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Local Food-Based Local Content Learning: Utilizing Avocado Seed Flour as a Substitute for Wheat Flour in Making Cookies for Elementary School Students

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ABSTRACT

Purpose of the study: This study aims to integrate local food resources into Local Content (Muatan Lokal) learning for elementary school students by utilizing avocado seed flour as a substitute for wheat flour in cookie production.

Methodology: The research was conducted using a Completely Randomized Design (CRD) with six treatment levels of avocado seed flour substitution and five replications. The procedures included the preparation of avocado seed flour following food science standards, cookie production using a standardized baking method, and evaluation of physical properties consisting of moisture content, water activity, hardness, and color. Data were analyzed using Analysis of Variance (ANOVA) followed by Duncan's Multiple Range Test (DMRT) at a 5% significance level.

Main Findings: The findings show that increasing the proportion of avocado seed flour significantly affected the physical properties of cookies, particularly reducing moisture content and increasing hardness, while also influencing color parameters (L, a, b*). The darkest cookies were produced by the 50% substitution treatment. of the replacement are very suitable for Mulok Elementary Schools because of their softer texture and stable characteristics.

Novelty/Originality of this study: The novelty of this study lies in the integration of multidisciplinary food science methods with elementary education through the development of a local food–based learning model that promotes contextual, hands-on learning using local resources.

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1. INTRODUCTION

Avocado (*Persea americana*) is a non-seasonal commodity that thrives in various tropical regions, including Indonesia [1]-[3]. Although avocado flesh is widely used as an antioxidant-rich food ingredient, other parts of the fruit particularly the seeds are underutilized and often treated as organic waste [4]-[6]. However, avocado seeds have great potential as an alternative food ingredient because they contain more than 80% starch, allowing them to be processed into flour and used in various food products, including cookies [7]-[9]. The use of avocado seed flour (TBA) is not only relevant for food technology innovation but also has great potential as a teaching material in elementary education, particularly in local content or mulok subjects that emphasize regional food wisdom [10]-[13].

TBA is categorized as low-protein and gluten-free flour, making it suitable for use in foods that do not require the formation of a gluten network, one of which is cookies [14]-[16]. Until now, cookies generally rely on wheat flour as a raw material, while Indonesia remains heavily dependent on wheat flour imports. This dependence impacts the economy and hinders the optimization of local resources [17], [18]. Therefore, the use of TBA as a partial substitute for wheat flour is an important strategy to support food diversification, reduce agricultural waste, and strengthen the use of local ingredients in local content learning [19], [20].

From a public health perspective, the growing interest in low-gluten foods has driven the search for safe and applicable alternative raw materials [21]-[23]. TBA can be a relevant option for consumers with gluten sensitivities [24]-[26]. Furthermore, in cookie production, the presence of gluten is not a major factor determining texture quality, so the use of TBA still allows for the production of edible physical characteristics [27]-[29]. This integration of health, food technology, and local resource optimization demonstrates the need for a multidisciplinary approach in wheat flour substitution research.

However, the use of TBA presents its own challenges. Avocado seed starch is prone to browning and has a high amylose content, which can affect the water absorption, color, moisture content, water activity, and texture of cookies [30], [31]. Color changes can impact consumer acceptance, while excessively high moisture content can potentially result in a softer texture and susceptibility to damage [32]-[34]. The complexity of these physical, chemical, and sensory factors requires a comprehensive analysis to understand the effect of TBA substitution on cookie quality in greater depth.

To date, research on avocado seed flour has focused more on chemical characteristics or basic formulations, while studies that integrate aspects of food technology, food physics, and functional characteristics are still limited [35]-[37]. Existing literature has not yet examined how the structural properties of avocado seed starch affect the physical parameters of cookies, such as color, moisture content, water activity, and texture, in a single integrated analysis [38]-[42]. Thus, there is a research gap that needs to be filled through a multidisciplinary approach to understand the performance of TBA as a wheat flour substitute.

