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Proximate Analysis of *Cocos nucifera L.* (Coconut) Haustorium

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Abstract: *Cocos nucifera L. (Coconut) haustorium, a spongy tissue formed during coconut germination was analyzed to determine its active constituents. The major active constituents of Coconut haustorium were determined using standard methods of AOAC for proximate analysis. This includes moisture, ash, fiber, protein, fat and total carbohydrates. Results for proximate analyses indicate that 100g of dried coconut haustorium contained moisture, ash, crude fiber, crude protein, crude fat, and total carbohydrates and found to be 88.52%±0.18, 1.20%±0.02, 1.32%±0.07, 7.92%±0.04, 11.75%±0.33, and 1.13%±0.46 respectively. The study showed that coconut haustorium is a good source of fat and protein and minimal source of ash or total minerals, fiber, and carbohydrates. Further studies are needed for product development using this sample.*

Keywords— Proximate analysis; Coconut haustorium

1. INTRODUCTION

1.1 Background of the Study

The coconut haustorium is the embryo of plant that grows inside of the coconut seed to make an organ of spongy mass or spongy tissue called "apple" or commonly known as "buwa". It is usually picked out and consumed. The milky tissues are intended to feed the growing embryo within a coconut while the embryo's leaves and roots develop outside of the fruit. The roots appear to be like an umbilical cord connection that allows the young plantlet to absorb from within the coconut.

In addition, coconut haustorium is believed to possess many benefits that support immune system health. It is anti-viral, anti-bacterial, and anti-parasite. It also improves digestion and absorption of nutrients, vitamins and minerals. Thus, it helps insulin secretion and symptoms associated with diabetes. It is also believed that it helps to protect the body from cancers that is due to insulin reduction. It reduces risk of heart health and improves good cholesterol. It protects against kidney failures and bladder infection and it also promotes weight loss. Recent studies show that coconut haustorium possess significant cardioprotective and antioxidant properties during isoproterenol-induced myocardial infarction in rats.[1]

Although coconut haustorium or buwa (in Visayan language) is widely known, it has limited information in literature. Most people especially in rural areas usually consider it as a waste material in coconut meat production.

In this connection, it is imperative to determine the active constituents, specifically the moisture content, ash (total minerals) content, crude fat, crude fiber, crude protein and total carbohydrates present in coconut haustorium as there are no studies conducted on the proximate analysis of this material.

1.2 Objectives of the Study

This study primarily aimed to analyze the *Cocos nucifera L.* (Coconut) haustorium using proximate analysis. Specifically, this study intends to determine the following in this sample as to:

1. Moisture Content
2. Ash Content
3. Crude Fiber
4. Crude Protein
5. Crude Fat
6. Total Carbohydrates

1.3 Significance of the Study

Generally, fruits are generally known as good source of nutrients and supplements for food in a world faced with the problem of food scarcity. They are known as excellent source of nutrients such as minerals and vitamins as well as carbohydrates. Fruits are vital portion of an adequate diet and serve as food supplement and as an appetizer. Fruits, seeds and leaves of many plants that already form common ingredients in a variety of traditional native dishes for rural populace and coconut play a big role for sustaining food. Coconut is always considered as a source of fiber, food, energy; a raw material for various food and non-food uses.[2]

This study intends to increase awareness and knowledge about the nutritional properties of the food constituents of coconut haustorium which will contribute to a greater body of information for food manufacturers and consumers. This would help future researchers find a potential source of useful information in developing nutritionally balanced formulations using coconut haustorium that would help improve the quality of life or health status of the society.

1.4 Scope and Delimitation

The proximate determination of the major food constituents of coconut haustorium of Tagnanan Tall (TAGT) coconut variety is used. It focused on the moisture content (wet basis), ash content, crude fiber, crude protein, crude fat (dry basis) and total carbohydrates based on the procedure described in Association of Official Analytical Chemists (AOAC). [3]

2. METHODOLOGY

2.1 Sampling

2.1.1 Collection of Samples

Germinated coconut samples were obtained from the local market at Magay Street, Zamboanga City. The presence of coconut haustorium in the germinated coconut seed was determined by the presence of coconut shoot, coming out of the coconut fruit.

2.1.2 Preparation of Samples

The germinated coconut seed samples were cut into half using bolo without damaging the coconut haustorium. The coconut haustorium was separated from the seed by wedging with spoon. The haustorium was sliced into smaller pieces and oven dried at 105 degrees centigrade (105°C) until dried and blend to homogenize and this sample was transferred to a resealable plastic pack container and refrigerated in freezer until needed.

2.2 Proximate Analysis Procedure of *Cocos nucifera L.* (Coconut) haustorium

2.2.1 Moisture Content Determination

Weight of the crucible was measured. Right after the sampling step, was added to the pre-weighed crucible then heated for 4 hours at 105ºC in an oven. The crucible was removed from the oven and cooled at room temperature and was then transferred into the desiccator and then weighed. This was re-heated for 30 minutes and the process was repeated until the successive constant weights were achieved.

