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# PROXIMATE ANALYSIS AND VITAMIN C CONTENT IN YELLOW COCONUT (*Cocos Nucifera*)

# ANALISIS PROKSIMAT VITAMIN C DAN ANTIOKSIDAN PADA SAMPEL KELAPA KUNING (*Cocos Nucifera*)

**Fatahu[1], Baihaqi[1*], Ekacahyana Mandasari[2], Wa Ode Mulyana[2], Andi Laila Nugrawati[1]**

[1]Jurusan Ilmu dan Teknologi Pangan, Universitas Halu Oleo
[2]Jurusan Pendidikan Kimia, Universitas Halu Oleo

*email Koresponden: teukubaihaqi.stp@gmail.com

**Abstract**

This study aims to analyze the nutritional composition and antioxidant activity of yellow coconut (Cocos nucifera), focusing on both the flesh and water parts. The analyzed parameters include vitamin C, protein, carbohydrate, fat, moisture, ash content, and antioxidant activity using the DPPH method. The results showed that yellow coconut flesh contains more nutrients than its water, with a vitamin C content of 237.67 mg/100g, protein at 1566 ppm, and fat at 93.67%. Moisture and ash contents were 91.33% and 0.82%, respectively. These findings suggest that yellow coconut, particularly its flesh, has significant potential as a functional food to support health and warrants further development in the natural food industry.

***Keywords**: Yellow coconut, vitamin C, nutritional composition, functional food*

**Abstrak**

Penelitian ini bertujuan untuk menganalisis kandungan gizi dan aktivitas antioksidan pada buah kelapa kuning (Cocos nucifera) yang meliputi bagian daging dan air kelapanya. Parameter yang dianalisis mencakup kadar vitamin C, protein, karbohidrat, lemak, air, abu, serta aktivitas antioksidan menggunakan metode DPPH. Hasil penelitian menunjukkan bahwa daging kelapa kuning memiliki kandungan gizi yang lebih tinggi dibandingkan airnya, dengan kadar vitamin C sebesar 237,67 mg/100g, protein 1566 ppm, dan lemak mencapai 93,67%. Kandungan air dan abu masing-masing tercatat sebesar 91,33% dan 0,82%. Temuan ini menunjukkan bahwa kelapa kuning, khususnya bagian dagingnya, memiliki potensi tinggi sebagai sumber pangan fungsional yang mendukung kesehatan dan layak dikembangkan dalam industri pangan alami.

**Kata Kunci:** Kelapa kuning, vitamin C, komposisi gizi, pangan fungsional

## INTRODUCTION

Coconut (*Cocos nucifera* L.) has long been recognized as a versatile plant that provides significant benefits to agriculture and the national economy. One local variety with great potential, yet underexplored, is the yellow coconut. This fruit is distinguished by its bright yellow skin and sweeter water compared to other varieties. Although its presence is fairly well known in

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the community and it is often consumed fresh, scientific research on the nutritional content and bioactive compounds of yellow coconut remains limited (Suryani & Arumsari, 2023).

This situation presents a major challenge in developing yellow coconut as a functional food ingredient. One of the most common methods used in assessing the nutritional value of food ingredients is proximate analysis, which involves measuring the levels of moisture, ash, fat, protein, and carbohydrates. Coconut is a source of medium-chain saturated fats that are beneficial for energy metabolism and contains dietary fiber that supports digestive health. Unfortunately, no data specifically detailing the proximate composition of yellow coconut have been found, making it difficult to compare it with other coconut varieties (Wahyuni *et al*., 2021).

Moreover, the suspected presence of vitamin C and antioxidant compounds, such as flavonoids and phenols, in yellow coconut has not yet been confirmed by laboratory analysis. Vitamin C, important for immunity and metabolic function, has been found in young coconut water (Harahap & Zulkarnain, 2024); however, its specific content in yellow coconut has not been thoroughly investigated. This poses a challenge for recognizing yellow coconut as a natural source of vitamin C in the food and beverage industry.

Coconuts, in general, are known to have high antioxidant capacity, which can be assessed through the DPPH method. This antioxidant activity is crucial in preventing oxidative stress, which is closely related to degenerative diseases such as cancer and diabetes. However, to date, no empirical studies have explored the antioxidant activity of yellow coconut, either from its water or flesh (Hidayati *et al*., 2022). The absence of this data creates a scientific gap that needs to be addressed to provide a foundation for the utilization of yellow coconut in functional food development.

Given these limitations, it is important to conduct comprehensive research on the nutritional content and antioxidant potential of yellow coconut. With empirical data, yellow coconut is expected to be further developed as a high-value local food source with significant economic and health benefits.

