Project Report

On

"Proximate Analysis of the Seed of *Pterygota alata*"

Submitted by:

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Date of Submission: 20 June, 2021

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Certificate of Approval

This is to certify that research work presented in this report entitled "Proximate Analysis of the Seed of *Pterygota alata"* is being submitted by Nafisa Tabassum Sosy (ID: 163-34-558) to the Department of Nutrition and Food Engineering, Daffodil International University is her authentic work.

It is further certified that the project report is recommended for submission for the partial fulfillment of the degree Bachelor of Science in Nutrition and Food Engineering.

NAkter

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Dr. Sheikh Mahatabuddin
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Letter of Transmittal

Date: 20 June, 2021
Dr. Sheikh Mahatabuddin
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**Subject:** Submission of Project Report on "Proximate Analysis of the Seed of *Pterygota alata*"

Dear Sir,

This is a pleasure to me to get the opportunity to submit the project report on "Proximate Analysis of the Seed of *Pterygota alata*" as a part of Bachelor degree in Nutrition and Food Engineering.

This report is prepared by based on the gained knowledge and found results after conducting several experiments during the research work. I have put my best effort to make the report valuable. I hope the report can serve its purpose.

I will be highly obliged if you kindly accept this report and give your valuable judgement.
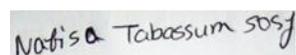
Sincerely yours,
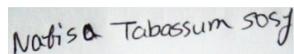
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Declaration

This project report entitled "Proximate Analysis of the Seed of *Pterygota alata"* is being submitted to the Department of Nutrition and Food Engineering, Faculty of Allied Health Sciences, Daffodil International University, Dhaka, Bangladesh as a requirement of the fulfillment of BSc. in Nutrition & Food Engineering. This project report is unique and carried out by Nafisa Tabassum Sosy's authentic work.

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Acknowledgement

At the beginning I want to show my gratitude to the Almighty Allah to give me strength to accomplish the project work successfully.

I want express my cordial gratitude supervisor **Nasima Akter Mukta**, Lecturer (Senior Scale), Department of Nutrition & Food Engineering, Daffodil International University for her continuous supervision and suggestion without which the project work could not be conducted properly.

I would also like to show my gratitude to **Dr. Sheikh Mahatabuddin**, Head, Department of Nutrition & Food Engineering, Daffodil International University and to **Professor Dr. Ahmad Ismail Mustafa,** Dean, Faculty of Allied Health Sciences for their valuable support during the research work.

I express my gratefulness towards the entire **Nutrition and Food Engineering Department** to provide me with the necessary facilities to complete the research work.

Abstract

Present study aimed to analyze the seed of *Pterygota alata* that is commonly known as Buddha coconut. The seed of *Pterygota alata* was analyzed to establish its nutritional composition. The result of the proximate analysis revealed that the seed contains 9.93% moisture, 1.88% ash, 24.64 % protein, 42.18% fat, 21.37% carbohydrate and 563.66 kcal/100g caloric value. Due to its low moisture quantity the seed could be stored for a longer time. The seed may be used as dietary supplements for its appreciable amount of protein and fat content. It could be an interest as a raw material for oil production industry for its high fat percentage. Along with this, the seeds could also be used as an ingredient of animal feed because of its low ash content.

Chapter 1: Introduction

1.1 Introduction:

Pterygota alata (Buddha Coconut) is a non-conventional plant of Bangladesh. It belongs to Malvaceae family. It is an evergreen tree usually grows to 30-35 meters tall. It has straight, cylindrical bole [1,2].The tree is found mainly in the East Asian countries. In Bangladesh, it can be found in the hilly forests of Chittagong and Sylhet as well as in the botanical gardens as ornamental tree [3]. Leaves are ovate-heart-shaped, 10-25 cm long, 7-15 cm wide. Fruit is woody and big, 7-12 cm in diameter, obliquely round. Seeds are covered with pod, compressed in 2 rows, winged. It was reported and noticed that seeds are eaten by the local people[1,4]. Oil is also can be extracted from the seeds [1]. Researchers found antioxidant properties from bark and leaves of the plant [5,6]. However, a little research has conducted with this plant.

Pterygota alata seed is a nut type seed. Nuts are among the nutritionally concerned food source which are taken in the balanced diet. Because most of the nuts are source of protein and fat with little amount of carbohydrate. The caloric value, protein quantity and quality, and overall nutrient content of seeds and nuts are quite good [4]. These constituents make the nuts and seeds important to the food processors and for food industry as well. Analyzation of seed and nut help to understand the quality of the particular seed or nut and to make new products.

