

# EFFECT OF NUTMEG CONCENTRATION IN NUTMEG JAM AND CAKES ON ACCEPTABILITY, NUTRITIONAL CONTENT AND ANTIOXIDANT ACTIVITY

Endang Rumayomi<sup>1</sup>, Anjar Briliannita<sup>1\*</sup>, Fajar Irianto<sup>1</sup>

<sup>1</sup>Jurusan Gizi, Poltekkes Kemenkes Sorong

Email: abriliannita@gmail.com

## ABSTRACT

Nutmeg, a key agricultural product of Fak-Fak Regency, is processed into diverse food products, including jams utilized in mini lontar cakes and rolled tart cakes. This study aimed to optimize the use of nutmeg flesh in jam production, evaluating its nutritional composition, antioxidant properties, and consumer acceptability. Conducted as an experimental study employing a completely randomized design (CRD), six formulations of nutmeg jam (S0 to S5) were prepared and analyzed. A sensory evaluation was performed by 30 semi-trained panelists from the Nutrition Department of the Polytechnic of the Ministry of Health, Sorong. Statistical differences in acceptability were assessed using the Kruskal-Wallis and Mann-Whitney U tests ( $\alpha \leq 0.05$ ). The results identified S5 (50% nutmeg pulp and 50% sugar) as the most preferred formulation, with significant differences in taste ( $p = 0.01$ ) and texture ( $p = 0.03$ ), but no notable differences in color ( $p = 0.06$ ), aroma ( $p = 0.33$ ), or overall acceptance ( $p = 0.99$ ). Nutritional analysis revealed a carbohydrate content of 45.09% and antioxidant activity of 69.8%, comparable to raw nutmeg pulp (70.4%). Furthermore, mini lontar cakes and rolled tarts incorporating S5 jam demonstrated superior carbohydrate levels (53.92% and 38.09%, respectively) and antioxidant activities (35.8% and 41.5%). These findings underscore the potential of nutmeg-derived products in contributing to functional food development, supporting the diversification of nutmeg-based snacks as a source of bioactive compounds and nutritional benefits.

**Keywords:** *nutmeg flesh, acceptability, nutritional value, antioxidant activity, nutmeg jam*

## INTRODUCTION

Indonesia is a major producer of nutmeg largest in the world followed by Granada, and the world's need for nutmeg is 90-95% fulfilled by the two countries. Indonesia is the largest supplier of nutmeg in Indonesia the world ranging between 70-75% The main producing areas are Provinces of North Sulawesi, Maluku, Sumatra West, Nangroe Aceh Darussalam, and Papua West, followed by Granada around 20-25%, and the remaining 5% is produced by Malaysia, India and Sri Lanka (Indriaty dan Assah, 2015).

Fak-Fak nutmeg is a variety superior in Fakfak City, West Papua Province based on the decision of the Minister of Agriculture Republic of Indonesia (Menteri Pertanian, 2017). Processed nutmeg in the field of pharmaceuticals includes fixed oils, essential oils, and Other ingredients that

contain anti-oxidants strong which is very useful, especially in neuropsychiatry and medical fields (Kamelia dan Silalahi, 2018).

Nutmeg content based on Gas Chromatography-Mass Spectrometry (GC-MS) analysis, it shows that the dominant compound components in the pulp and mace are myristicin, sabine,  $\alpha$ -pinene,  $\beta$ ,  $\beta$ -pinen which contribute to the distinctive aroma of nutmeg (Liunokas dan Karwur, 2020). The pulp of nutmeg is used as a nutmeg juice drink. According to the results of research on the addition of maltodextrin reduces the level of vitamin C breakdown during processing and cooking. The product's vitamin C content is the lowest experiencing damage is 114.27 mg/100g at 15% addition maltodextrin. Sensory quality of the product instant drinks of papaya juice and cider nutmeg is also preferred

with an increasing proportion of additions to maltodextrin (Gabriela, Rawung, dan Ludong, 2020).

Apart from being nutmeg juice, nutmeg is used as a special flavor addition to cake. Research results show that the essential oils of Nutmeg flesh contain 21 components. The chemical with the most components is oxygenated fertilization. With the higher concentration of essential oils from fruit flesh nutmeg, consumer acceptance of the taste and aroma of the cake decreased but still on a hedonic scale rather like up like. As for color, texture, and overall there is no significant difference between their treatment. When compared to the control, the cake with oil concentration of essential oils from nutmeg flesh 0.05% was no different. Cake-containing oil the essential oils of nutmeg flesh have advantages nutritional and functional if compared with control samples (Sipahelut, Tetelepta, dan Patty, 2017).