Based on previous research, there is a significant research gap that serves as an important basis for this study. The study by Csurgó and Megyesi [42] emphasized the role of local food in the formation of community identity and cohesion, but focused more on sociological aspects and regional development, without concretely examining how local food is integrated into formal learning practices, especially at the elementary level. On the other hand, Pratolo's [43] research highlighted the representation of food and health discourse in language learning materials, but was still limited to the analysis of texts and discourses in textbooks, and did not address practice-based learning (*experiential learning*) that directly involves the processing of local food. Meanwhile, Vargas [44]. offered a conceptual model of holistic food education that is theoretically strong and based on global policy, but did not provide contextual examples of the use of specific local food ingredients as learning media in the classroom. Thus, there is no research that integratively connects local food innovations, analysis of food properties, and its implementation as local wisdom-based learning content for elementary school students. This research aims to fill this gap by combining food science approaches and local content-based pedagogy, thus not only contributing to food diversification and the utilization of local resources, but also enriching contextual learning practices that are relevant to the real experiences of learners from an early age.

The novelty of this research lies in the application of multidisciplinary analysis to simultaneously evaluate the effect of TBA on various physical characteristics of cookies, while simultaneously positioning it as a scientific basis for the development of teaching materials for elementary school local content. In the context of elementary education, the use of TBA in cookie making is highly relevant for introducing students to local food diversification, reducing organic waste, and creativity in utilizing local ingredients. This activity supports local content competencies, including the ability to identify local resources, process simple food products, and implement innovations based on local culture.

The urgency of this research is further heightened given Indonesia's need for alternative food ingredients that can reduce dependence on wheat, increase the added value of agricultural waste, and instill sustainability values in the younger generation through basic education. The results of this research are expected to not only enrich knowledge in the field of food science but also provide practical contributions to the development of local food-based learning modules that are engaging, applicable, and relevant to the context of regional food wisdom.

2. RESEARCH METHOD

2.1 Research Design

This study used a Completely Randomized Design (CRD) with six treatments of wheat flour substitution with avocado seed flour (TBA) at levels of 0%, 10%, 20%, 30%, 40%, and 50%, each with five replications, resulting in a total sample of 30 cookie units. This experimental design allows for analysis of the direct effect of TBA substitution on the physical properties of cookies, while also providing a scientific basis for determining the most suitable formulation for adaptation in elementary school Local Content (Mulok) learning.

The materials used included low-protein wheat flour, avocado seed flour, margarine, powdered sugar, eggs, skim milk, and baking powder [45]. The materials for testing (moisture content, water activity, hardness, and color) were all cookie samples from the treatments [46]-[48]. The equipment used complies with food science research standards and includes dough processing equipment, an oven, a mixer, a rolling pin, an aluminum cup, a desiccator, an analytical balance, an aw meter, a texture analyzer, and a color reader. The TBA substitution treatment formulations are presented in Tables 1 and 2 below.

Table 1. Avocado Seed Flour Substitution Treatment

Treatment	Avocado Seed Flour	Wheat Flour
T0	0 %	100 %
T1	10 %	90 %
T2	20 %	80 %
T3	30 %	70 %
T4	40 %	60 %
T5	50 %	50 %

The formulation of the material composition for each treatment is presented in Table 2.

Table 2. Formulation for each treatment (%)

Ingredients (%)	Treatment					
	T0	T1	T2	T3	T4	T5
Avocado seed flour	0	4	8	12	16	20
Low-protein wheat flour	40	36	32	28	24	20
Margarine	32	32	32	32	32	32
Powdered sugar	15	15	15	15	15	15
Eggs	8	8	8	8	8	8
Skim milk	4.8	4.8	4.8	4.8	4.8	4.8
Baking powder	0.2	0.2	0.2	0.2	0.2	0.2

This experimental design allows the study to analyze the direct effect of avocado seed flour composition on the physical properties of cookies in a multidisciplinary manner, encompassing the chemical characteristics of the flour, reactions during the baking process, and the physical quality of the final product.
Hypotheses were tested to determine the effect of TBA substitution on the physical properties of cookies.
H_0: There is no effect of substituting wheat flour with avocado seed flour on the physical properties of cookies.
H_1: There is an effect of substituting wheat flour with avocado seed flour on the physical properties of cookies.