Calculation:

The percentage of moisture was calculated as follows:

$$\%\text{Moisture} = \frac{(w2-w1)-(w3-w1)}{weight\ of\ sample} x100$$

where:

w1= weight of empty crucible
w2= weight of crucible + sample before drying
w3= weight of crucible + dried sample after drying.

% Dry Matter = 100 - % Moisture

2.2.2 Ash Content Determination of *Cocos nucifera L.* (Coconut) haustorium

Five (5) grams of sample was added to a pre-weighed crucible. The crucible with sample was then dried in the oven at 100ºC and evaporated to dryness. The crucible was transferred to a Vulcan furnace at about 550ºC and was left there until a white or light grey ash results. Temperature was maintained for eight (8) hours. After eight (8) hours, the crucible with ash content was cooled at room temperature then moistened with distilled water. The crucible with sample was re-heated over a hot plate to slowly dry the ash then re-ashed in the Vulcan furnace at 550°C to constant weight.

Calculation:

The calculation of the total ash as a percentage of the original sample was given that:

$$\%\ \text{Ash} = \frac{(w3-w1)}{(w2-w1)} x100$$

where:

w1 = weight of empty crucible
w2 = weight of crucible + sample before ash
w3 = weight of crucible + ash

2.2.3 Crude Fiber Determination

For this part the homogenized coconut haustorium sample was brought to Department of Science and Technology IX, Regional Standard and Testing Laboratories, Pettit Barracks, Zamboanga City for crude fiber analysis.

2.2.4 Protein Content Determination

One (1) gram of sample was weighed and was placed in the digestion flask. Fifteen (15) ml of concentrated H_2SO_4 and 7.9 grams of catalyst mixture were added in the digestion flask. The sample was digested for 1 hour and 30 minutes at 420ºC. After the digestion this sample was allowed to cool and with caution 80 ml of distilled water was added to the flask. The cakes appeared and were dissolved by shaking the tubes.

Three (3) Erlenmeyer flasks containing 30 ml of 4% boric acid solution were prepared. The digested samples were distilled and collected. This digested samples were transferred to the prepared flask and were titrated with standardized 0.2N HCl solution.

Calculation of protein:

$$\%\ Protein\ = \frac{(V_{HCl} - Blk)N_{HCl}\ \times\ 1.401\ \times 6.25}{Ws}$$

Elements:

V_{HCl} – Volume of HCl used to titrate the distillate
Blk – Blank
N_{HCl} – Normality of HCl
Ws – Weight of sample

2.2.5 Crude Fat Determination

Two (2) grams of dried ground sample were weighed in a filter paper. Thimbles were soaked in diethyl ether and constant weights of fat soxhlet flask were determined. The sample was placed into the thimble and was place in the fat extractor. One hundred fifty (150) ml of diethyl ether was added to the fat extraction set-up. Fat was extracted with

diethyl ether for 10 hours. The fat extracted was first air-dried for 10 minutes and then oven dried at 105ºC until constant weight was obtained.

Calculation of fat extract:

$$\% \text{ Fat} = \frac{\text{weight sample before extraction} - \text{weight sample after extraction}}{\text{weight of the sample}} \text{x}100$$

2.2.6 Total Carbohydrates Determination of *Cocos nucifera L.* (Coconut) haustorium

All other estimated fractions of proximate analysis were used to calculate the total carbohydrate content. The total % carbohydrates is calculated based on the given formula.

% Total Carbohydrates = 100- [%Moisture + %Ash + %Protein + %Fiber]

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3. RESULTS AND DISCUSSION

Proximate Composition of *Cocos nucifera L.* (Coconut) haustorium

Table 1 show the results on the moisture and ash content of *Cocos nucifera L.* (Coconut) haustorium.

Table 1 Results for Moisture and Ash Content of *Cocos nucifera L.* (Coconut) haustorium

Replicate	% Moisture Mean (SD)	Grand Mean	% Ash Mean (SD)	Grand Mean
Replicate 1	88.47±0.33	88.52±0.18	1.175±0.02	1.20±0.02
Replicate 2	88.75±0.05		1.196±0.04	
Replicate 3	88.30±0.17		1.220±0.01	

The results for moisture content reveal a grand mean percentage of 88.52 and standard deviation of ±0.18. This shows that the moisture content of coconut haustorium is reliable and is relatively high since the coconut haustorium, is naturally surrounded with its water inside the coconut. Hence, coconut haustorium is high in its moisture content, which is indicative of low dry weight matter.

Ash content measures the total mineral composition of fruits. Results show that the ash content of coconut haustorium, has a grand mean of 1.20% and standard deviation of ±0.02. This means that ash content of the coconut haustorium sample is low, but a bit higher than generally fruits contain which is 0.2-0.8%. The percent ash of coconut haustorium implies that it has relatively minimal micronutrients present. [4]

Table 2 show of results crude fiber and protein of *Cocos nucifera L.* (Coconut) haustorium.