In this research, the nutmeg of Fakfak will be used as jam on mini lontar cakes and rolled tart cakes. One of the traditional food types of snacks are Lontar Cake, Lontar Cake is a traditional food originating from Fak-Fak Regency and is recognized as a cake of Dutch heritage with the name original roomtaart which means cream cake, Fak-Fak cake community more eloquently referred to as Lontar Cake. Nutmeg is very often found in Fakfak City West Papua Province. Nutmeg can be used as a form of diversification food, increasing the income local community in Fakfak City, high economic value, substance content good nutrition antioxidants, and multifunction. In this research, the use of nutmeg as fruit jam Fakfak nutmeg is then added to the typical cake of the Fakfak people, namely mini lontar and rolled tarts.

## METHOD

This type of research is a pure experiment and uses tests Kruskal-Wallis. If there is a difference in the effect of the next test, use the test Mann-Whitney at the 5% level. Meanwhile, for the acceptability test, 30 moderately trained panelists were used. Criteria for moderately trained panelists who have undergone organoleptic training and demonstrate consistency and informativeness in organoleptic assessments. This research was

carried out in June until September 2023. The research location is making nutmeg jam and making mini lontar and rolled tarts in the Lab. Culinary Nutrition and Lab. Food Technology in the Nutrition Department, Health Polytechnic, Ministry of Health, Sorong. As for the selection of panelists and product acceptability testing is carried out in the Lab. Assessment of Nutritional Status, Nutrition Department, Health Polytechnic, Ministry of Health, Sorong. Meanwhile, testing of the nutritional value and antioxidant activity of nutmeg pulp jam and nutmeg jam cake products was carried out in The Laboratory of Chemix Pratama Yogyakarta. The main ingredient used in this research is nutmeg which has inclusion criteria, namely: fruit flesh nutmeg obtained from the market in the city of Fakfak, nutmeg local varieties sold by people in Fak-fak City. Other ingredients were obtained at supermarkets in Fak-fak City. Other ingredients for making mini lontar and rolled tarts are wheat flour, granulated sugar, SP emulsifier, chicken eggs, sweetened condensed milk, and water. Chemical reagents for testing nutritional value, food fiber content, and antioxidant activity.

