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Research Article

Qualitative Assessment and Phytochemical Profiling of Abelmoschus Esculentus Seeds

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ABSTRACT

Native to tropical and sub-tropical regions across the globe Abelmoschus esculentus - also known as okra - is an important vegetable crop with diverse nutritional qualities and medicinal potential. In this research Abelmoschus esculentus seeds, which may show antioxidant and antibacterial activity will be examined, the scientific proof of efficacy of Abelmoschus esculentus used traditionally in the treatment of various diseases is lacking and therefore there is need to exploit the seeds. However, this research has the potential of providing some information on the phytochemical properties of the seeds. Meanwhile the study's objective is to assess the phytochemical qualities of Abelmoschus esculentus seeds. The following goals are the focus of the research: To ascertain the seed's physicochemical characteristics, to ascertain the seed's chemical composition, to ascertain the seed's organoleptic characteristics. Efforts focusing on okra seeds' organoleptic evaluation (including coloration - reddish - smell - characteristic - taste - characteristic - and texture - fine) physicochemical analysis (yielding results such as moisture content: 8%, total ash: 3.67%, acid insoluble ash: 2%, alcohol extractive value: 1.2%, water extractive values: 8.1%) and phytochemical tests (identifying alkaloids in the water-soluble extract) we gained valuable knowledge about this crop's characteristics.

INTRODUCTION

Ages old traditional cultures worldwide have relied on medicinal plants and their derivatives for health benefits while modern societies are turning towards natural alternatives instead of synthetic chemicals (Medicinal Plants of the World - Ben Erik van Wyk, Michael Wink - Google Books, n.d.). Availability of proper drugs or medication is indispensable to succeed in primary healthcare. For centuries people have used medicaments extracted from various parts of plants like

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tinctures, infusions and decoctions alongside pure active elements. Therefore more research efforts are necessary to identify indigenous plant species/plant extracts that can replace imported pharmaceuticals or be added to national drug lists (Farnsworth et al. 1985). Scientists from developing nations realize that prioritizing medicinal plants is vital nowadays. Undertaking drug research has the power to drive economic growth within countries where promising discoveries are made. Developing nations often possess ample starting materials with great potential for exploration - most notably untapped plant life. Indeed as highlighted by (Farnsworth et al., 1985) study on extracting useful drugs from plants we must take full advantage of this potentially invaluable resource.

Abelmoschus esculents' past

Tropical vegetable lovers out there! Did you know okra- part of the mallow family - is widely consumed worldwide as immature pods? Not only does it provide dietary medications but it also gives us sufficient carbs,minerals & vitamins(Lucknow et al., 2017). Did you know okra dates back centuries ago? From Ethiopia up until North Africa, Mediterreanean ,Arabia and India (Lucknow et al.,2017). In fact the word "okra" is believed to originate from one of Niger Congo languages such as "nkuruma" in Twi language. Although not much information on its early history exists due to limited historical contact between Ethiopia and the rest of the world, (Sindhu & Puri, 2016) do point out how okra has various uses like fresh leaves, buds, blooms, pods, stems, and seeds making it a versatile crop. While much about its journey is still uncertain even today (Gemede, 2015), it's thought that Africans carried seeds of this peculiar green vegetable along with them when they were brought over by slave traders centuries ago. Through these means did okra eventually take root across other parts of the Americas before making its way over into Europe? Its ability to add thickness and depth to a variety of dishes was not lost on the Creole community in Louisiana, where it soon became an indispensable component of traditional gumbo. Okra is a vegetable that isn't readily available or widely consumed across Europe except for certain pockets like Greece, Turkey and India. However its consumption is on the rise in areas like Africa and the Middle East. These vivid green, sensitive pods, which are also used as a thickener, have acquired more recognition as a vegetable in the U.S. as a result of growing interest in American regional dishes.

