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# An Evaluation of the Nutritional Content of Rattan Shoots as a Potential Learning Resource for Local Wisdom-Based Education

**Musdalifah Nurdin[1], Syech Zainal[1,*], Nasria[1], Raya Agni[1], Samsurizal M. Suleman[1], Siti Eneng Sururiyatul Mu'aziyah[2], Moh. Sabran[1]**
[1]Department of Biology Education, Universitas Tadulako, Sulawesi Tengah, Indonesia
[2]Department of Science Education, Universitas Trunojoyo Madura, Jawa Timur, Indonesia

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**ABSTRACT**

**Purpose of the study:** Rattan, a valuable resource for both industry and local food, is evaluated for its nutritional content in this study. The research explores its potential as a learning resource based on local wisdom in Sibado Village, Sirenja District, aiming to raise awareness and promote sustainable use within the community.

**Methodology:** A quantitative descriptive research approach was used, involving proximate analysis to measure (Soxhlet method), protein (spectrophotometric method), water (thermogravimetric method), ash (dryashing method), and carbohydrates (proximate method) of rattan shoots. Data were collected from Sibado Village and analyzed in the Chemistry Laboratory of Tadulako University, Palu. An e-pocket book was developed as a learning resource.

**Main Findings:** The results of the study obtained an average fat content of 0.332%, protein content of 2.110% and carbohydrate content of 6.082%. The results of the study were integrated as a learning resource in the form of a local wisdom-based pocket book that had been validated by content experts, design experts, media experts and students with an average value of 81.7%, meaning it is very suitable for use as a learning resource.

**Novelty/Originality of this study:** This study is the first to combine nutritional analysis of *Daemonorops robusta* with the development of a local wisdom-based educational tool, bridging scientific data and pedagogy to enhance biodiversity awareness, cultural relevance, and contextualized learning in formal education.

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***Corresponding Author:***
Syech Zainal,
Department of Biology Education, Universitas Tadulako,
Palu, Sulawesi Tengah, 94148, Indonesia
Email: syechzainal97mpd@gmail.com

## 1. INTRODUCTION

Rattan, particularly *Daemonorops robusta*, is a significant natural resource in Indonesia, especially in regions like Sulawesi, where it serves multiple purposes, including as a food source, material for crafts, and in cultural practices [1], [2]. Rattan shoots, or *umbut rotan*, are consumed as a vegetable in various traditional dishes, particularly in regions such as Central Kalimantan and Sulawesi, where they are integral to local cuisine and cultural practices [3], [4]. Despite its extensive use, there is limited research on the nutritional content of rattan shoots, which is essential for understanding its potential as a dietary component and a resource for local education [5]-[7].

The nutritional composition of rattan shoots remains underexplored, though recent studies have begun to provide insights into their proximate composition. Analysis of rattan shoots has shown that they contain significant levels of water (90.280%), moderate amounts of carbohydrates (6.082%), and low levels of fats (0.332%) [1], [8]. This composition suggests that rattan shoots could be a hydrating, low-calorie food option with potential energy-providing properties, especially in areas with limited access to conventional food resources [1], [8]. The relatively low protein content (2.110%) suggests that rattan shoots could complement protein-rich food sources, such as legumes or fish, to create a balanced diet [9], [10].

Beyond its nutritional value, rattan holds deep cultural significance in Indonesia. In Central Kalimantan, the Dayak community incorporates rattan shoots into traditional dishes such as *sayur umbut rotan*, emphasizing its cultural importance [2], [4]. The ethnobotanical practices surrounding rattan demonstrate how this plant serves not only as a food source but also as a material for crafts, reflecting local ecological knowledge [4], [11]. Furthermore, rattan plays an economic role as a non-timber forest product (NTFP), providing a livelihood for communities in regions like Terengganu, Malaysia, through the sale of raw materials and crafted goods [12], [13]. The sustainability of rattan is threatened by over-exploitation and habitat degradation. Unsustainable harvesting practices have led to the decline of rattan populations, particularly in natural forests [3]. Effective conservation and sustainable management practices are essential to ensure the continued availability of rattan as a resource [13]. As such, promoting sustainable harvesting methods and raising awareness about the importance of rattan can contribute to preserving this valuable resource [14].

In recent years, the role of rattan in food security has garnered attention. Given its high water content and moderate carbohydrate levels, rattan shoots have the potential to contribute to addressing malnutrition [15]-[17], especially in remote areas with limited access to conventional food sources [1], [8]. Additionally, further research into the specific vitamins and antioxidants in rattan shoots could unlock additional health benefits, similar to other plants like bamboo, which are known for their antioxidant properties [9], [18]. Rattan shoots provide valuable nutrients but should be part of a diverse diet to ensure adequate protein and other essential nutrients [10], [19]. Comparative analyses of rattan with other indigenous vegetables, such as *Crambe kotschyana* and *Rorippa nasturtium-aquaticum*, indicate that rattan can complement other food sources in local diets, enhancing nutritional security [19]-[21].