The analytical testing criteria used were as follows, Hypothesis testing in this study was conducted using the F test with decision-making criteria, namely if the calculated F value is smaller than the F table then H_0 is accepted, whereas if the calculated F value is greater than or equal to the F table then H_0 is rejected. Acceptance or rejection of the null hypothesis is the basis for determining the significance of the influence of the tested variables. This hypothesis approach supports multidisciplinary analysis because it not only considers statistical aspects, but also integrates the chemical characteristics of analog rice flour (TBA), such as starch, amylose, and water content, which are then analyzed for their impact on the physical properties of the product, including the level of hardness and color of the bread. In addition, the analysis of the results is also linked to aspects of bread processing technology, thus providing a comprehensive understanding of the relationship between ingredient composition, processing processes, and final product quality.

2.2 Research Procedures

2.2.1 Avocado Seed Production

The avocado seed flour (TBA) production process is carried out according to food science standards and modified from Purba & Gultom [49]. All stages are designed to produce flour with stable physical and chemical characteristics, making it suitable for use as a substitute ingredient in cookie production. In general, the process consists of material selection, initial processing, drying, milling, and sieving. The procedure sequence is described below.

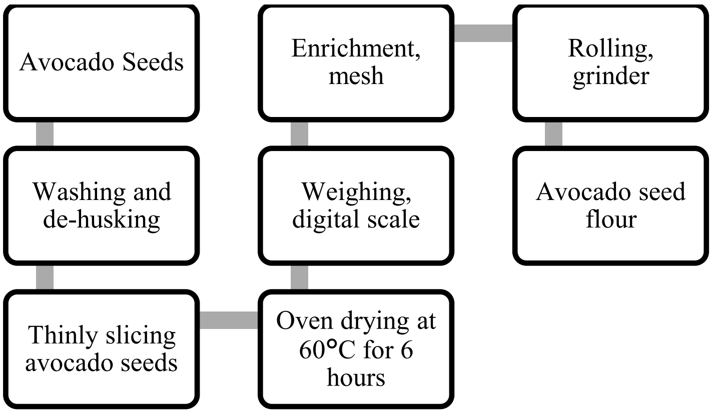

Figure 1. Flowchart for Making Avocado Seed Flour

This process has pedagogical relevance because it can be used as an illustration of the transformation of local materials and the utilization of agricultural waste in elementary school secondary school curriculum learning.

2.2.2 Making Cookies

The cookie-making procedure in this study was modified from Hussain et al. [50]. The process begins with mixing, where margarine and sugar are mixed using a mixer on medium speed for approximately eight minutes until homogeneous. Next, eggs are added to the mixture and stirred again for approximately two minutes. After that, a mixture of wheat flour consisting of TBA and wheat flour, skim milk, and baking powder is gradually added and stirred for approximately one minute until evenly mixed. The dough is then kneaded by hand for approximately five minutes to achieve a smooth texture. The next stage is shaping, where the dough is rolled out using a rolling pin and shaped according to the desired shape. The shaped dough is then baked at 150°C for approximately 20 minutes until cooked through. This cookie-making procedure is relatively simple, making it suitable for learning at the primary school level.

2.3 Variable Testing

Testing was conducted on two types of samples: avocado seed flour and cookies. The proximate analysis performed on the avocado seed flour samples included testing carbohydrate content using the by-difference method, crude protein content using the micro-Kjeldhal method, crude fiber content using the gravimetric method, ash content using the oven method, and crude fat content using the Soxhlet extraction method. The cookie samples also included testing moisture content using the oven method, water activity, hardness, and color.