1.2 Origin of the study:

Daffodil international University offers research facilities in the laboratories of the institution. A project or Thesis report is a requirement for completing the graduation in Nutrition and Food Engineering. The report was made by me based on my own experience and research work.

1.3 Objective of the study:

Analysis of unfamiliar seeds is important as there is little or no information on their composition and uses. Analysis of the seed of *Pterygota alata* will help to understand the nutritional profile of the seeds and making the best use of them in various applications. Good nutrition is a basic human right and important to stay healthy. The potentiality of many rare and non-conventional plant seeds like *Pterygota alata* have not recognised yet.

Main objectives of the study:
- To understand the nutritional profile of the seeds of *Pterygota alata.*
- To bring the seeds into sharp focus by highlighting their immense potential.
- To encourage further research and study related the seeds of *Pterygota alata.*
- To understand application of the seeds as a food source.

1.4 Limitations of the study:

➢ The pandemic situation created for the COVID-19 was the main problem for not able to conduct some of the analysis.

➢ The lacking of some machineries is a reason behind not able to conduct some test properly.

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Chapter 2: Methods and Materials

2.1 Sample Preparation

Fruit Collection:

Fresh and matured fruits were harvested from The National Botanical Garden, Mirpur 1, Dhaka. Fruits were taken to the laboratory of the Dept. of Nutrition and Food Engineering for further processing.

Figure 2.1: a) *Pterygota alata* Fruit; b) Winged seeds in a *Pterygota alata* Fruit

Seed Processing:

- Separation: Seeds were separated from the fruit.
- Winnowing: Wings and shells were removed from the seeds by the help of knives.
- Cleaning: Some dirt and foreign materials were removed.
- Drying: Seeds were then oven dried at 60ºC for 3 hours until the moisture content was less than 8.
- Size Reduction: Then the seeds were finely ground by the food grinder.
- Storage: Ground seed sample were kept in sealed polyethene bags and stored at -20ºC.

Figure 2.2: a) Dried Seeds of *Pterygota alata*; b) Powdered seed Sample

2.2 Proximate Analysis of *Pterygota Alata* Seed

2.2.1   Moisture Analysis:

Moisture is an important of any food properties. Because it will help to understand about the longevity of the product storage life. Higher amount of moisture facilitates microbial growth and thus shorten the storage time of the product. Moisture analyzing of the seeds of *Pterygota alata* was done by the Digital Moisture Analyzer (Model: XY – 105 MW).

Apparatus and Machineries:
- Digital Moisture Analyzer
- Mortar and Pestle
- Spatula

Procedure:

1   Some fresh cleaned seeds were taken in the mortar.
2   Then seeds were then crushed with the pestle.
3   About 1g of crushed seeds were placed on the tray of the analyzer.
4   The result showed by the analyzer was noted.

2.2.2   Determination of Ash Content:

Ash content determination is done for understanding the total amount mineral compounds present in the food product. The quality of many foods depends on the concentration and type of minerals they contain, including their taste, appearance, texture and stability. High mineral contents sometimes inhibit the growth of certain microorganisms. Some minerals are useful for human diet like phosphorous, sodium, calcium, potassium etc.

Apparatus and Machineries:
- Muffle furnace
- Crucibles and lids
- Weighing machine
- Desiccator with desiccants

Procedure:

- ➤ At first crucible was washed with distilled water and then preheated at 105⁰C for 1 hour.
- ➤ After cooling the crucible in desiccator its weight was taken.
- ➤ ~1g of powdered seed sample was taken in the crucible and the lid was half closed.
- ➤ Then the crucible was placed in the preheated muffle furnace and kept for heating at 600⁰C for 6 hours.
- ➤ Then the crucible (with ash) was cooled in the desiccator and weight was taken.

Calculation:

The formula followed for the determination of Ash Content:

$$\text{Total Ash \%} = \frac{(W2 - W)}{W1} \times 100$$

Where,

W2= weight (g) of Crucible with Ash
W = weight of empty Crucible
W1= weight of sample

Figure 2.3: Ash Content from the seed sample

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2.2.3 Determination of Fat Content

Determination of fat content is must needed for understanding the nutritional profile of a food or food product. Fats don't dissolve in water but they dissolve in organic solvents like Hexane, Petroleum Ether etc. Fats are triglycerides which are mainly produced by the linkage of glycerol and fatty acids. Although saturated fats are bad for health, unsaturated fats are healthy in many ways. Fats are found basically in animal and plant sources.