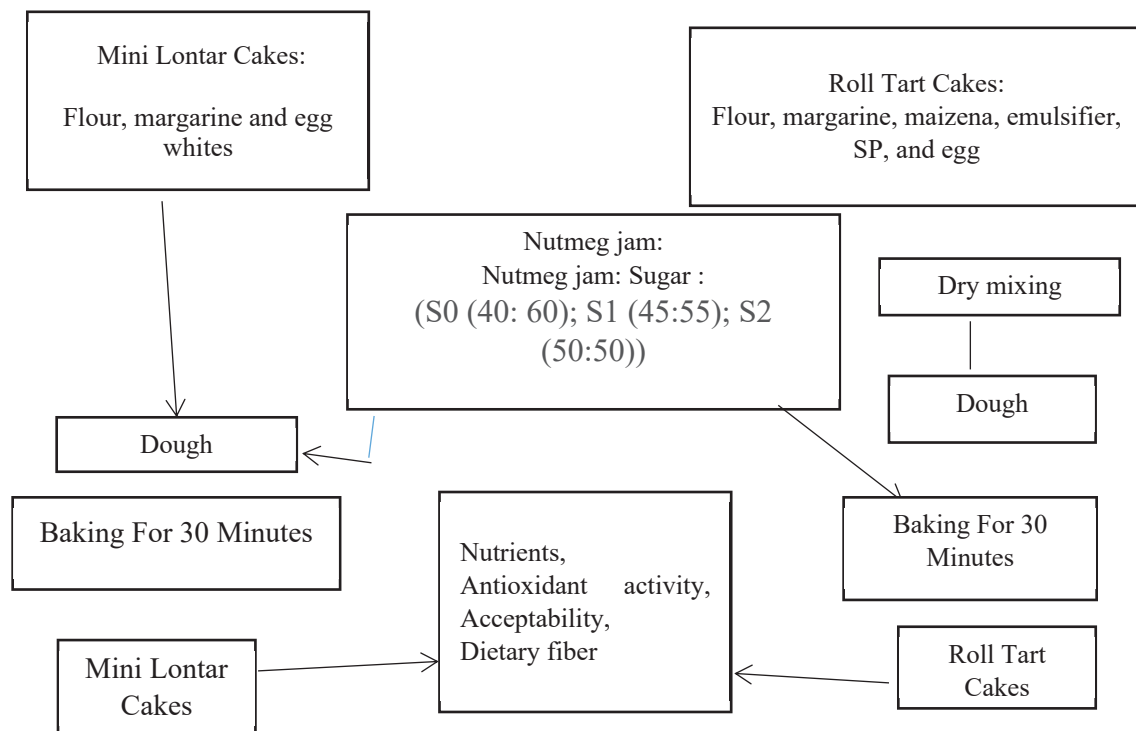
## 1. Research Procedures

### a). Making Mini Lontar and Rolled Tarts

Making mini lontar refers to research (Ang, Banindro, dan, Yulianto, 2020) and making rolled tarts is expected to be able to create dessert products that are rich in nutrients referring to research (Aini dan Ratnaningsih, 2021). Flow chart for making cake (Fig 1) Data processing trial and error. Variations in the composition of the ingredients for making mini lontar cakes and rolled tarts can be seen in Table 1 and Table 2. Baking is done in an oven with a set temperature and time, namely 135°C for 30 minutes. Cooling is done by leaving the mini lontar and rolled tart products that have been removed from the oven at room temperature.

### b) Preparation of Nutmeg Jam

The preparation of nutmeg pulp jam was carried out which is an alternative nutmeg jam as a form of utilization of nutmeg pulp, preparation of nutmeg pulp jam as in research conducted by (Setyawati et al. 2013). Preparation of raw materials is done by removing the nutmeg skin. The flesh



**Figure 1.** Flowchart for making

**Table 1.** Composition Of Mini Lontar Nutmeg Jam

| No | Composition              | Sample (%) |      |      |      |      |      |
|----|--------------------------|------------|------|------|------|------|------|
|    |                          | S0         | S1   | S2   | S3   | S4   | S5   |
| 1  | Flour                    | 23,3       | 23,3 | 23,3 | 23,3 | 23,3 | 23,3 |
| 2  | Butter                   | 2,10       | 2,10 | 2,10 | 2,10 | 2,10 | 2,10 |
| 3  | Egg                      | 14         | 14   | 14   | 14   | 14   | 14   |
| 4  | Sweetened Condensed Milk | 11,2       | 11,2 | 11,2 | 11,2 | 11,2 | 11,2 |
| 5  | Vanilla Powder           | 0,35       | 0,35 | 0,35 | 0,35 | 0,35 | 0,35 |
| 7  | Nutmeg Jam               | 20         | 30   | 35   | 40   | 45   | 50   |
| 8  | Sugar                    | 80         | 70   | 65   | 60   | 55   | 50   |

**Table 2.** Composition Of Rolled Tart Cake Nutmeg Jam

| No | Composition   | Sample (%) |      |      |      |      |      |
|----|---------------|------------|------|------|------|------|------|
|    |               | S0         | S1   | S2   | S3   | S4   | S5   |
| 1  | Flour         | 7,89       | 7,89 | 7,89 | 7,89 | 7,89 | 7,89 |
| 2  | Butter        | 17,1       | 17,1 | 17,1 | 17,1 | 17,1 | 17,1 |
| 3  | Egg           | 47,3       | 47,3 | 47,3 | 47,3 | 47,3 | 47,3 |
| 4  | Emulsifier SP | 1,97       | 1,97 | 1,97 | 1,97 | 1,97 | 1,97 |
| 5  | Maizena       | 7,89       | 7,89 | 7,89 | 7,89 | 7,89 | 7,89 |
| 6  | Milk Powder   | 3,95       | 3,95 | 3,95 | 3,95 | 3,95 | 3,95 |
| 7  | Sugar         | 2050       | 30   | 35   | 40   | 45   | 50   |
| 8  | Nutmeg flesh  | 8050       | 70   | 65   | 60   | 55   | 50   |