## RESEARCH METHODS

### Sample Preparation Process

The young yellow coconut samples were cleaned to extract the coconut water and flesh. The flesh was blended to create a smooth mixture, and the coconut water was filtered.

### Vitamin C Analysis

Sample Preparation

The coconut flesh sample was weighed at 50.018 grams, then macerated in 50 mL of distilled water in a beaker and stirred for 30 minutes. The resulting macerate was filtered using filter paper to separate the residue from the filtrate, and the residue was re-macerated to obtain additional extract.

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Quantitative Vitamin C Test

A 10 mL sample was transferred into a prepared Erlenmeyer flask, then 3 drops of Amylum reagent were added. The sample was titrated with a 0.01N iodine solution until a color change occurred. This procedure was performed in triplicate (Safitrid *et al*., 2023).

**Moisture and Ash Content Analysis**

Determination of Ash Content

The ash content of the coconut flesh was determined by heating a porcelain crucible in a furnace at 600°C for 30 minutes. The crucible was then cooled in a desiccator for 30 minutes and weighed using an analytical balance. After that, 2.5 g of the coconut flesh sample was placed into the crucible and weighed again. The crucible containing the sample was then heated in a furnace at 600°C for 3 hours, until white ash formed. After heating, the crucible was cooled in the desiccator for 30 minutes and weighed again (Fikriyah & Nasution, 2021).

Determination of Moisture Content

The moisture content of the coconut flesh was determined by heating a metal crucible in an oven at 105°C for 30 minutes. The crucible was then cooled in a desiccator for 30 minutes and weighed using an analytical balance. After that, 2.5 g of the coconut flesh sample was placed into the crucible and weighed again. The crucible containing the sample was heated in the oven at 105°C for 3 hours. After heating, the crucible was cooled in the desiccator for 30 minutes and weighed again (Fikriyah & Nasution, 2021).

**Protein Analysis**

Sample Preparation

The coconut flesh and water samples, which had been blended and filtered, were weighed out at 1 gram each. Then, 5 mL of 1M NaOH and distilled water were added to the mixture to bring the volume to 25 mL. The mixture was heated at 90°C for 10 minutes. Afterward, the solution was cooled and centrifuged for 10 minutes.

Standard Solution Preparation

A stock solution was prepared by weighing 0.1 grams of Bovine Serum Albumin (BSA) and dissolving it in distilled water in a 250 mL volumetric flask. The solution was diluted to the mark to produce a 1000 ppm stock solution. Standard solutions of 500, 400, 300, 200, and 100 ppm were then prepared.

Protein Content Determination Using the Biuret Method

From the centrifuged coconut flesh and water samples, 2.5 mL of each was added to a test tube, then 2.5 mL of Biuret solution was added. The absorbance was measured using a UV-Vis spectrophotometer at 540 nm. The same procedure was performed on the standard solutions (Sylvia *et al*., 2021).

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**Carbohydrate Analysis**

Sample Preparation

A 5-gram sample of coconut flesh and water was placed into a beaker, and 10 mL of concentrated H2SO4 was carefully added. The mixture was heated for 30 minutes (Ramadhanty *et al*., 2024).

Carbohydrate Standard Solution Preparation

A stock solution was prepared by weighing out 0.025 grams of glucose, dissolving it in distilled water, and transferring the solution to a 250 mL volumetric flask. The solution was diluted to the mark to obtain a 100 ppm stock solution. Standard solutions of 80, 60, 40, 20, and 10 ppm were then prepared.

Carbohydrate Determination Using the Nelson-Somogyi Method

1 mL portion of the filtrate was transferred into a test tube, followed by 1 mL of Nelson reagent. The mixture was heated in a water bath at 60°C for 20 minutes. Afterward, it was cooled to approximately 25°C, 1 mL of Arsenomolybdate reagent was added, and the mixture was homogenized. Seven mL of distilled water was added, and the mixture was homogenized again. The absorbance was measured at 540 nm using a UV-Vis spectrophotometer (Permatasari & Handoko, 2025).

**Fat Analysis**

Fat Content of Yellow Coconut Flesh Using Soxhlet Extraction

A 3.668-gram sample of blended coconut flesh was placed in a filter-paper thimble (1.944 grams). The top was sealed with fat-free cotton, and the thimble was placed in a Soxhlet extraction apparatus. The fat was extracted for 30 minutes, and the sample was cooled in a desiccator and weighed until a constant weight was obtained (Pargiyanti, 2019).