Solvent Extraction method was used for the extraction of fat from the *Pterygota alata* seed sample. Petroleum Ether (40-60⁰C) was used as solvent. Sample was placed in the soxhlet apparatus and solvent was heated at its boiling temperature. When the solvent siphons back it extracts the fat from the sample. Solvent was then evaporated with Vacuum Evaporator for getting the oil.

Apparatus and Machineries:

- Soxhlet Apparatus
- Condenser
- Round Bottom Flask
- Weighing Machine
- Thimble
- Measuring Cylinder
- Vacuum Rotary Evaporator

Reagent:

- Petroleum Ether (40-60⁰C)

Procedure:

- Weight of empty round bottom flask was noted and 250 ml of Petroleum Ether was taken in the flask.
- Around 25g of powdered sample was taken into the thimble and then thimble was placed into the soxhlet apparatus.
- Then the flask containing solvent was heated at 50⁰C and extraction was carried out for 8 hours.
- The solvent was evaporated by a rotary evaporator at 45⁰C under low pressure.
- After complete evaporation of the solvent, weight of round bottom flask containing oil was measured.

Calculation:

$$\% \text{ Of Fat} = \frac{\text{weight of flask containing oil} - \text{weight of empty flask}}{\text{Weight of seed sample}} \times 100$$
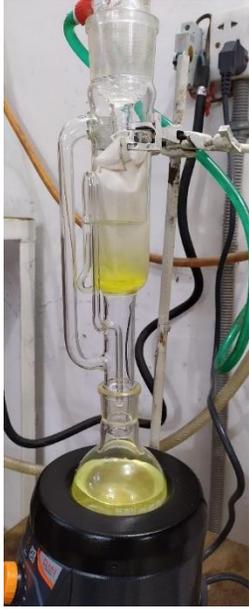
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Figure 2.4: a) Extraction of fat by Soxhlet Apparatus;

b) Evaporation of solvent by Rotary Evaporator; c) Extracted oil

2.2.4   Determination of Protein Content:

Protein is the structural component of foods. They are building block of cells, very important component for human body. They are a major source of energy, as well as g essential amino-acids. Determination of protein content was done by using Kjeldahl Method described in AOAC 2001.11 [7]. In Kjeldahl method, Sample is digested with a strong acid so that the nitrogen of the sample converts into ammonia which is then trapped in the form of ammonium ion in a receiving acid after neutralizing with base during distillation. Ammonium ion concentration in the acid solution, which is equivalent to the amount of nitrogen in the sample is measured via titration with Acid.

Reagents:
- Concentrated H_2SO_4
- Catalyst Mixture: $K_2S_2O_4$: $CuSO_4 = 7$: 0.8
- 40% NaOH solution
- Methyl Red and Bromocresol Green indicators
- 4% Boric Acid (H_3BO_3) Solution
- 0.1M HCL

Procedure:

❖ *Digestion*
  - ➢ Around 1 g of powdered seed sample was taken to the digestion flask.
  - ➢ 15ml of H_2SO_4 and 7.8g of catalyst mixture was added.
  - ➢ The solution was heated at about 420⁰C.
  - ➢ Heating was stopped when all the fume is gone and the solution was clear.
  - ➢ Flask was cooled.

❖ *Distillation*

  - ➢ Digested sample solution was transferred to distillation flask and diluted by enough dist. water to make the volume 80ml.
  - ➢ Then 50 ml NaOH was added.
  - ➢ 30ml of H_3BO_3 with indicator was taken in the receiving flask.
  - ➢ The sample solution was heated and the distillation was stopped when volume of receiving flask increased up to at least 150 ml.

❖ *Titration*
  - ➢ Titration of the receiving solution was done against 0.1M HCL to purple gray end point.

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Calculation:

$$\text{Nitrogen \%} = \frac{(V_S - V_B) \times M \times 1.401}{W}$$

Crude Protein % = Nitrogen % × 6.25

Where,
V_S = ml of HCL needed to titrate test
V_B = ml of HCL needed to titrate blank
M = Molarity of HCL
W = Sample weight (g)

Figure 2.5: a) Reagents and solutions for the protein determination;

b) Digestion of sample during protein determination

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2.2.5   Determination of carbohydrates:

Carbohydrate is one of the major essential macronutrients which the main source of energy. Besides, it also participates in many body metabolisms.
Carbohydrate content of the seed was calculated by difference:
Total Carbohydrates (without fiber) =100 – (Ash% +moisture%+ Protein% +Fat %)

2.2.6   Estimation of calorific value

The calorific values (kcal/100g) of the seed was calculated with the help of the Atwater factors of protein, fat and carbohydrate as reported by (Onyeike et al, 1995)[8].