of the nutmeg flesh has been peeled and washed thoroughly, then cut and soaked in a salt solution (2.5%) for 3-4 hours to avoid enzymatic browning. Next, it is cleaned with running water and then the nutmeg flesh is drained and steamed for 10 minutes. After that, the nutmeg flesh is coated with granulated sugar according to the composition variation for 24 hours. Then, after 2 x 24 hours the nutmeg flesh is crushed into nutmeg pulp. Next, the nutmeg pulp is cooked at a temperature of 105-1100°C for 30-60 minutes over medium heat. During cooking, add sufficient food coloring to the nutmeg pulp. In nutmeg jam, what is varied is the composition of nutmeg flesh jam: granulated sugar, namely S0- 20:80, S1-30:70, S2- 35:65, S3- 40:60, S4-45:55, S5 -50:50. Selected nutmeg jam then used in mini lontar nutmeg cakes and rolled tarts.

#### c). Nutrient Analysis

Nutrient analysis in the research took the form of protein, fat, water content, and ash content analysis, while carbohydrate content used a different method. Protein analysis in this study used the method Kjeldahl (Rohman, 2013).

Analysis of fat in nutmeg jam and processed cake products using the method soxhlet (Rohman, 2013), namely mass of fat = (weight of flask+boiling stone+extracted oil) (weight of flask+boiling stone). In this research, levels are determined by the method by different (subtraction result from 100% with other components). In this study, ash content was determined using the dry ashing method, and water content was determined using the gravimetric method (AOAC,1995).

#### d). Antioxidant Activity Analysis

Equipment for evaluating the antioxidant activity of roll tart cakes and mini lontar cakes with the addition nutmeg jam , a spectrophotometer using the radical scavenging activity method using 2,2-Diphenyl-1-Picrylhydrazyl (DPPH) radical as previously described by (Luís et al , 2014) with some modifications.

#### e). Acceptance Testing

Acceptability testing was carried out to determine the panelists' level of preference in terms of taste, color, aroma, texture, and overall nutmeg jam The panelists in the research were somewhat trained panelists who were students of the Nutrition Department, Health Polytechnic, Ministry of Health,

Sorong. Panelists have received training on acceptability tests. The samples presented to the panelists were 20 grams each. The score used in the acceptability test consists of a score of 1-7 (very dislike-very like). The panelists prepare themselves to do it acceptance test after receiving an explanation from the researcher. Panelists fill out the consent form to become panelists test the samples that have been prepared and write them on the acceptability test sheet. Drinking water was served to the panelists after assessing the acceptability of each nutmeg jam sample so that they could neutralize the remaining food samples on the panelists' taste buds.

## RESULTS AND DISCUSSION

In this research, chemical testing (nutrient analysis and antioxidant analysis) was conducted on raw nutmeg flesh, nutmeg processed products such as nutmeg jam, nutmeg roll tart cake, and mini lontar cakes. Organoleptic tests were also carried out in accordance with organoleptic testing standards. The research results are as follows:

### 1). Nutmeg Jam Acceptance Test

This study indicates that the results of organoleptic tests on nutmeg jam with various compositions of nutmeg flesh to sugar ratio (S0- 20:80, S1-30:70, S2- 35:65, S3-40:60, S4-45:55, S5 -50:50) were preferred - very liked by moderately trained panelists. The selected nutmeg jam was the S5 with a composition of nutmeg flesh to sugar ratio of 50:50, which was most preferred by the panelists. The panelists' evaluation indicated that the taste of S5 nutmeg jam resembled tamarind candy with a hint of nutmeg flavor, tangy, sweet, and delicious. Therefore, S5 nutmeg jam was used as the jam in the roll tart cake and pie cake products. Organoleptic test results showed differences in taste and texture in this study's products. However, there were no differences in overall aspect, aroma, and color among the six nutmeg jam samples. This is consistent with a study conducted by (Ratna and Palupi, 2021) which found that the innovation of nutmeg-flavored sweet potato cheese cake had an average overall liking score of 3.9 and 4.6 (moderately liked). Another study also showed