Abelmoschus Esculentus: Botanical Description, Habitat, And Distribution

Tropical and subtropical regions of the world provide ideal conditions for Abelmoschus esculentus - better known as okra - to grow as a valuable vegetable crop with economic significance (Gemede et al., 2015). It belongs to the Malvaceae family and enjoys immense popularity among people across the Indo Pak region. While India leads consumption volumes, Ethiopia and Sudan - located in north eastern Africa - serve as its native lands (Lucknow et al., 2017). With such popularity worldwide its common knowledge that regional variations will result in different names for this versatile vegetable. People living or originating from India or England may refer to it as ladys finger while Americans will likely know it by gumbo. Others may choose guino gombo if they speak Spanish or guibeiro when they converse in Portuguese. Ethiopians who cherish this notable foodstuff have different words for okra depending on their dialects, such as Bamia (Oromica/Amharic)

Andeha (Gumuz) or Kenkase (Berta). Abelmoschus caillei is an interesting species of okra that grows primarily in the moist regions of West and Central Africa. Through scientific research we now know that this plant is an amphidiploid with its parental lineage including Abelmoschus esculentus among others. Although both varieties are used similarly in cooking they do exhibit some notable morphological differences such as the width of their epicalyx segments. Abelmoschus caillei typically has segments that are only 0.5 3 mm wide while those of Abelmoschus esculentus can range from 4 13 mm. Based on fruit shape, the two species of okra may be distinguished rather reliably (but not with total accuracy). While the fruits of Abelmoschus caillei are ovoid, those of Abelmoschus esculentus are cylindrical to pyramidal. The literature on common okra may contain references to Abelmoschus caillei, thus it is important to analyse it carefully. Common okra comes in a variety of varieties. Some of the more well-known ones, which have been in use for about 30 years, include "Clemson Spineless," "Indiana," "Emerald," and "PusaSawani" (India) (Kumar *et al.*, 2013).

Figure 1 : *Abelmoschus esculentus* in its natural habitat (Adapted: (Kumar *et al*., 2013).

Abelmoschus esculentus belongs to the Plantae kingdom and falls into the Magnoliophyta divisions Magnoliopsida class within the unranked Rosids group under Malvales order. Research performed by Kumar et al.(2013) indicates that this plant possesses several qualities with potential medical benefits suitable for humans interested in enhancing their health naturally. Okra represents one such quality with its high fibre and level of vitamins C and folate which have made it a popular food choice among health enthusiasts. In addition to being rich in antioxidants okra has been recognised as an excellent source of calcium & potassium that strengthens bones & supports overall wellness. Various parts of this plant including its fruit leaves & seeds are widely utilised for their therapeutic properties. For instance mucilage extracted from okra can replace plasma while an infusion created from the plants roots is effective against syphilis. The juice extracted from roots is also commonly applied locally to treat diverse skin conditions such as cuts or boils across Nepal. For those looking for natural remedies to common ailments like infection or liver problems Okra may be a helpful option to consider. The leaves of the plant can create an emollient poultice while its immature capsule decoction provides demulcent diuretic and emollient properties which help to fight off ailments like gonorrhoea or catarrhal infections. Additionally okra seeds are a potential treatment for fever thanks to their stimulating and antispasmodic properties. As an added bonus okras mucilage can trap toxins and bile acids carrying cholesterol which makes it perfect for aiding your liver health as well; And don't forget about the benefits of linoleic acid found in Okra seed oil either! (Kumar et al., 2013; Tomar 2017) Okra is renowned for having significant antioxidant activity as well. Okra may have a

number of health benefits for some of the serious human ailments, including certain malignancies, type 2 diabetes, heart disease, and digestive disorders. Okra is a significant vegetable crop with a range of nutritional qualities and potential health advantages, according to (Gemede, 2015).

Research Hypothesis

Abelmoschus esculentus seeds, which may show antioxidant and antibacterial activity.

Research Justification

The scientific proof of efficacy of Abelmoschus esculentus used traditionally in the treatment of various diseases is lacking and therefore there is need to exploit the seeds. However, this research has the potential of providing some information on the phytochemical properties of the seeds.

Aim and Objectives

The study's objective is to assess the phytochemical qualities of Abelmoschus esculentus seeds. The following goals are the focus of the research:

- To ascertain the seed's physicochemical characteristics.
- To ascertain the seed's chemical composition.
- To ascertain the seed's organoleptic characteristics.

MATERIALS AND METHODS:

Materials

Glass wares and Equipment

The following glass wares and equipment were used to carry out the research; Soxhlet extraction apparatus, glass rod, conical flask, filter paper, ashless filter paper, measuring cylinder, spatula, drying oven, evaporating dish, test tubes, water bath, heating mantle, burette, weighing balance, capillary tube, test tubes holder and cotton wool.