However, many communities remain unaware of the nutritional content of rattan shoots, which limits their potential as a dietary resource [1], [22]. To address this knowledge gap, it is essential to develop educational materials [5], [23], [24] that inform local populations about the nutritional value of rattan. This can be achieved through practical and engaging formats such as pocket books, which can encourage independent learning among students and community members [25], [26]. The proposed research aims to evaluate the nutritional content of rattan shoots and explore its integration as a local wisdom-based educational resource in Sibado Village, Sirenja District. By focusing on the development of educational materials like pocket books, this study seeks to enhance local awareness of rattan's nutritional value and promote its sustainable use in local diets [25], [27]. Pocket books, which are small, portable, and easy to use, offer an effective way to encourage independent learning and knowledge dissemination [28], [29].

Moreover, the integration of local wisdom into educational curricula is crucial for fostering a deeper connection between students and their cultural heritage [30]-[32]. Incorporating local food sources like rattan into the curriculum can enhance students' understanding of sustainable food systems and promote the conservation of natural resources [33]-[35]. By linking education to local traditions and resources, the study also contributes to the broader goals of sustainable development [36], [37] and environmental stewardship [38], [39]. The integration of local wisdom into education [40], [41] has proven to be an effective strategy for promoting cultural pride, environmental consciousness, and sustainable practices among students [42]-[44]. Through the inclusion of rattan in the curriculum [45]-[47], students can gain a deeper appreciation of their natural environment and the role of indigenous knowledge in preserving ecosystems [48] and cultural identities [2], [49].

In conclusion, rattan shoots offer a promising yet under-researched food source with potential nutritional, cultural, and economic benefits. By integrating this knowledge into educational resources, such as pocket books, this research aims to raise awareness about rattan's value and its potential role in food security and cultural preservation. This study seeks to fill the gap in understanding the nutritional content of rattan and promote its use as a learning resource based on local wisdom, supporting sustainable educational practices that benefit both the environment and local communities.

To the best of our knowledge, this study is the first to systematically evaluate the proximate nutritional content of *Daemonorops robusta* and simultaneously develop an educational tool rooted in local wisdom for use in formal learning environments. Unlike previous studies that focused solely on ethnobotanical or nutritional aspects, this research bridges scientific nutritional data with pedagogical application through a validated e-pocket book. This integrative approach promotes both local biodiversity and cultural relevance in science education, contributing to the advancement of contextualized learning resources.

## 2. RESEARCH METHOD

This research is a quantitative descriptive research that aims to describe/measure carefully the phenomenon studied through laboratory test results. The research location is in Sibado Village and continued with nutritional content analysis in the Chemistry Laboratory of the Faculty of Mathematics and Natural Sciences, Tadulako University, Palu. The research sample is Noko rattan shoots (*Daemonorops robusta* Warburg) in the form of fat content (*soxhlet method*), protein (*spectrophotometric method*), water (*thermogravimetric method*), ash (*dryashing method*), and carbohydrates (*proximate method*). The research results are integrated in e-pocket book.

### 2.1. Fat Analysis

AOAC (2015) explains that to calculate fat content, use the formula as in (1).

$$\% \text{ Fat content} = \frac{W3-W2}{W1} \text{ x } 100 \quad \ldots (1)$$

Description:
W1: Initial sample weight (grams)
W2: Weight of pumpkin without fat (grams)
W3: Weight of pumpkin + sample after extraction (grams)

### 2.2. Protein Analysis

Data analysis was first carried out using the standard curve method, linear regression y = bx + a was made based on absorbance and concentration data from standard solutions. To calculate protein levels, use the following formula as in (2).

$$\text{Protein } (\%) = \frac{\frac{X}{1000} \text{ x F x Fp}}{W} \quad \ldots (2)$$

Description
X : Sample BSA concentration (ppm)
Y : Volume (L)
Fp : Dilution factor (if any)
W : Sample weight (g)

### 2.3. Water Analysis

The water analysis is by using the formula as in (3).

$$\text{Water content } (\%) = \frac{(Wo+Ws)-Wi}{Ws} \text{ x } 100 \quad \ldots (3)$$

Description:
Ws: Weight of sample before oven (grams)
Wi: Weight of sample + cup after oven (grams)
Wo: Weight of empty cup (grams)