that the essential oil from nutmeg flesh contained 21 chemical components with the majority being oxygenated compounds. The higher the concentration of essential oil from nutmeg flesh, the lower the consumer acceptance of taste and aroma of the cake, but still within the moderately liked to liked hedonic scale. However, there were no significant differences in color, texture, and overall liking among treatments. Compared to the control, cakes with 0.05% concentration of essential oil from nutmeg flesh showed no difference. Cakes containing essential oil from nutmeg flesh had significant nutritional and functional advantages compared to the control sample. Consumption of such products can aid in preventing and improving health disorders caused by oxidation, such as aging, atherosclerosis, and carcinogenesis (Habibe et al., 2013). This is because the nutmeg flavor originates from its chemical components such as monoterpenes hydrocarbons and monoterpenes alcohols, while the main aroma components found in nutmeg oil are terpenes, terpene alcohols, and phenolic ethers (Aulia and Suseno, 2020).

## 2). Nutrients Analysis

The research findings indicate that the nutritional value of nutmeg flesh is higher in terms of its water content due to not undergoing drying or roasting treatments compared to processed nutmeg products such as nutmeg jam, roll tart cake, and pie cake. This aligns with research showing that the nutritional values contained in every 100 g of nutmeg flesh are calories (42 cal), protein (0.30 g), fat (0.20 g), carbohydrates (10.90 g), calcium (32 mg), phosphorus (24 mg), iron (1.50 mg), vitamin A (29.50 IU), vitamin C (22 mg), and water (88.10 g) (Arief et al., 2015) as cited in (Aulia and Suseno, 2020).

The statistical test results using the Mann-Whitney test indicate that the mean nutritional values of carbohydrates, fats, proteins, moisture content, and ash content have significant differences among nutmeg fruit, nutmeg jam, mini lontar cake, and roll tart cake ( $p = 0,015 < 0,05$ ).

The higher protein content in roll tart compared to other products could be due to the addition of ingredients rich in protein during the preparation of roll tart. Ingredients such as nuts,

seeds, or dairy products commonly used in roll tart recipes contribute to its higher protein content. The highest carbohydrate content in nutmeg jam may result from the addition of sugars during the jam-making process. Sugar is a primary ingredient in jam recipes, contributing to its sweetness and texture. Additionally, some fruits naturally contain higher amounts of carbohydrates, which can also contribute to the overall carbohydrate content in the jam.

The similar lipid (fat) content in roll tart and pie could be attributed to the use of similar ingredients or preparation methods. Both roll tart and pie recipes often involve the use of butter, margarine, or oils in their pastry or crust, which contribute to the lipid content in the final products. Additionally, the proportion of fats used in the recipes may be similar, resulting in comparable lipid content in both products. The high water content in nutmeg flesh can optimize nutmeg jam products and add antioxidant compounds to nutmeg jam.

## 3). Antioxidant Activity Analysis

The antioxidant activity content in nutmeg flesh in this study was very high at 70.4%, which is similar to the antioxidant activity in nutmeg jam at 69.8%, because previous research has shown that nutmeg flesh contains high levels of phenolic compounds and flavonoid compounds. Nutmeg flesh has strong antioxidant activity compared to seeds, roots, and stems. Antioxidants are compounds capable of delaying the oxidation reaction of a molecule by inhibiting the initiation process of the oxidation reaction itself. Several methods have been developed to test antioxidant activity such as DPPH (1,1-diphenyl-2-picrylhydrazyl). The most effective and efficient method for testing antioxidant activity in natural materials containing antioxidant structures is the DPPH method because of its sensitivity to the tested sample and its high chelating power against ions in suppressing free radicals, thereby increasing the antioxidant activity value results (Rumagit and Antasionasti, 2023).

The diversification of nutmeg-based products can enhance the value of nutmeg, increase income, and provide benefits for both nutmeg farmers and the industry. One home industry in Sukadamai



Village has developed nutmeg flesh-based products into nutmeg juice, which offers numerous health benefits. This observation aims to (Aulia and Suseno, 2020). Thus, this research is highly beneficial as it can offer recommendations to local governments, communities, and academia to utilize nutmeg fruit in cake and nutmeg jam products.