Table 3. Proximate analysis of avocado seed flour

Parameter	Method
Water content	Oven 105°C
Protein content	Micro-Kjeldahl
Fat content	Soxhlet
Ash content	Oven ashing
Carbohydrate levels	By difference
Crude fiber	Gravimetry

A proximate analysis of avocado seed flour was conducted to determine the basic chemical characteristics that directly affect the quality of food products, particularly cookies that use this flour as a substitute ingredient. Parameters analyzed included moisture, protein, fat, ash, carbohydrate, and crude fiber content. Moisture content was measured using an oven method at 105°C to ensure the dryness of the material, as a low moisture content improves storage stability and reduces the risk of microbial growth. Protein content was analyzed using the Micro-Kjeldahl method, which measures total nitrogen as the basis for determining protein content. Fat content was analyzed using the Soxhlet method, which extracts oil components from flour using an organic solvent.

Next, ash content was determined through an oven ashing process to reflect the amount of minerals contained in avocado seed flour. Carbohydrate content was calculated using the by-difference method, subtracting the total water, protein, fat, and ash from 100%, thus reflecting the starch and sugar content, which play a crucial role in the structure of cookies. Meanwhile, crude fiber content was analyzed using a gravimetric method, which measures the fiber residue after acid and base digestion.

This series of proximate analyses not only provides an overview of the chemical composition of avocado seed flour, but is also crucial in multidisciplinary studies because each parameter has direct implications for the physical properties of cookies, such as texture, color, moisture content, and water activity of the final product. Therefore, the results of this analysis provide a strong foundation for understanding how avocado seed flour can affect cookie quality when used as a substitute for wheat flour.

The physical properties of the cookies were tested to determine how substituting wheat flour with avocado seed flour affects the quality of the final product. The first parameter analyzed was moisture content, which was determined using the oven method as described [51]. Cookie samples were heated at 105°C until they reached a constant weight, then the moisture content was calculated using the formula

$$\text{Water content} = \underline{[A-(C-B)]} \times 100\ \%\ A \qquad ...(1)$$

Information:
A = Weight of sample before oven-drying (*grams*)
B = Weight of cup after oven-drying (*grams*)
C = Weight of cup and sample after oven-drying (*grams*).

Next, water activity was measured using an aw meter after being calibrated with a NaCl standard with a relative humidity of 75%. Water activity reflects the availability of free water in cookies, which can be used for microbial growth and is directly related to product shelf life. A lower aw value indicates better stability and a crispier texture. The next parameter, the hardness of the cookies, was tested using a Texture Analyzer. This measurement was performed by applying pressure through a probe that presses against the surface of the cookies until the structure breaks. The maximum force recorded by the instrument indicates the cookie's hardness. This parameter is crucial for assessing how amylose, moisture content, and fat composition interact during the baking process to form the product's texture.

Color testing was conducted to determine the visual changes in the cookies due to the substitution of avocado seed flour. Measurements were made using a Color Reader, which generates color values based on three main parameters: L, a, and b*. The L value indicates brightness, the a value indicates a tendency toward red or green, and the b value indicates a tendency toward yellow or blue. These color changes are generally influenced by the Maillard reaction, sugar caramelization, and natural pigments in the flour.

2.4 Data Analysis

The test data were analyzed using Analysis of Variance (ANOVA) to determine whether the substitution of wheat flour for avocado seed flour significantly affected the physical properties of the cookies. If the ANOVA results showed a significant difference, the analysis was continued with Duncan's Multiple Range Test (DMRT) at a 5% significance level to identify specific differences between the treatment groups. This statistical approach is crucial in multidisciplinary studies because it allows researchers to quantitatively and comprehensively link the chemical aspects of flour, food technology processes, and the physical responses of cookies, resulting in more precise and scientifically sound interpretations.

3. RESULTS AND DISCUSSION

This section explains the experimental findings as well as the complete discussion. Research results are presented in the form of tables to facilitate understanding, while the discussion is divided into several structured sub-sections.

