision, visualization, and reviewing research articles for publication. Ulfa Aulia: methodology data processing, research report preparation, article preparation.

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