### 2.4. Ash Analysis

The way to ash analysis is by using the following formula as in (4)

$$\text{Ash Analysis} = \frac{W1-W2}{W} \text{ x } 100 \quad \ldots (4)$$

Description:
W: Weight of sample before ashing (grams)
W1: Weight of sample + cup after ashing (grams)
W2: Weight of empty cup (grams)

### 2.5. Carbohydrate Analysis

The way to calculate carbohydrate levels is by using the following formula as in (5).

$$\%K = 100 - \% \text{ (protein + fat + ash + water)} \quad \ldots (5)$$

### 2.6. Validation of Pocket Book

Data analysis for assessment can be done using the following formula as in (6) (Arikunto, 2014).

$$Average = \frac{\text{Total number of percentages}}{\text{Number of Assessment aspect items}} \quad \ldots (6)$$

The average score obtained from the validation process is then interpreted based on eligibility criteria. These criteria classify the learning media into categories ranging from "Very unworthy" to "Very worthy" as shown in Table 1.

Table 1. Criteria for the Eligibility of Learning Media

| Score in percent | Eligibility category |
|---|---|
| <21% | Very unworthy |
| 21-40% | Unworthy |
| 41-60% | Quite worthy |
| 61-80% | Worthy |
| 81-100% | Very worthy |

## 3. RESULTS AND DICUSSION

Results of fat content data analysis in Table 2. Above shows the fat content in the shoots of Noko rattan the first repetition of the fat content is 0.289%, the second repetition of the fat content is 0.365% and the third repetition of the fat content is 0.341 with an average value of 0.332% and The results of analysis of the fat content of noko rattan shoots in fresh wet conditions using the Soxhlet method are shown in Figure 1.

Table 2. Results of Fat Content Analysis Using The Soxhlet Method

| Sample | Cup Weight (gr) | Sample Weight (gr) | Final Weight (gr) | Fat Content (%) |
|---|---|---|---|---|
| *Rattan shoots P1* | 104.186 | 5.54 | 104.202 | 0.289 |
| *Rattan shoots P2* | 122.229 | 5.48 | 122.249 | 0.365 |
| *Rattan shoots P3* | 139.457 | 5.576 | 139.476 | 0.341 |
| Average value | | | | 0.332 |

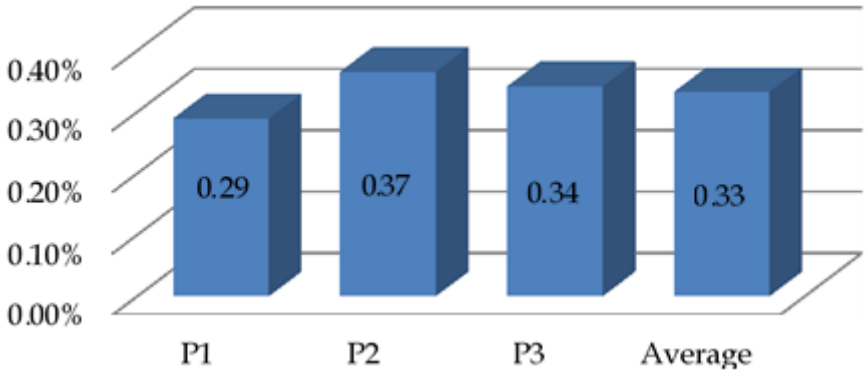


Figure 1. Fat content of noko rattan shoots

Results of protein content data analysis Table 3.

Table 3. Absorbance of BSA Standard Solution by UV-Vis Spectrophotometry at a Wavelength of 530 nm

| BSA Concentration (ppm) | Absorbance 530 (nm) |
|---|---|
| 500 | -0.094 |
| 1000 | -0.067 |
| 2000 | 0.001 |
| 3000 | 0.063 |
| 4000 | 0.132 |
| 5000 | 0.196 |

Results of fat content data analysis in Table 2. Above shows the fat content in the shoots of Noko rattan the first repetition of the fat content is 0.289%, the second repetition of the fat content is 0.365% and the third repetition of the fat content is 0.341 with an average value of 0.332% and The results of analysis of the fat content of noko rattan shoots in fresh wet conditions using the Soxhlet method are shown in Figure 1. Determination of the protein standard curve using the absorbance obtained from the measurement results using variations of the standard solutions made. The absorbance obtained was measured using a UV-Vis spectrophotometry instrument at the maximum wavelength obtained in the protein solution. The maximum wavelength used in this study was 530 nm. The following is a picture of the BSA standard curve (Figure 2).