3.1. Moisture Content of Avocado Seed Flour Cookies

The moisture content of cookies with different substitution levels of avocado seed flour (TBA) is presented in Table 4.

Table 4. Moisture Content of Cookies (%)

Treatment	Moisture Content (%)
T0	5.92 ± 1.18
T1	5.13 ± 1.13
T2	5.03 ± 1.22
T3	4.83 ± 1.05
T4	4.42 ± 1.31
T5	4.27 ± 0.94

Statistical analysis showed that avocado seed flour substitution did not significantly affect the moisture content of cookies ($P>0.05$). This occurs because the total starch and fiber content of wheat flour and avocado seed flour is relatively similar. Wheat flour contains high starch composed of amylose and amylopectin, while avocado seed flour also contains high starch and fiber. The combination of these components results in comparable water-binding capacity among treatments.

According to Purba [50], ingredients rich in starch and fiber are capable of binding large amounts of water, and even heating does not release bound water easily [53]-[55]. This explains why all treatments remained within the moisture range allowed by the cookies quality standard (maximum 5% according to SNI 01-2973-1992). To describe the relationship between water content and molecular interaction in a material, the following equation is presented as in the template:

$$E_v - E = \frac{h}{2m}\left(K_x^2 + k_y^2\right) \quad \ldots(1)$$

Where :
E_v= vaporization energy,
E= internal energy,
h= Planck constant,
m= mass,
k_x, k_y= binding constants.

This equation illustrates that water retention is influenced by internal binding forces in the food matrix.

The stable water content results across all treatments offer significant potential for application in elementary school-based local content learning. Cookies with low water content have a good shelf life, making them safe for use as practical products for students in local food processing projects. Teachers can utilize this data to explain to students that local ingredients, such as avocado seeds, can produce long-lasting products without preservatives, thereby encouraging students to appreciate the potential of local foods. Furthermore, measuring or comparing water content can be incorporated into simple science literacy activities relevant to local food-based local content.

3.2. Water Activity of Avocado Seed Flour Cookies

The water activity (aw) values are shown in Table 5.

Table 5. Water Activity of Cookies (aw)

Treatment	aw
T0	0.46 ± 0.07
T1	0.42 ± 0.08
T2	0.44 ± 0.07
T3	0.42 ± 0.06
T4	0.41 ± 0.08
T5	0.42 ± 0.04

No significant differences ($P>0.05$) were observed among treatments, indicating that avocado seed flour substitution does not affect the aw value. This finding aligns with the moisture content results, because aw is strongly correlated with the amount of free water available in the product [56]-[58].

Wheat flour contains high amylopectin (72%), which can absorb and retain water during baking, resulting in low aw values [15], [59]. Meanwhile, avocado seed flour has high fiber content that binds water tightly, making it difficult for water to evaporate during heating [50], [60], [61]. As a result, all treatments produced aw values between 0.41–0.46, which are safe for preventing microbial growth.

The low aw values across all treatments indicate that the cookies are potentially safe to store and suitable for use as a learning product for local content. Teachers can use these findings to introduce the concept of local food security, while demonstrating that local ingredients can produce products of comparable quality to imported ingredients. Within the context of local content, students can be taught how water activity affects the shelf life of food and why traditional Indonesian foods such as crackers, cookies, and traditional snacks generally have low aw to prevent spoilage. This reinforces students' understanding that local foods have a scientific basis for their processing.

3.3. Hardness of Avocado Seed Flour Cookies

The hardness of cookies from each treatment is shown in Table 6.