### Conclusion And Recommendation

The fruit preserve with the best overall acceptance in terms of color, aroma, texture, taste, and overall preference is S5 (with a fruit-to-sugar composition of 50%:50%). The composition of S5 is considered to be the optimal combination of ingredients for making nutmeg preserve. Nutmeg

preserves are known for their high carbohydrate content. Consequently, S5 nutmeg preserve is used as a filling for mini lontar cakes and rolled tarts. The antioxidant activity of the nutmeg preserve remains the same with the antioxidant activity value of raw nutmeg, namely 70.4%%, including high. Likewise, the antioxidant activity content in mini lontar cakes and rolled tarts is around 41% - 31.8%, and the carbohydrate content is around 38% - 53.92%. Nutmeg jam can be used in other food products such as bread, etc. because it contains high antioxidant activity and sufficient carbohydrates so that it can be a healthy and nutritious snack.

**Table 1.** Organoleptic Testing of Nutmeg Jam

| Sample | Organoleptic |           |            |           |            |
|--------|--------------|-----------|------------|-----------|------------|
|        | Colour       | Aroma     | Taste      | Texture   | Overall    |
| S0     | 4.89±0.83    | 4.57±0.83 | 4.07±1.15  | 4.43±0.79 | 5.07 ±0.89 |
| S1     | 5.28±0.76    | 4.72±0.76 | 4.64±0.83  | 4.85±0.75 | 5.12 ±0.63 |
| S2     | 4.14±0.89    | 4.64±0.89 | 4.85±1.00  | 4.10±0.99 | 4.64±1.03  |
| S3     | 5.28±0.97    | 4.61±0.97 | 4.89±1.13  | 4.32±1.09 | 5.00 ±1.02 |
| S4     | 5.28±0.80    | 4.92±0.81 | 4.89±1.103 | 4.61±0.87 | 5.10±0.83  |
| S5     | 6.07±0.86    | 5.64±0.98 | 6.21±0.62  | 5.75±1.04 | 6.14±0.89  |

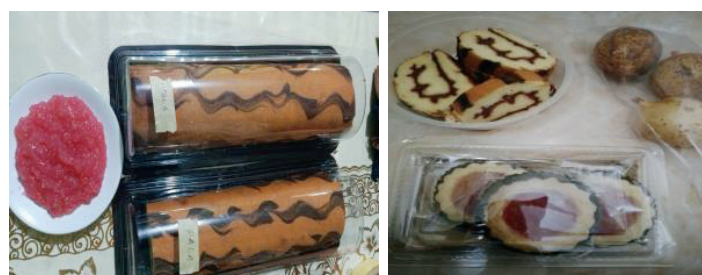
Data is presented as the average ± SD

**Table 2.** Antioxidant Activity, Nutrition Composition of Nutmeg, Nutmeg Jam, Roll Tart Cake, and Mini Lontar Cake (100 gram)

| Composition              | Nutmeg      | Nutmeg Jam  | Roll Tart Cake | Mini Lontar Cake | p value |
|--------------------------|-------------|-------------|----------------|------------------|---------|
| Water (%wb)              | 91.82±0.035 | 49.46±0.035 | 36.99±0.035    | 23.87±0.035      | 0,016   |
| Ash (%db)                | 0.38 ±0.08  | 1.44±0.050  | 0.84 ±0.030    | 0.88 ±0.030      | 0,022   |
| Karbohidrat(%bdf)*       | 5.93±0.09   | 45.09±0.14  | 38.09±0.135    | 53.92±0.168      | 0,015   |
| Protein (%)              | 1.30± 0.02  | 1.78±0.037  | 7.87 ±0.07     | 4.70±0.024       | 0,016   |
| Lipid (%)                | 0.55±0.07   | 0.96±0.01   | 16.61±0.06     | 16.61±0.01       | 0,016   |
| Antioxidant Activity (%) | 70.4±0.13   | 69.8±0.16   | 41.5±0.20      | 35.8±0.14        | 0,016   |