Calorific value (kcal/100g) = (% protein×4) + (% fat×9) + (%carbohydrate ×4)

Chapter 3: Result and Discussion

Moisture Content:

Moisture content found from the seed sample of *Pterygota alata* was 9.93% which is nearly an acceptable value as a report recommended that moisture of legumes should range between 7.0% and 11.0% [9]. The low moisture content of the seeds shows that it be stored for a long time without being at risk of microbial attack.

Ash Content:

Ash content is the indicator of mineral content of a sample. Total ash content found from the seed powder of *Pterygota alata* is 1.88%. It has been recommended that ash contents of nuts, seed and tubers should be within 1.5-2.5% to be suitable for animal feeds [10]. So, the seed can be recommended for animal feeds. Ash content found form the seeds are relatively lower than some other reported seeds of Malvaceae family [11].

Fat Content

The oil extracted from the seeds of *Pterygota alata* is 42.18% which is higher compared to reported other seeds of *Malvaceae* family such as *S. monosperma* (12.04%±1.44), *Sterculia urens* (21.55% ±1.14), *Sterculia foetida* (32.44%), *Cola nitida* (5.71%±0.74) [12–15].The fat percentage of the seed is also comparable to the other fat rich seeds like soybean seed, cashew nut , watermelon seed containing 23.5%, 36.7% , 42.51% fat respectively [16,17]. As fat is an important nutrient in diet, it could be a source of dietary fat. Besides fats are raw materials for soap, lubricant, biofuel, paint, cosmetics etc. So, the extracted oil could be an industrial interest.

Protein Content:

Total investigated crude protein content from *Pterygota alata* seed sample is 24.64 %. The value is highly comparable to some of protein rich seeds and beans like soybeans, pumpkin seeds, gourd seeds cowpeas, pigean peas, watermelon seeds containing between 23.1- 33.0% of protein [18]. The reported value is lower than some of the seeds of Malvaceae family such as *Hibiscus sabdariffa* (35.35% ± 0.10), *Adansonia digitate* (29.79%±0.03) but higher than reported of *Pterygota macrocarpa* (7.21% ±0.12), *Sterculia monosperma* (7.77% ±1.05) [12,19–21]. However, it is rich of considerable amount of protein. The RDA for protein consumption for children of the age of 1-10 years ranges from 23.0-36.0g and for adult, 44-56g [22]. So, the seeds of *Pterygota alata* may provide enough protein to a child daily.

Carbohydrate Content:

Total Carbohydrate content calculated (by difference) is 21.37% which is relatively lower than some other reported Malvaceae seeds such as *Cola nitida* (28.56%), *Sterculia urens* (34.45%±1.61), but close to the value of *Adansonia digitate* (24.58 ± 0.50%) and *Sterculia setigera* (21.03±0.4%) [12,13,15,23]. As the seed contains relatively low amount of carbohydrate, it may not be recommended for a carbohydrate source. However, the seed contains a moderate amount of carbohydrate which could provide enough energy.

Calorific Value:

Calculated calorific value is 563.66 kcal/100g of seed sample. So, the seed can be a good source of energy from which about 40% of energy is coming from fat content of the seed. As excessive intake of fat can result weight gain, defatted seed residue can be a source of protein.

Table 1: Proximate analysis of the seeds of *Pterygota alata*:

Composition	Value *
Moisture (%)	9.93
Total Ash (%)	1.88
Fat (%)	42.18
Protein (%)	24.64
Carbohydrate (by difference) (%)	21.37
Calorific Value (kcal/100g)	563.66

* (All the tests were carried out in triplicate and the results are showed in mean value. Calorific value was calculated with the help of Atwater values of Protein, Fat and Carbohydrate [8])

**Chapter 4:
Conclusion**

Conclusion:

Seeds of unconventional plants can become important because they can be used as sources of food, medicinal products etc. The present work aimed to find out the nutritional value and possible application of the seed of *Pterygota alata*. Observed value for the moisture, ash, fat, protein, carbohydrate and calorific value were 9.93%, 1.88%, 42.18%, 24.64%, 21.37% and 563.66 kcal/100g respectively. It could be concluded that the seed contains a high amount of oil and protein compared to some other seeds. Thus, the seed could be a subject for oil extraction, and remaining content can be a source of high protein feed or food supplement. It could be suggested as a better ingredient of animal feed for its low mineral percentage. More research such as analysis of amino acids, fatty acids, specific mineral contents etc. is needed to get a complete nutritional profile of the seed.

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