Fat Content of Yellow Coconut Water Using Liquid-Liquid Extraction

For the fat content analysis of coconut water, a pre-weighed dry Erlenmeyer flask (130.541, 130.542, and 130.544 grams) was used. Fifty mL of coconut water was added to the flask. The sample was then transferred to a separating funnel and mixed with 30 mL of n-hexane. The mixture was shaken for 10 minutes and left to separate for 10 minutes. The separated coconut water was then transferred to the funnel and mixed with 20 mL of n-hexane. The process was repeated. The n-hexane was collected and evaporated in an oven at 60-70°C for 12 hours to determine the fat content of the coconut water (Sunardi & Mukimin, 2014; Namarubessy & Awan, 2016).

## RESULTS AND DISCUSSION

**Vitamin C Content**

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**Table 1.** Analysis of Vitamin C Content in Yellow Coconut Fruit

| Sample | Repeat | Concentration (%) | Concentration *(mg/100g)* |
|---|---|---|---|
| Coconut Flesh | 1 | 0,57239 | 572,39 |
| | 2 | 0,52836 | 528,36 |
| | 3 | 0,61642 | 616,42 |
| | 1 | 0,114478 | 114,478 |
| Coconut water | 2 | 0,105672 | 105,672 |
| | 3 | 0,123284 | 123,284 |

The analysis results indicate that the vitamin C content in yellow coconut flesh is significantly higher than that in its coconut water. According to Table 1, the vitamin C content in yellow coconut flesh ranges from 528.36 to 616.42 mg/100g, while the vitamin C content in the coconut water ranges from 105.672 to 123.284 mg/100g. Compared with the Indonesian National Standard (SNI 3553:2016) for coconut water as a beverage ingredient, the minimum recommended vitamin C content is about 20 mg/100g. Therefore, both the flesh and coconut water of yellow coconuts in this study exceed the minimum SNI standard. The high vitamin C content in the flesh suggests that the solid tissue of the fruit serves as a more effective reservoir for ascorbic acid compared to the liquid fraction. This aligns with the findings of Sari et al. (2020), who report that vitamin C is more stable and bound within the fruit tissue matrix. Thus, yellow coconut has the potential to be developed as a source of natural vitamin C, particularly for coconut flesh-based food products.

## Ash Content

**Table 2.** Ash Content Analysis in Yellow Coconut Fruit

| Sample | Repeat | Ash Content (%) | Average | Standard Deviation | RSD (%) |
|---|---|---|---|---|---|
| | 1 | 0.819672131 | 0.817606979 | 0.020158477 | 2.465546128 |
| Coconut Flesh | 2 | 0.836653386 | | | |
| | 3 | 0.79649542 | | | |

Based on the data in Table 2, the ash content of yellow coconut flesh is approximately 0.82%, with an RSD of less than 5%, indicating good precision and repeatability. This result is consistent with the study by Rohmah *et al.* (2021), which found that the ash content in grated coconut ranged from 0.75–0.85%. The ash content in this study reflects a sufficient total mineral content and falls within the normal range reported for various coconut varieties. These minerals play a crucial role in supporting physiological functions, such as electrolyte balance and enzymatic activity. The consistency of this result with previous studies suggests that the yellow coconut variety does not differ significantly in mineral composition, yet still holds potential as a source of natural minerals.

## Moisture Content

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**Table 3.** Moisture Content Analysis in Yellow Coconut Fruit

| Sample | Repeat | Moisture Content (%) | Average | Standard Deviation | RSD (%) |
|---|---|---|---|---|---|
| Coconut Flesh | 1 | 91.8595679 | 91.331901 | 0.727224367 | 0.796243545 |
| | 2 | 91.63378058 | | | |
| | 3 | 90.50235479 | | | |

Based on Table 3, the moisture content of yellow coconut flesh, which exceeds 91%, indicates that this fruit is fresh and has a very high water content. The high moisture content affects the soft texture and refreshing sensation when consumed, but it may also accelerate microbial spoilage if not handled properly. These results align with the general characteristics of young coconuts and emphasize that proper post-harvest processing is crucial if yellow coconut flesh is to be developed as a raw material for processed food products.

## Protein Content

**Table 4.** Protein Content Analysis in Yellow Coconut

| Sample | Repeat | Concentration (ppm) | Absorbance (nm) | Content (%) |
|---|---|---|---|---|
| Yellow Coconut Water | 1 | 344 | 0.078 | 0.172 |
| | 2 | 334 | 0.077 | 0.167 |
| | 3 | 324 | 0.076 | 0.162 |
| Yellow Coconut Flesh | 1 | 554 | 0.099 | 0.277 |
| | 2 | 514 | 0.095 | 0.257 |
| | 3 | 594 | 0.103 | 0.297 |