Data is presented as the average ± SD

\*bdf = *by different*



**Figure 2.** Nutmeg, Nutmeg Jam, Nutmeg Roll Tart Cake, and Mini Lontar Cake

## REFERENCES

- Aini, Nadia. Nur., and N. Ratnaningsih. 2021. "Penambahan Tepung Mangga Dalam Substitusi Pembuatan Mini Mango Roll Cake." *Prosiding Pendidikan Teknik Boga Busa FT UNY* 16(1): 1–9. <https://journal.uny.ac.id/index.php/ptbb/article/download/44518/16553>.
- Ang, E F A, B S Banindro, and Y H Yulianto. 2020. "Perancangan Buku Resep Potret Kuliner Papua 'Mace Pu Dapur: Warisan Bumi Cenderawasih Untuk Nusantara.'" *Jurnal DKV Adiwarna*: 1–9. <http://publication.petra.ac.id/index.php/dkv/article/view/10399%0Ahttp://publication.petra.ac.id/index.php/dkv/article/viewFile/10399/9280>.
- Arief, Ratna Wylis, Firdausil AB, and Robet Asnawi. 2016. "Potensi Pengolahan Daging Buah Pala Menjadi Aneka Produk Olahan Bernilai Ekonomi Tinggi." *Buletin Penelitian Tanaman Rempah dan Obat* 26(2): 165.
- Aulia, Syifa, and Sugeng Heri Suseno. 2020. "Diversifikasi Produk Olahan Buah Pala (Myristica Fragrans) Di Desa Sukadamai." *Jurnal Pusat Inovasi Masyarakat* 2(6): 966–71.
- Dareda, Christina Tang, Edi Suryanto, and Lidya I. Momuat. 2020. "KARAKTERISASI DAN AKTIVITAS ANTIOKSIDAN SERAT PANGAN DARI DAGING BUAH PALA (MYRISTICA FRAGRANS Houtt)." *Chemistry Progress* 13(1): 48–55.
- Gabriela, Michella C, Dekie Rawung, and Maya M Ludong. 2020. "Pengaruh Penambahan Maltodekstrin Pada Pembuatan Minuman Instan Serbuk Buah Pepaya (Carica Papaya L.) Dan Buah Pala (Myristica Fragrans H.)." *Cocos* 7(7): 1–8.
- Indriaty, Fetty, and Yunita F Assah. 2015. "Pengaruh Penambahan Gula Dan Sari Buah Terhadap Kualitas Minuman Serbuk Daging Buah Pala." *Jurnal Penelitian Teknologi Industri* 7(1): 49.
- Kamelia, Luh Putu Lina, and P. Yosi Silalahi. 2018. "Buah Pala Sebagai Salah Satu Fitofarmaka Yang Menjanjikan Di Masa Depan." *Molucca Medica* 11(April): 96–101.
- Lestarinigrum, Puji, and Esteria Priyanti. 2020. "Studi Pemanfaatan Buah Pisang Raja Nangka Untuk Olahan Kue Lontar, Bavarois Pudding, Dan Choco Truffle." *Prosiding Seminar Nasional Riset Teknologi Terapan*.
- Liunokas, Angreni B., and Ferry F. Karwur. 2020. "Isolasi Dan Identifikasi Komponen Kimia Minyak Asiri Daging Buah Dan Fuli Berdasarkan Umur Buah Pala (Myristica Fragrans Houtt)." *Jurnal Biologi Tropis* 20(1): 69–77.
- Lung, Jackie Kang Sing, and Dika Pramita Destiani. 2018. "Uji Aktivitas Antioksidan Vitamin A, C, E Dengan Metode DPPH." *Farmaka* 15(1): 53–62.
- Ratu, Mega Adistya Kumala, and Sri Palupi. 2021. "Cheese Cake Dengan Substitusi Ubi Jalar (Ipomea Batatas) Sebagai Dessert Kekinian." *Jurnal UN* 16(1): 1–9.
- Rumagit, Tjandra A, and Irma Antasionasti. 2023. "Analisis Korelasi Aktivitas Antioksidan Minuman Herbal Pala Dengan Kandungan Total Fenolik Dan Total Flavonoid." 2(1): 58–65.
- Setyawati, Retno, Jurusan Teknolgi Pertanian, Fakultas Pertanian, and Universitas Jenderal. 2013. "Karakteristik Selai Buah Pala : Pengaruh Proporsi Gula Pasir , Gula Kelapa Dan Nenas The Properties of Nutmeg Jam : Proportion of Cane Sugar , Coconut Sugar and Pineapple." *Jurnal Pembangunan Pedesaan* 13(2): 147–55.
- Sipahelut, Sophia G, Gilian Tetelepta, and John Patty. 2017. "KAJIAN PENAMBAHAN MINYAK ATSIRI DARI DAGING BUAH PALA (Myristica Fragrans Houtt.) PADA CAKE TERHADAP DAYA TERIMA KONSUMEN." *J. Sains dan Teknologi Pangan* 2(2): 486–95.