Table 6. Hardness of Cookies (g/mm)

Treatment	Hardness (g/mm)
T0	526.00 ± 128.29 d
T1	470.20 ± 71.25 d
T2	362.40 ± 23.00 c
T3	230.60 ± 54.49 b
T4	92.70 ± 6.68 a
T5	77.60 ± 8.05 a

Avocado seed flour substitution significantly influenced hardness values (P<0.05). Increasing substitution levels decreased hardness. The softest cookies were obtained at 50% substitution. Two main factors explain this finding that, the low level of hardness of the resulting cookies can be explained by two main factors, namely the starch content and the presence of gluten in the raw materials. Wheat flour is known to contain higher starch compared to avocado seed flour. During the baking process, starch undergoes gelatinization and retrogradation which contributes to the formation of a harder cookie structure [62], [63]. Conversely, cookies with a lower starch content tend to have a weaker structure resulting in a softer texture. In addition, avocado seed flour does not contain gluten, even though gluten plays an important role in forming a protein network that is able to trap gas and strengthen the cookie structure. Therefore, increasing the proportion of avocado seed flour in the formulation causes a weakening of the cookie network structure and a decrease in the product hardness level [39], [64]. so that the higher the level of avocado seed flour substitution, the softer the texture of the resulting cookies.

Differences in cookie firmness at various substitution levels can be utilized in local content learning to introduce students to the process of modifying the texture of local food ingredients. Cookies that become softer at higher substitution levels are ideal for student practice, especially for lower grades who require softer textured foods. This data opens up opportunities for experiential learning, where students can directly experience the differences in texture and then analyze how local flour affects the final product. This is highly relevant to the objectives of local content learning: building exploration skills, creativity in processing local ingredients, and strengthening appreciation for the richness of regional food.

3.4. Color Characteristics of Avocado Seed Flour Cookies

Color (L* value) measurements are shown in Table 7

Table 7. Lightness (L) of Cookies

Treatment	L* Value
T0	74.89 ± 0.83
T1	53.96 ± 1.27
T2	46.79 ± 0.56
T3	40.77 ± 0.63
T4	34.12 ± 0.96
T5	28.06 ± 0.46

Substitution of avocado seed flour significantly decreased the lightness value (P<0.05). A lower L* value indicates a darker color. The darkest cookies were produced by the 50% substitution treatment. This darkening occurs due that, The color change in the resulting product is influenced by the relatively high content of phenolic compounds in avocado seeds, such as tannins, flavonoids, and polyphenols [65]. These compounds easily undergo browning reactions when exposed to oxygen and high temperatures during the processing process. In addition, during the baking stage, the Maillard reaction also occurs, namely the interaction between amino groups and reducing sugars, which contributes to the intensification of the brown color in the product. The presence of phenolic compounds in the dough system can strengthen the occurrence of this browning reaction, so that the color of the cookies becomes darker after the baking process [51], [66]. The resulting darker color may influence consumer acceptance, as cookies are generally expected to have a lighter, golden-brown appearance.

The color change in cookies due to the high phenolic content of avocado seed flour can be an engaging educational tool for elementary school students. In the local content curriculum, teachers can explain natural browning reactions (non-enzymatic and enzymatic) as simple, directly observable phenomena. Children will learn that different colors do not necessarily indicate bad food, but rather are characteristics of local ingredients rich in bioactive compounds. This supports the local content curriculum's goal of fostering pride in the unique characteristics of local foods. In fact, the dark color of cookies can be used as an identity for local avocado seed-based products, thereby introducing students to the concept of the uniqueness of regional food products.

Overall, the research findings indicate that substituting wheat flour with avocado seed flour produces cookies that are safe, suitable, and adaptable as teaching materials for local content subjects in elementary schools. Through the cookie-making practice, students not only learn about local food but also develop life skills, culinary creativity, environmental awareness, and an appreciation for regional potential. Thus, the research data not only contributes to food science but also strengthens the scientific basis for the development of local wisdom-based learning modules for local content subjects in elementary schools.