Table 2 Results for Crude Fiber and Protein of *Cocos nucifera L.* (Coconut) haustorium

Replicate	% Crude Fiber Mean	Grand Mean (SD)	% Crude Protein Mean (SD)	Grand Mean
Replicate 1	1.37	1.32±0.07	8.22±0.07	7.92±0.04
Replicate 2	1.32		7.79±0.03	
Replicate 3	1.31		7.53±0.03	

Visually, the coconut haustorium is spongy and watery and the yellow outer portion is the part only which is apparently fibrous. The result for crude fiber content shows a grand mean of 1.32% and standard deviation of ±0.07. From the results it is inferred that the coconut haustorium has minimal amount of crude fiber as compared to the percentage fiber in coconut meat that is 8%. This implies that it is less beneficial for human consumption since there is less action on fecal volume and produces an effect on carbohydrate and lipid metabolism. [5]

On the other hand, the coconut haustorium sample shows a grand mean percentage of 7.92 and standard deviation of ±0.04 as to its protein content which is higher than most plants have (<5%). The percent crude protein content of coconut haustorium is relatively high in comparison to the raw coconut meat that contains about 5% of crude protein. This implies that coconut haustorium may possibly contain high amount of essential amino acids that is needed by the body and utilized as a source of energy and is beneficial for human in preventing the conditions such as hypertension and osteoporosis. [6]

Table 3 shows the results on crude fat and total carbohydrates of *Cocos nucifera L.* (Coconut) haustorium.

Table 3 Results for Crude Fat and Total Carbohydrates of *Cocos nucifera L.* (Coconut) haustorium

Replicate	% Crude Fat Mean (SD)	Grand Mean	% Total Carbohydrates Mean	Grand Mean (SD)
Replicate 1	11.70±0.32		0.77	

Replicate 2	11.87±0.38	11.75±0.33	0.98	1.13±0.46
Replicate 3	11.66±0.28		1.64	

As observed physically, the coconut haustorium is oily especially in the straw yellow portion of it. Result shows that its crude fat content gives a grand mean percentage of 11.75 and standard deviation of ±0.33. The crude fat content of coconut haustorium implies that it has relatively low amount of crude fat as compared to percent fat present in coconut meat, which is 41%. However, the results apparently indicate that coconut haustorium contains fats.

As for the total carbohydrate content results indicate that the coconut haustorium sample has a grand mean percentage of 1.13 and standard deviation of ±0.46. Coconut haustorium is relatively minimal in comparison to the coconut meat as a whole contained 4% of the total carbohydrates. This means that coconut haustorium sample contain less carbohydrates.

Table 4.2 shows the summary of results of the proximate analysis of *Cocos nucifera L.* (Coconut) haustorium as to its composition.

Table 4.2 Results for proximate analysis of *Cocos nucifera L.* (Coconut) haustorium as to its composition

Parameter	Mean	Standard Deviation
Moisture	88.52	±0.18
Ash	1.20	±0.02
Fiber	1.32	±0.07
Protein	7.92	±0.04
Fat	11.75	±0.33
Total Carbohydrates	1.13	±0.46

Results on the analyses of the *Cocos nucifera L.* (Coconut) haustorium shows the grand mean and standard deviation for moisture content of 88.52±0.18, for ash content of 1.20±0.02, for crude fiber of 1.32±0.07, for crude protein of 7.92±0.04, for crude fat of 11.75±0.33, and for total carbohydrates of 1.13±0.46 respectively.

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4. SUMMARY, CONCLUSION, AND RECOMMENDATION

This study primarily aimed to analyze the *Cocos nucifera L.* (Coconut) haustorium using proximate analysis. Specifically, this study intends to determine the following in this sample in terms of moisture content, ash (total minerals) content, crude fiber, crude protein, crude fat, and total carbohydrates.

To determine the moisture, ash, crude fiber, crude protein, crude fat, and total carbohydrates content of the sample *Cocos nucifera L.* (Coconut) haustorium, proximate analysis was used to carry this out based on the procedure described in Association of Official Analytical Chemists (AOAC).

Results of the *Cocos nucifera L.* (Coconut) haustorium show the grand mean and standard deviation for moisture content of 88.52±0.18, for ash content of 1.20±0.02, for crude fiber of 1.32±0.07, for crude protein of 7.92±0.04, for crude fat of 11.75±0.33, and for total carbohydrates of 1.13±0.46 respectively.

An in-depth study of the *Cocos nucifera L.* (Coconut) haustorium needs to carry out for the determination of the mineral and vitamin, and composition of amino acids present. Since Tagnanan is the variety of the coconut haustorium utilized in this study it is suggested to utilize other or different varieties of coconut seed to study for product development.

5. REFERENCES

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