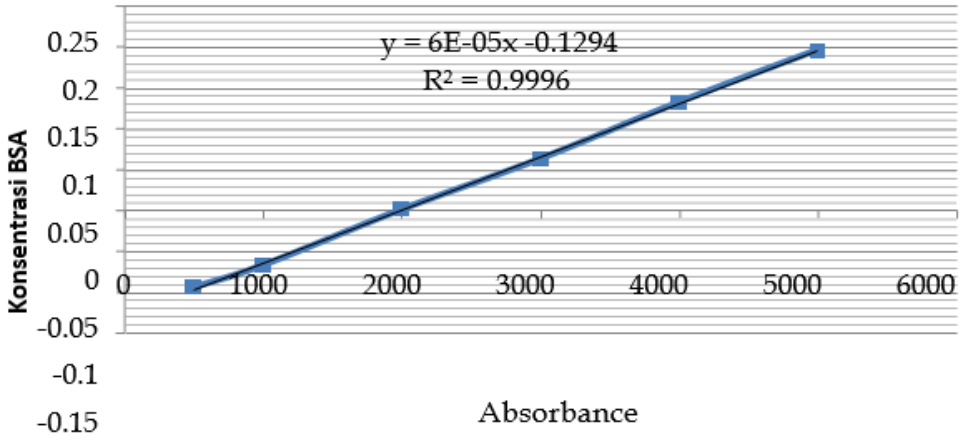


Figure 2. Standard curve of the relationship between protein concentration and absorbance

The determination of the standard curve is carried out to determine the concentration and absorbance of the standard protein, so that if the absorbance of the sample is known, the sample content can be calculated by substituting it into the standard curve equation. The results of the absorbance of the protein solution are obtained in the form of a curve, with the Y value being the absorbance of the standard protein solution and X being the concentration of the protein solution. Based on the curve, the value of y = 6E-05x - 0.1294 and the value of $R^2$ = 0.9996 can be obtained.

Further in Table 4. Shows the protein content in Noko rattan shoots the first repetition of the protein content is 2.148%, the second repetition of the protein content is 2.172% and the third repetition of the protein content is 2.009% with an average value of 2.110%. The results of the analysis of protein content of Noko rattan shoots in fresh wet conditions using the spectrophotometric method are shown in Figure 3.

Table 4. Results of protein content analysis using the spectrophotometric method

| Sample | Absorbance 530 nm | BSA concentration (mg/L) | Volume (L) | Sample Weight (gr) | Protein Content (%) |
|---|---|---|---|---|---|
| *Rattan shoots P1* | -0.115 | 221.5385 | 0.025 | 1.289 | 2.148 |
| *Rattan shoots P2* | -0.115 | 221.5385 | 0.025 | 1.275 | 2.172 |
| *Rattan shoots P3* | -0.117 | 190.7692 | 0.025 | 1.187 | 2.009 |
| | | Average | | | 2.110 |

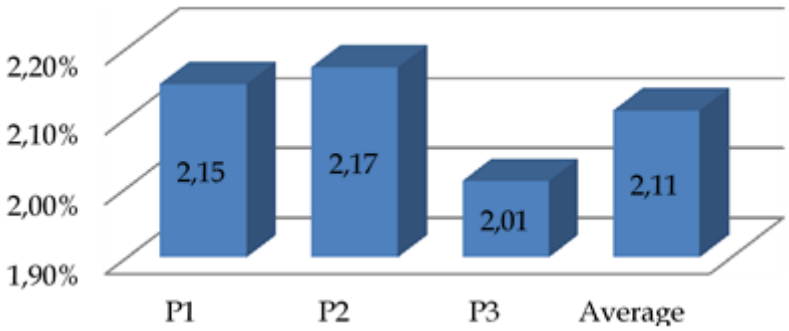


Figure 3. Protein content of noko rattan shoots

Table 5. Shows the water content in the Noko rattan shoots. The first repetition of the water content was 90.659%, the second repetition of the water content was 90.906% and the third repetition of the water content was 89.276% with an average value of 90.280% and The results of analysis of the water content of Noko rattan shoots in fresh wet conditions using the thermogravimetric method are shown in Figure 4.