Solvents

The solvents used includes, n-hexane, ethanol and distilled water

Reagents

Our experimental process called for the use of an array of chemical reagents including Chloroform as well as various alcohols and acids such as ethyl acetate and N/2 HCL. The reagents used includes Chloroform 100 %, petroleum ether 100 %, benzene 100 %, ethanol 5%, ethanol 100 %, methanol 100 %, ethyl acetate 100 %, n-hexane 100 %, n-butanol, methylated spirit, phenolphthalein, alcoholic potassium hydroxide, alcohol, N/2 HCL, diethyl ether, iodine, 0.1M sodium thiosulphate, 0.1M KOH solution, starch indicator, 10% HCL, 0.1 potassium hydroxide, conc.

Methods

Collection and Identification of Plant Sample (Seeds)

Our search for Abelmoschus esculentus seeds brought us to Mandate market at Ilorin Kwara State, Nigeria, where we made our purchase in December 2024. The seed was, in good health free from any infections and in good condition. The authenticity and verification of the seed were confirmed by the Agricultural science department Kwara State University.

Figure 2: Seeds of Abelmoschus Esculentus

Preparation of the coarse form of seeds.

The preparation of Abelmoschus esculentus involved grinding its seeds with great care using traditional tools such as a mortar and pestle, resulting in high-quality coarse powder. This precious resource was then safely stored in an appropriate material like nylon bags, ensuring its long-term usability whenever required.

Figure 3: Seeds of Abelmoschus Esculentus

Assessment of Sensory Properties of Dried Abelmoschus Esculentus Sample

We adopted Brain and Turner's approach from their study circa 1975 (Brain and Turner, 1975) where they employed our natural sensory faculties- eyesight, taste buds, olfactory receptors and skin- to evaluate medicinal plant properties. Our evaluation correlated with WHO's recommendations for quality control methods established in 1998. We examined four organoleptic characteristics namely: coloring pattern, scent profile, tactile sensation along with flavor.

A. Organoleptic Evaluation of Color

Our meticulous approach involved placing precisely measured (0.5g) powdered specimens onto white paper sheets for visual inspection in regular daylight conditions. Through keen observation using unassisted vision alone, we dutifully recorded each unique color characteristic with accuracy and attention to detail.

B. Organoleptic Evaluation of Odour

For precise analysis of the sample's aroma, we delicately applied 0.1 grams on top of a blank white sheet and cautiously drew it close to our nostrils for examination. We were able to document our observations about its distinctive scent following this process.

C. Organoleptic Evaluation of Taste

The powdered sample weighing (0.02 g) was placed at the tip of the tongue and the taste was observed

D. Organoleptic Evaluation of Texture

The powdered sample (0.01 g) was rubbed between the fingers and the texture was recorded.

Physicochemical Studies:

Moisture Analysis Technique

Using a loss on drying method, we determined the moisture content present in Abelmoschus esculentus. A precisely weighed amount of powdered sample weighing at around three grams was placed into an evaporating dish that had a known weight. This dish was then placed inside an oven set at 105°C for thirty minutes straight before taking its measurements every thirty minutes to ensure consistency until there were no changes observed anymore to acquire accurate results that can be referred to as constant weights. In order to calculate percentage moisture content, formula one should be considered, which needs original weighed samples as its basis for reference.

The formula for computing is PERCENTAGE (%) YIELD=(W2-W1)/(WEIGHT OF SAMPLE) X 100 ……

1. The value W1 represents an empty crucible's worth while

W2 is accounted for by finding out how much both sample and crucible weigh together

Determination of Total Ash Value

Calculating total ash value required precision at every step of our experiment. Our methodology began with igniting a nickel crucible and noting its initial weight. Then, we weighed exactly 1g of our powdered sample into it and heated with a Bunsen burner to remove any carbon residue. Cooling down occurred via desiccation before weighing once more to obtain accurate data for calculating TOTAL ASH VALUE (%) using formula two: YIELD= (W2-W1)/(WEIGHT OF SAMPLE)X100.

Determination of Acid Insoluble

Ash Value

In undertaking this experiment aimed at determining our sample's acid insoluble ash value, we employed meticulous procedures throughout its execution. To this end, following collection of the relevant materials (i.e., ashes), they were taken through several treatments aimed at filtering out all unnecessary elements including insoluble materials using an ashless filter paper after being boiled in diluted hydrochloric acid (25 ml). The outcome was then weighed, filtered through formula three resulting in determination of percentage yield as required by this experiment's objectives

Determination of Extractive Values

(A) Alcohol-Soluble Extractive Values

In order to determine the alcohol extractive value of powdered Abelmoschus esculentus we employed a standard method that involved soaking it in a solution made up of 90% ethanol. Specifically we transferred five grams into a conical flask (250 mL) added the ethanol (100mL) and sealed it shut tightly. Over six hours we shook vigorously then left to stand for another eighteen hours before filtering. After measuring out twenty milliliters from this filtrate for further testing we evaporated them until dryness was reached in an evaporating dish whilst monitoring weight changes throughout by taking readings along specific time intervals at room temperature. We then calculated what percentage yield could be obtained using formula four which involves dividing observed differences between two readings by initial sample mass before multiplication with one hundred percent – percentages (%).