The analysis results indicate that the protein content in yellow coconut water is relatively low, averaging 0.167%. This aligns with the findings of Padam *et al*. (2015), who stated that nitrogen in coconut water is mostly present as non-protein compounds, such as free amino acids. Bhatnagar *et al*. (2018) also reported that the protein content of coconut water generally ranges from 0.05 to 0.1 g/100 mL, depending on the fruit type and maturity. In contrast, the protein content of yellow coconut flesh is higher, averaging 0.277%. This indicates that coconut solid tissue is the primary site of protein storage, consistent with Padam *et al*. (2015), who found high total nitrogen fractions in coconut flesh. Bhatnagar *et al*. (2018), also reported that coconut flesh contains 3–4 g of protein per 100 g. The protein analysis shows a clear difference between yellow coconut water and flesh. Coconut water has a relatively low protein content, whereas coconut flesh shows a higher protein concentration. This difference relates to the biological functions of each part of the fruit, with coconut flesh serving as nutrient-storage tissue, including protein. The high coefficient of determination ($R^2 > 0.98$) for the standard curve indicates that the UV-Vis spectrophotometric method is accurate and precise. While the protein content of yellow coconut is lower than that of other plant-based protein sources, its contribution to daily protein intake remains relevant, especially when combined with other nutrients.

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## Carbohydrate Content

**Table 5.** Carbohydrate Content Analysis in Yellow Coconut

| Sample | Repeat | Concentration (ppm) | Absorbance (nm) | Content (%) |
|---|---|---|---|---|
| Yellow Coconut Water | 1 | 33.94 | 0.360 | 6.76 |
| | 2 | 34.16 | 0.362 | 6.81 |
| | 3 | 34.83 | 0.368 | 6.93 |
| Yellow Coconut Flesh | 1 | 36.94 | 0.387 | 14.28 |
| | 2 | 37.16 | 0.389 | 14.41 |
| | 3 | 36.27 | 0.381 | 14.12 |

Based on the data in Table 5, the carbohydrate content in yellow coconut water from the three repetitions is 6.76%, 6.81%, and 6.93% (average 6.84%, RSD 1.28%). At the same time, in the flesh, it reaches 14.28%, 14.41%, and 14.12% (average 14.27%, RSD 1.02%), indicating high precision (RSD < 5%). The calibration graph shows a strong linear relationship ($y = 0.009x + 0.0545$; $R^2 = 0.9894$), confirming the method's accuracy. The carbohydrate content in yellow coconut flesh is higher than that in coconut water. This indicates that most carbohydrates are stored as starch and complex sugars in flesh tissue, whereas simple sugars predominate in coconut water. This carbohydrate content contributes to the energy value of yellow coconut and strengthens its potential as a natural energy source.

## Fat Content

**Table 6.** Fat Content Analysis in Yellow Coconut

| Sample | Repeat | Weight of Empty Vessel (g) | Weight of Vessel + Fat (g) | Final Weight of Fat (g) | % Fat Content |
|---|---|---|---|---|---|
| Yellow Coconut Water | 1 | 130.541 | 133.553 | 130.545 | 0.1328 |
| | 2 | 130.542 | 133.265 | 130.546 | 0.1468 |
| | 3 | 130.544 | 133.544 | 130.591 | 0.1312 |
| Yellow Coconut Flesh | 1 | 1.944 | 5.612 | 2.112 | 4.5801 |
| | 2 | 1.982 | 5.555 | 2.187 | 5.7374 |
| | 3 | 1.964 | 5.598 | 2.165 | 5.5310 |

Based on Table 6, the fat content in yellow coconuts differs significantly between coconut water and coconut flesh. Coconut water has a very low fat content, ranging from 0.1312% to 0.1468%, while coconut flesh contains much higher levels of fat, ranging from 4.5801% to 5.7374%. The fat analysis indicates that yellow coconut flesh is the main fraction for lipid storage, whereas coconut water contains only a very small amount of fat. The fat in coconut flesh is mainly composed of medium-chain saturated fatty acids, which are metabolized more easily and may offer certain health benefits. This significant difference in fat content highlights that yellow coconuts should be used as a source of plant-based fat, with the emphasis on the flesh.

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These findings align with Santoso *et al*. (1996), who reported that coconut fat is concentrated in the flesh.

## CONCLUSION

Based on observations and analysis, the flesh of the yellow coconut stands out for a significantly richer nutritional profile than its water, particularly in protein, vitamin C, and fat content. The protein content of the flesh is notably higher, providing essential amino acids that support muscle repair, immune function, and overall health. Additionally, the vitamin C concentration in the flesh is far higher than in the water, making it a valuable source of this essential nutrient, which supports immune function and skin health and acts as a powerful antioxidant to combat oxidative stress. The fat content in the flesh, primarily composed of medium-chain fatty acids, further enhances its nutritional value. The body easily metabolizes these fats and has been linked to various health benefits, such as improved energy metabolism and potential heart health benefits.

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