Table 5. Water Content Analysis Results Using Thermogravimetric Method

| Sample | Cup Weight (gr) | Sample Weight (gr) | 3 Hours Oven | 1 Hour Oven | Average Oven | Water Content (%) |
|---|---|---|---|---|---|---|
| *Rattan shoots P1* | 26.136 | 5.31 | 26.634 | 26.63 | 26.632 | 90.659 |
| *Rattan shoots P2* | 25.532 | 5.916 | 26.07 | 26.07 | 26.070 | 90.906 |
| *Rattan shoots P3* | 27.385 | 5.32 | 27.956 | 27.955 | 27.956 | 89.266 |
| Average | | | | | | 90.280 |

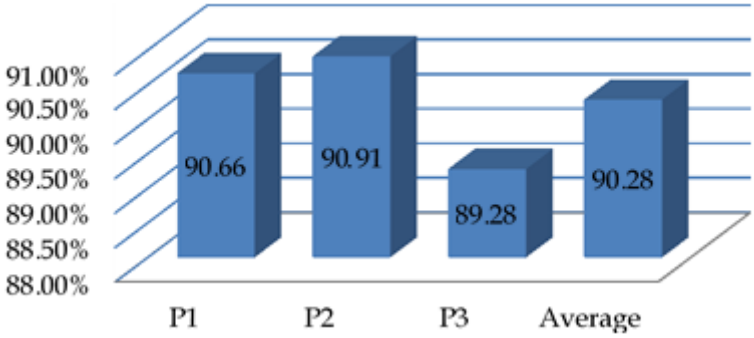


Figure 4. Water content of noko rattan shoots

Table 6. Shows the ash content in noko rattan shoots. The first repetition of the ash content was 1.291%, the second repetition of the ash content was 1.092% and the third repetition of the ash content was 1.207% with an average value of 1.196%. The results of the analysis of the ash content of noko rattan shoots in fresh wet conditions using the dryashing method are shown in Figure 5.

Table 6. Results of Ash Content Analysis Using The Dryashing Method

| Sample | Cup Weight (gr) | Sample Weight (gr) | Final Weight (gr) | Ash Content (%) |
|---|---|---|---|---|
| *Rattan shoots P1* | 27.532 | 1.162 | 27.547 | 1.291 |
| *Rattan shoots P2* | 28.662 | 1.191 | 28.675 | 1.092 |
| *Rattan shoots P3* | 30.727 | 1.16 | 30.741 | 1.207 |

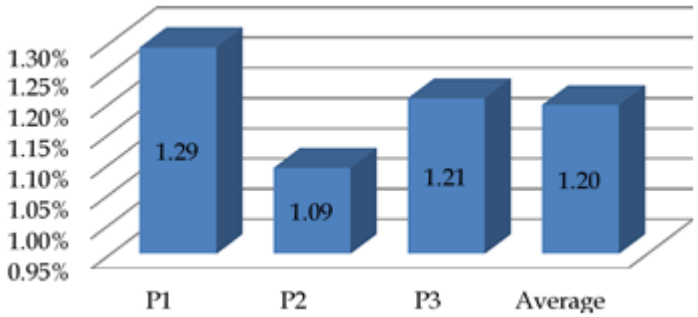


Figure 5. Ash content of noko rattan shoots

Table 7. Shows the analysis of carbohydrate content using the by difference method where the carbohydrate content is obtained from 100 minus the added value of each protein content, fat content, ash content and water content. The carbohydrate content obtained in the first repetition was 5.613%, in the second repetition the carbohydrate content was 5.466% and in the third repetition the carbohydrate content was 7.167% with an average value of 6.082% and The results of the analysis of carbohydrate content of Noko rattan shoots in fresh wet conditions using the by difference method are shown in Figure 6.

Table 7. Results of Carbohydrate Content Analysis with The Difference Method

| Sample | Water content (%) | Ash content (%) | Protein Content (%) | Fat Content (%) | Carbohydrate Content (%) |
|---|---|---|---|---|---|
| *Rattan shoots P1* | 90.659 | 1.291 | 2.148 | 0.289 | 5.613 |
| *Rattan shoots P2* | 90.906 | 1.092 | 2.172 | 0.365 | 5.466 |
| *Rattan shoots P3* | 89.276 | 1.207 | 2.009 | 0.341 | 7.167 |
| Average | | | | | 6.082 |

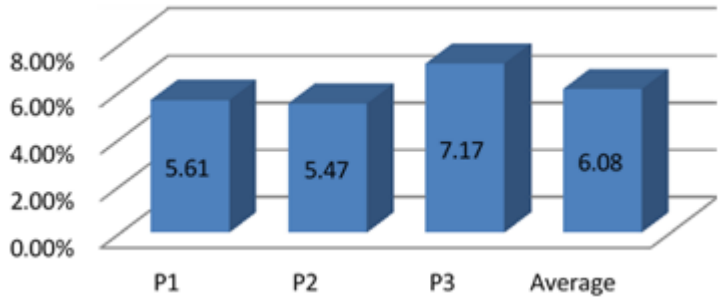


Figure 6. Carbohydrate content of noko rattan shoots

The results of the calculation of the percentage of the assessment of the feasibility of learning resources in the form of pocket books carried out by the expert team, namely content experts, design experts and media experts are as follows.