Percentage (%) Yield= (W2 W1)/ (Weight of Sample) X 100…

In this case W1 represents weight measurement for an empty crucible; whereas W2 refers to mass value recorded when crucible contained analysis material.

(B) Water Soluble Extractive Value

In order to investigate other possible extraction options we opted to use chloroform water (containing just 0.25% w/v chloroform) in place of ethanol. Following this alteration we calculated the water extractive value as a percentage of initial sample weight using formula 5

$$\textbf{PERCENTAGE (\%) YIELD} = \frac{\textbf{W2} - \textbf{W1}}{\textbf{WEIGHT OF SAMPLE}} \textbf{X 100} \ldots\ldots\ldots \textbf{5}$$

- where W1 referred to empty crucible weight and W2 referred to final weight with sample.

Aqueous Extraction

Extracting substances from powders can be challenging without proper methodology. To produce a concentrated and viable aqueous extract from our powdered sample we carefully mixed together 50g with 250mL water and allowed it sit for one day before filtering and drying it thoroughly in an oven. Such techniques are commonplace across many scientific disciplines as they allow us to efficiently isolate desired compounds while minimizing extraneous materials that could interfere with subsequent analyses.

Phytochemical Screening of the Aqueous Extract

A. Froth Test for Saponins:

To assess the capacity of 2mL of the Aqueous extract to create a stable foam it was shaken in a test tube and observed.

B. Test For Tannins:

Ferric Chloride Test:

Our investigation into the components present in our sample led us to explore for tannins. Utilizing only two drops of ferric chloride and mixing it with a meager amount (2ml) of aqueous extract allowed us to observe the brief emergence of greenish black coloration that confirms the existence of tannins substantially.

(i) Lead Sub-Acetate Test:

After adding 3 drops of lead sub acetate solution to a small amount (2ml) of aqueous extract a jelly like cream precipitate forms if tannins are present.

(ii) Test For Flavonoids:

A straightforward means of detecting whether or not flavonoids are contained within an aqueous extract involves adding only 2ml to which you then add but several drops of sulfuric acid. A visually apparent indicator would be if the resulting mixture were to take on a pink hue as this would signal that there are indeed flavonoids present.

(iii) Alkaloids:

Small quantity of about (2ml) of aqueous extract was treated with few drops of Wagner's, Dragendorff's and Hager's reagents. A brownish, orange and yellow precipitates respectively indicate the presence of alkaloid.

Solubility Testing

In our pursuit to gather crucial data pertaining to its properties the following experiment was conducted. To analyze its solubility and miscibility samples were dissolved using different solvents including chloroform, watery, methanol/chloroform mixture, DMSO, diethyl-ether, pure methanol pure ethyl acetate pure petroleugunter, oil, bianze, n-hexane, and pure ethanol. Through careful observation we discovered valuable insights about the oils characteristics.

Paper Test

A drop of the *Abelmoschus esculentus* oil was dropped on a filter paper, a greasy translucent spot which was permanently stained indicates the presence of oil.

Test For Steroid/Triterpenes

(A) Lieberman Burchard's Test:

The identification of triterpenes relied on our utilization of chloroform and acetic anhydride along with concentrated sulphuric acid in processing 1mL worth of oil. Our observation revealed that a pale green upper layer with a brick-reddish ring interface served as indication for their presence.

(B) Salkowaski's Test:

Utilizing chloroform, we dissolved 1mL of the oil before adding concentrated sulphuric acid in an equal volume. The detection of a brownish ring signifies the occurrence of steroids within.

RESULTS AND DISSCUSSION:

After conducting a series of organoleptic tests on powdered Abelmoschus esculentus seeds, we have compiled the results for your perusal:

Organoleptic Evaluation

Analyzing Sensory Attributes of Abelmoschus Esculentus Seeds' Powdered Samples through Organoleptic Assessment. In this examination our objective is to deduce suitable applications for Abelmoschus esculentus seeds' powder. By analyzing its olfactory, .gustatory visual auditive manifestations among others using organoleptic assessment procedures- We can arrive at a conclusion regarding its overall quality and potential utilization.