Based on a review of Saputri and Desstya [67], local wisdom-based learning at the elementary school level is more focused on integrating local cultural values into science learning to improve student creativity and learning outcomes, but is still limited to conceptual and pedagogical approaches without leading to real product-based learning that is applicable in students' daily lives. Furthermore Harisatunisa and Sauqi [68] emphasize the implementation of contextual learning based on local culture by utilizing the surrounding environment as the main learning resource, but have not linked this local wisdom to food-based innovations or strengthening scientific literacy and nutritional awareness of elementary school students. Meanwhile Febriyanto [69] focuses his study more on strengthening local wisdom-based character education through a conceptual approach and literature review, without involving the implementation of direct learning that is practical, experimental, and oriented towards local material processing activities by students. Thus, these three studies have not specifically examined local food-based local content learning that is integrated into product-based learning activities [70]. Therefore, the research entitled Local Food-Based Local Content Learning: Utilizing Avocado Seed Flour as a Substitute for Wheat Flour in Making Cookies for Elementary School Students is here to fill this gap by offering a novelty in the form of utilizing non-conventional local food ingredients, namely avocado seed flour, as a contextual learning medium that integrates aspects of local wisdom, environmental sustainability, scientific literacy, and nutritional awareness of elementary school students in an integrated manner.

The novelty of this research lies in the development and implementation of local food-based local content learning that integrates learning activities with real product innovation through the use of avocado seed flour as a substitute for wheat flour in making cookies for elementary school students. Different from previous research that generally focuses on the integration of local cultural values conceptually, contextually, or character building without the involvement of applicable products, this research offers an experiential learning approach that connects local wisdom, scientific literacy, nutritional awareness, and environmental sustainability issues in a single learning process. Thus, this research not only expands the meaning of local wisdom from the realm of values and culture to the realm of educational food innovation, but also presents a contextual learning model that is relevant to students' daily lives and global challenges such as food security and organic waste management.

The implications of this research are pedagogical, practical, and conceptual. Pedagogically, local wisdom-based food learning can increase student active engagement through meaningful practical activities, thereby supporting the development of scientific literacy, creativity, and contextual understanding at the elementary school level. Practically, this research provides innovative alternatives for teachers in implementing project-based learning and local wisdom that align with the Independent Curriculum and strengthen the Pancasila Student Profile, particularly in the dimensions of critical reasoning, creativity, and environmental awareness. Conceptually, the results of this research enrich the study of local wisdom-based learning by emphasizing that local food and agricultural waste can be utilized as integrative learning media, not only for cultural preservation, but also as a means of sustainable education relevant to health and environmental issues.

This study has several limitations that should be considered when interpreting the results. First, the scope of the study was limited to one elementary school context and one type of local food ingredient, namely avocado seeds. Therefore, generalizing the results to other school contexts or local food ingredients requires caution. Second, the study focused more on the implementation aspects of learning and student learning experiences, thus not examining quantitative aspects in depth, such as analyzing the nutritional content of cookies or measuring improvements in learning outcomes statistically. Third, this study did not compare the effectiveness of local food wisdom-based learning with conventional learning models experimentally. Therefore, further research is recommended to expand the context, use experimental designs, and explore variations in other local food ingredients to strengthen the validity and scientific contribution of the study.

4. CONCLUSION

This study confirms that avocado seed flour can be used to produce cookies with acceptable physical characteristics across various substitution levels, and when contextualized within elementary education particularly in the Muatan Lokal subject focusing on local food wisdom the findings offer a strong scientific foundation for developing learning modules based on regional ingredients. Substituting wheat flour with avocado seed flour not only reduces reliance on non-local commodities but also enhances students' understanding of regional resources, sustainable practices, and traditional processing knowledge, with cookies containing 30–50% substitution being especially suitable for Mulok Elementary School due to their softer texture and stable characteristics. Overall, integrating local food science into classroom practice promotes experiential, contextual, and culturally grounded learning that aligns with the objectives of Mulok Elementari School in fostering appreciation for local potentials and regional culinary heritage.

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USE OF ARTIFICIAL INTELLIGENCE (AI)-ASSISTED TECHNOLOGY

The authors declare that no artificial intelligence (AI) tools were used in the preparation, analysis, or writing of this manuscript. All aspects of the research, including data collection, interpretation, and manuscript preparation, were carried **out** entirely by the authors without the assistance of AI-based technologies.

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