***Results of Assessment of Learning Resources by Content Experts***

The results of the assessment of learning resources in e-pocket books by content experts, stated that the learning resources are suitable for use as can support the learning process, with the percentage being 77.5%.

Table 8. Percentage of Eligibility of Learning Resources by Content Experts

| No | Assessment Aspect | Scale | Percentage (%) |
|---|---|---|---|
| 1. | Accuracy of font size | 4 | 80 |
| 2. | Clarity of sentences | 4 | 80 |
| 3. | Systematic writing | 3 | 60 |
| 4. | Attractiveness of material description display | 4 | 80 |
| 5. | Suitability of images with material description | 4 | 80 |
| 6. | Provision of supporting sources as references for reading sources relevant to the material | 4 | 80 |
| 7. | Suitability between the title of the pocket book and the contents of the material | 4 | 80 |
| 8. | Clarity of description and nutritional content of rattan shoots | 4 | 80 |
| Total | | 31 | 620 |
| Average | | 3.87 | 77.5 |
| Description | | Worthy | |

***Results of Learning Resource Assessment by Design Experts***

The results of the assessment of learning resources e-pocket books by design experts, stated that the learning resources are very suitable for useand can support the learning process, with the percentage 82.22%.

Table 9. Percentage of Learning Resource Suitability by Design Experts

| No | Assessment Aspect | Scale | Percentage (%) |
|---|---|---|---|
| | **Cover** | | |
| 1. | Suitability of the layout of the title writing on the cover | 4 | 80 |
| 2. | Accuracy of font size | 4 | 80 |
| 3. | Suitability of the color and font type used on the cover | 4 | 80 |
| 4. | Attractiveness of the cover appearance | 4 | 80 |
| | **Order of Material** | | |
| 1. | Suitability between material and reflection of content | 4 | 80 |
| 2. | Clarity of sentences | 4 | 80 |
| 3. | Accuracy of image layout | 4 | 80 |
| 4. | Quality and size of images | 4 | 80 |
| 5. | Consistency of font size | 5 | 100 |
| | Total | 37 | 740 |
| | Average | 4,1 | 82,22 |
| | Description | Very Worthy | |

***Results of Learning Resource Assessment by Media Experts***

The results of the assessment of learning resources e-pocket books by media experts, stated that the learning resources are suitable for use as learning resources and can support the learning process, with the percentage 75.55%.

Table 10. Percentage of Learning Resource Eligibility by Media Experts

| No | Assessment Aspect | Scale | Percentage (%) |
|---|---|---|---|
| | **Cover** | | |
| 1. | Attractiveness of the cover of the pocket book | 4 | 80 |
| 2. | Suitability of font size | 3 | 60 |
| 3. | Suitability of title appearance | 4 | 80 |
| 4. | Suitability between font and cover color | 4 | 80 |
| | **Order of Material** | | |
| 1. | Suitability of material and media used | 4 | 80 |
| 2. | Quality of images used | 3 | 60 |
| 3. | Accuracy of image size | 4 | 80 |
| 4. | Suitability of font size in learning sources | 4 | 80 |
| 5. | Accuracy between images and descriptions in learning sources | 4 | 80 |
| | Total | 34 | 680 |
| | Average | 3.77 | 75.55 |
| | Description | Worthy | |

***Percentage Results of Assessment of the Feasibility of Learning Resources in the Form of Pocket Books by Students***

The validation results of experts including content experts, design experts and media experts have been obtained, then the learning resources in the form of pocket books were assessed by a group of 25 students. The assessment students of learning resources e-pocket books that the learning resources are very feasible to be used as learning resources and can support the learning process with the percentage 91.6%.

Table 11. Percentage of Eligibility of Learning Resources by Students

| No | Assessment Aspect | Scale | Percentage (%) |
|---|---|---|---|
| 1 | Do you think the contents of this pocket book are interesting? | 4.64 | 92.8 |
| 2 | Do you think the contents of this pocket book are easy to understand? | 4.6 | 92 |
| 3 | How clear are the images in this pocket book? | 4.24 | 84.8 |
| 4 | How clear is the writing (text) in the pocket book? | 4.68 | 93.6 |
| 5 | Do you think the appearance of the images in this pocket book is interesting? | 4.44 | 88.8 |
| 6 | Do you think this pocket book is interesting overall? | 4.72 | 94.4 |
| 7 | Can this pocket book help make it easier to find out the nutritional content of rattan shoots in Sibado Village? | 4.64 | 92.8 |
| 8 | Is the Latin writing used in this book correct? | 4.68 | 93.6 |
| | Total | 36.64 | 732.8 |
| | Average | 4.58 | 91.6 |
| | Description | | Very Worthy |

***Percentage of Average Results of Pocket Book Feasibility Test***

The validation results by the expert, based on the average value of the feasibility of the learning resources in the form of e-pocket books, it is categorized as very feasible to used as a learning resource and can support the learning process, with the percentage 81.7%.