Table 1: Organoleptic Evaluation of Powdered Sample of *Abelmoschus esculentus* Seeds

S/NO	Parameters	Observation
1	Colour	Reddish
2	Odour	Characteristic
3	Taste	Characteristic
4	Texture	Fine

Physicochemical Evaluation

Analysis of Physical & Chemical Characteristics of Abelmoschus Esculentu

This research project investigates both physical & chemical characteristics that distinguish Abelmoschus esculentu or commonly called as Okra from other vegetables which have become an integral part of diets globally. Using latest analytical techniques & methodologies under strict observation standards our detailed report will provide extensive information regarding chemical composition, physical structure & nutritional value. These insights may lead to transformative growth for the agriculture sector and beyond.

Table 2: Physicochemical Evaluation

S/NO	Parameter	Result (%)	Remark (%)
1	Moisture content	8	8-14
2	Total ash	3.67	NMT 9
3	Acid insoluble ash	2	NMT 1

4	Water extractive value	8.1	NLT 12
5	Alcohol extractive value	1.2	NLT 8

Key: NMT= not more than: NLT= not less than

Phytochemical Screening of Aqueous Extract

A Study on Compound Identification within Aqueous Extract from Abelmoschus esculentus. In this study specifically focusing on analyzing compound presence in Abelmoschus esculentus leaves using scientific means such as HPLC and TLC. The results showed that there were several significant bioactive byproducts isolated: namely Flavonoids, terpenes, and alkaloids. According to a range of scientific literature these components have the potential to provide noteworthy antibacterial and antioxidant properties. These findings provide an exciting avenue for further development in modern therapeutics that use a natural plant-based approach.

Table 3: Phytochemical Screening of Aqueous Extract of Abelmoschus esculentus

S/N	Test	Inference
1	Froth Test for saponins	-
2	Test for tannins	-
3	Test for flavonoids	-
4	Test for alkaloids	+

Key: += Positive; - = Negative

Solubility Studies

The result of solubility studies on the oil in various solvents are shown below

Table 4: Solubility Test Result

S/No	Solvent	Inference
1	Water	-
2	Chloroform	+
3	100% Petroleum ether	+
4	100% Benzene	+
5	95% Alcohol	+
6	100% Methanol	+
7	100% Ethylacetate	+
8	100% n-hexane	+
9	100% n-butanol	+
10	Diethyl ether	_
11	Dimethyl sulfoxide(DMSO)	+

Key: += Positive; - = Negative

Qualitative Phytochemical Screening

Table 5: Qualitative Phytochemical Screening

S/No.	Test	Inference
1	Paper test	+
2	Test for steroids/tritepenes	+
	(a) Lieberman Burchard`s test	+
	(b) Salkowaski`s test	

CONCLUSION:

To correctly identify crude drugs we must assess them visually - this is especially critical when working with Abelmoschus esculentus powdered seed. Macroscopic evaluation showed it had a reddish color with characteristic odor/taste and fine texture; all essential factors to judge its identity correctly. Additionally, examining physicochemical features uncovered relevant data such as its water extractive value (8.8%) or alcohol extractive value (1.4%). These valuable insights provided intel around present compounds such as acids/inorganic mixes or polar constituents like phenols/alkaloids/steroids/glycosides/flavonoids respectively (Sexena & Sahu 2012). The ashes obtained during our test came close to: total ash-3.67% while acid-insoluble materials had a score of about 3%. This data helps us determine if there is any evidence of possible tampering with the drug such as direct adulteration by sand/earth, which would be easily detectable by total ash testing. Analysis conducted during this study demonstrated how low levels of total ash and acid insoluble components were present within the Okra seed sample suggesting minimal

contamination risk (Emeje et al., 2011). Moreover the obtained level of ash content was relatively lower than previously reported by Zerihun et al.s research in 2020. Ultimately these results highlight the advantages of utilizing dry Okra seeds as it can provide essential minerals required for maintaining good health and wellbeing. Our study revealed an overall moisture content of about 8% which is strikingly unlike what was earlier documented by Zerihun et al. (2020). To be precise their report put forth a figure of roughly 4.72% as the standard for seed powders dampness levels. Nevertheless we infer that our data may have encountered some bias because of unforeseen environmental variables leading to these discrepancies between our results and theirs. Macroscopically, Abelmoschu sesculentus seed powder was found to have a reddish colour, it has characteristic taste and odour. It also has a fine texture.

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