Table 12. Average Percentage of E-Pocket Book Feasibility Test

| No | Validator | Validation Score (%) |
|---|---|---|
| 1 | Content Expert | 77.5 |
| 2 | Design Expert | 82.5 |
| 3 | Media Expert | 75.5 |
| 4 | Student Group | 91.6 |
| | Total | 326.87 |
| | Average | 81.7 |

***Determination of Fat Content***

The nutritional content of rattan shoots, namely the fat content in rattan shoots found in Sibado Village. Determination of fat content in noko rattan shoots (Daemonorops robusta Warburg) using the soxhlet extraction method, soxhletation was carried out using a soxhlet apparatus, the process with a filtration system with a repeated vapor-liquid circulation process using the same solvent with heating in direct contact with the sample, so that the ability to extract samples is good without depending on the amount of solvent [50]. The sample used in this study was noko rattan shoots in a fresh, wet state. Table 1. informs that the fat content in noko rattan shoots obtained an average result of 0.332%. The results of this study indicate that the fat content in noko rattan shoots is the same as the Indonesian Ministry of Health, stating that rattan shoots have a fat content of 0.3% per 100 grams of BDD.

Fat is an organic compound that is insoluble in water, but soluble in non-polar organic solvents, one of which is n-hexane. As a food ingredient, fat has an important role to be consumed by people who do heavy physical tasks, fat can provide a more attractive taste [51]. Fat functions as a provider of reserve energy, a carrier of essential nutrients, and as a protector of soft body organs [52]. Fat can also dissolve various vitamins, namely vitamins A, D, E, and K. Therefore, consuming foods that contain fat will guarantee the provision of these vitamins for the body's needs and fat in the body has an important role, because the reserve fat in the body can protect various important organs [53]. When viewed from its fat content, which is based on research results that the fat content in noko rattan shoots in 100 grams is 0.332% which means it is in the low category. so that this rattan vine can be consumed daily by all levels of society, both children, adolescents, adults and the elderly. WHO recommends that fat intake is no more than 30% of total energy intake per day or equivalent to 67 grams of fat per day, if energy requirements are 2000 calories or equal to 5-6 spoons. Thus, if reviewed from the fat content of the noko rattan vine obtained, it is 0.332% and is included in the low category. The habits and hobbies of the Sibado people consume rattan vine to be used as a complementary vegetable for food. It can be said that rattan vine can help meet daily fat needs if combined with other foods.

***Protein Content Determination***

Nutritional content of rattan noko shoots, especially protein content. Spectrophotometric protein testing is an instrumental analysis method based on the interaction between energy and matter. Determining the concentration of a substance by measuring the absorption of light at a certain wavelength. In this case, the wavelength chosen is the one that provides the greatest absorbance, and is usually the most extreme wavelength.

The working principle of spectrophotometry involves the phenomenon of light absorption by certain chemical compounds, especially in the ultraviolet and visible regions. This process helps identify and measure the extent to which certain materials can absorb energy at certain wavelengths. This approach allows the determination of the concentration of certain substances in a sample based on increased light retention at specific wavelengths [54]. Protein is one of the nutritional components needed by the body to form and repair tissue in the body. Protein has an important role as a functional and structural component in all body cells [55]. Protein is also one of the largest parts of the body after water which has a special function that cannot be used by other nutrients such as building and maintaining body cells and tissues [56].

The results of the study of the analysis of the protein content of rattan shoots in fresh wet conditions were weighed as much as 5 grams with 3 repetitions so that an average value of 2.110% was obtained. The results of this study indicate that the fat content of noko rattan shoots is relatively low with the Indonesian Ministry of Health, which states that rattan shoots have a protein content of 2.4% per 100 grams of BDD. The difference in protein content between the results obtained by researchers and the Indonesian Ministry of Health is due to the different types of rattan shoots used. Fulfillment of protein needs based on the Nutritional Adequacy Rate (AKG) of each person varies, this depends on age, gender and certain diseases. For adults, it is necessary to consume 65-75 g / day of protein. Rattan shoots with a concentration of 5 grams contain 2.110% protein, so consuming 10 g / day of rattan shoots can meet protein needs of 4.22%. The habit of the people of Sibado Village of consuming rattan shoots as a vegetable complement to food, with a protein content of 2.110%, can help meet daily protein needs.

***Determination of Carbohydrate Content***

The nutritional content of rattan shoots, especially carbohydrate content, uses proximate analysis with the carbohydrate by difference method, namely determining carbohydrates through calculations, not by subtracting 100 from the amount of % protein content, fat, ash and water. The results of the study and calculations showed that noko rattan shoots have a carbohydrate content with an average value of 6.082%. These results indicate that the carbohydrate content of noko rattan shoots is higher than the Indonesian Ministry of Health, which states that the carbohydrate content of rattan shoots is 5.5%. Carbohydrates are a basic need required by the body. Carbohydrates are important ingredients that produce energy sources and are often used as a good source of energy for the body. Carbohydrates come from plants and animals. The main function of carbohydrates is to produce energy, in the liver it is used as detoxification, in addition to helping the metabolism of fat and protein [57].

BPOM [58]explains that the need for carbohydrates is 50% -65% per day. The Adequate Nutritional Intake (AKG) especially carbohydrates per day, namely women aged 19-49 years need 309-312 grams and men need 375-394 grams per day and for babies/ children need 58-254 grams per day. Fresh rattan shoots in 100 grams of BDD contain 6,082% thus consuming rattan shoots can be said to be able to meet the body's daily carbohydrate needs if consumed as a complement to staple foods such as rice.

***Utilization of Research Results as Learning Resources in the Form of Pocket Books***

Learning resources are all sources that can be used by students in learning. These sources can be people (educators), data (learning materials or materials), environment (where learning takes place), methods (methods or techniques applied by educators in the learning process), and media (tools used by educators in the learning process) [59]. The e-pocket books that have been designed in this study refer to a standardized book framework including title, page title, introduction, main chapter, conclusion, references and appendices [28], [29]. The results of the nutritional content assessment of rattan shoots in Sibado Village were used as learning resources in the form of e-pocket books.

The feasibility of the pocket books made as learning resources was validated by a team of experts, namely content experts, design experts, and media experts to find out the weaknesses of the e-pocket books. The validation results of the e-pocket book media by content experts were 77.5%, design experts 82.22%, and media experts 75.55%, so that the e-pocket book is suitable for use as a learning medium. Furthermore, the e-pocket book was tested for its suitability on 25 students of the Biology Education Study Program and a percentage value of 91.6% was obtained. After validation carried out by a team of experts and students, an average value of 81.7% was obtained. Through the results of the assessment, the pocket book is very suitable to be used as a learning medium as explained by [60] that the percentage category of a learning medium is said to be very suitable if it reaches 81-100%.

The findings of this study hold several educational implications. First, the nutritional data of rattan shoots can be utilized as a real-world example to teach biology and environmental science in culturally relevant ways. Second, the development and validation of a local wisdom-based e-pocket book exemplify how indigenous food sources can be transformed into engaging educational materials. Practically, this resource can be used in rural schools to improve student engagement and awareness of local biodiversity, while also supporting

food education and environmental conservation efforts. These implications suggest the potential for integrating local knowledge into formal education to create more meaningful learning experiences.

While the study offers promising insights, it also has several limitations that should be acknowledged. First, it focuses exclusively on one species of rattan (*Daemonorops robusta*) from a specific region (Sibado Village), which may limit the generalizability of the results. Second, the educational implementation was limited to validation stages and did not measure long-term learning outcomes. Future research should therefore include classroom-based experimental trials to evaluate the effectiveness of the e-pocket book in enhancing students' knowledge, attitudes, and behaviors related to local food and sustainable consumption. These further explorations are essential to strengthen the evidence base and refine the educational applications of indigenous resources.

Building on both the implications and limitations of this study, several recommendations are proposed to support more contextualized and culturally relevant education. Educators are encouraged to incorporate local plants such as rattan into teaching materials to strengthen students' cultural identity and enhance the connection between learning and their environment. In line with this, curriculum developers should consider integrating local biodiversity into science and health education, particularly within rural and indigenous communities. To further support these efforts, policymakers are urged to facilitate the production and distribution of localized educational resources, such as e-pocket books, to improve access to culturally appropriate learning tools. Finally, expanding future research to include other indigenous plants can help uncover their broader educational value across various academic disciplines.

## 4. CONCLUSION

The results of the evaluation of the nutritional content of rattan shoots in Sibado Village with the Noko rattan proximate analysis showed that the average fat content was 0.332%, the protein content was 2.110% and the carbohydrate content was 6, 082%. The results of this study are very suitable to be used as a learning resource in the form of a pocket book with a percentage of 81.7% and integration as a for local Wisdom-based education in Sibado Village.

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