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Research Paper

Preliminary Study and Phytochemical Screening of Peanut Shell

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ABSTRACT

Peanut shells, an abundant agricultural by-product, are often discarded despite their potential as a valuable source of bioactive compounds. The present study was conducted to perform a preliminary investigation and phytochemical screening of peanut shell extracts to evaluate their chemical constituents and possible therapeutic significance. The dried peanut shells were powdered and subjected to solvent extraction using suitable solvents such as ethanol, methanol, and aqueous media. Standard qualitative phytochemical tests were carried out to detect the presence of major secondary metabolites. The results revealed the presence of important phytoconstituents including flavonoids, tannins, phenolic compounds, alkaloids, saponins, and glycosides, while steroids and terpenoids were found in moderate or trace amounts depending on the solvent used. These compounds are known for their antioxidant, antimicrobial, and anti-inflammatory properties. The findings suggest that peanut shells, though considered waste, possess significant phytochemical potential and may be utilized in the development of natural therapeutic agents or value-added products. This preliminary study highlights the importance of further quantitative analysis and biological activity evaluation to fully explore the pharmacological and industrial applications of peanut shell extracts..

INTRODUCTION

Peanut, also known as groundnut, is a legume crop that is widely cultivated from its edible seeds. The scientific name of the peanut plant is Arachis hypogaea. peanuts are grown in many countries, including the United States, China, India, and Nigeria, among others. Peanuts are an important source of protein and oil, and are used in a variety of food products, including peanut butter, candy, and snack foods. In addition, peanut shells and stems are used as animal feed, and peanut oil is used in cooking and in the production of biodiesel. Peanuts are also valued for their ability to fix nitrogen in the soil, which can benefit other crops in a rotation system. A peanut shell is the

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outermost layer or covering of a peanut, which is a legume and not a nut. The peanut shell is typically thin, brittle, and papery, and is usually light brown in colour. It serves to protect the edible part of the peanut, which is the kernel or seed that is commonly consumed roasted or salted. The peanut shell is not typically eaten, but it can be used as animal feed or as a source of fiber for paper and other products. Additionally, some people use peanut shells as a natural mulch for gardening's. [1-2]

Figure No 1- Peanuts

Also known as ground nut, earth nut, pygmy nut, monkey nut or ground bean. Its scientific name is Arachis hypogaea. Peanuts actually grow underground, as opposed to nuts like walnuts, almonds etc. that grow on trees. Peanuts, along with beans and peas, belong to the single plant family, Leguminosae. Legumes are edible seeds enclosed in pods. It is considered as the world's fourth most important source edible vegetable oil and third most important source of vegetable protein. About 5000 years ago peanuts were first grew in Brazil-Bolivia-Peru region.

In the 1500s century Spanish and Portuguese explorers shipped peanuts from South America to Asia, Europe and Africa. An American named George Washington Carver began his research work and developed more than 300 other uses for peanuts and improved peanut horticulture so much that he is considered by many to be the "father of the peanut industry''. Peanut was introduced in Bangladesh and in this region by the Portuguese sailors along with other vegetables and fruits. Nowadays peanuts are cultivated around the world almost in 80 countries.

In Bangladesh peanuts are cultivated in Noakhali, Faridpur, Kishoreganj, Patuakhaliu, Rangpur and Dhaka districts in 35000 hectors of lands and about 40,000 metric tons of peanuts produced annually. Peanut is an annual herbaceous plant growing 30 to 50 cm tall. Peanut plants grow best in sandy or loose soil with warm, sunny weather and moderate rain. Most peanuts need about five months to grow to maturity. The leaves of the peanuts plants are opposite and they grow as pairs in groups four.

It is interesting that peanuts leaflets fold up in pairs at night. Each leaflet is 1 to 7 cm long and 1 to 3 cm broad. The flowers are a typical pea flower in shape, 2 to 4 cm across bright yellow with reddish veining. Peanut flower is a self-pollinating flower and grows low on the plant. Most flowers bloom for one day and then wilt. Once the flower is pollinated, the petals fall off and the ovary starts to enlarge. The budding ovary grows a small stem and the embryo penetrates the soil where the peanut starts to form into a legume pod. Pods are 3 to 7 cm long containing 1 to 4 seeds. The pods, which are ripen within 120 to 150 days after the seeds are planted.

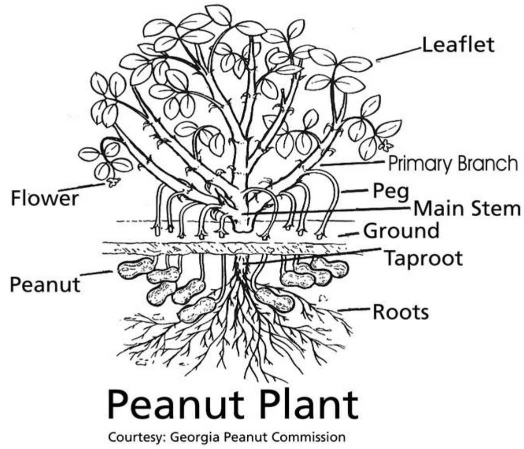

Figure No 2- Peanut Plant

They contain more anti oxidants than grapes, green tea, tomatoes, spinach, broccoli and carrots. Despite of its utility some people are allergic to peanuts.

An antimicrobial finish is a type of textile treatment that prevents or inhibits the growth of microorganisms such as bacteria, fungi, and viruses. This finish can be used on a variety of textiles, such as clothing, bedding, and medical fabrics. Antimicrobial finishes on textiles can help to reduce the spread of infections and illnesses, making them especially useful in healthcare settings, food processing plants, and other areas where hygiene is essential. Chemical treatments, nanotechnology, and natural agents such as silver ions or tea tree oil can all be used to create antimicrobial finishes. The effectiveness of antimicrobial finishes varies depending on the microorganisms targeted and the finish's durability.

Figure No 3-Flower of Peanut

Figure No 4- Pods after Picking

Growth and Development: The optimum soil temperature for seed germination is 25–30°C. Low temperatures retard germination and development and increase the risk of seedling diseases. Upon germination, the primary root elongates rapidly, reaching 10–12 cm before lateral roots appear. As growth proceeds, the outer layer of the primary root of a seedling is sloughed off so that root hairs do not form. Branching is dimorphic, with vegetative branches and reduced reproductive branches. Secondary and tertiary vegetative branches can develop from the primary vegetative branches. Flowering may start as early as 20 days after planting, but 30–40 days after planting is more usual. The number of flowers produced per day decreases as the seeds mature.

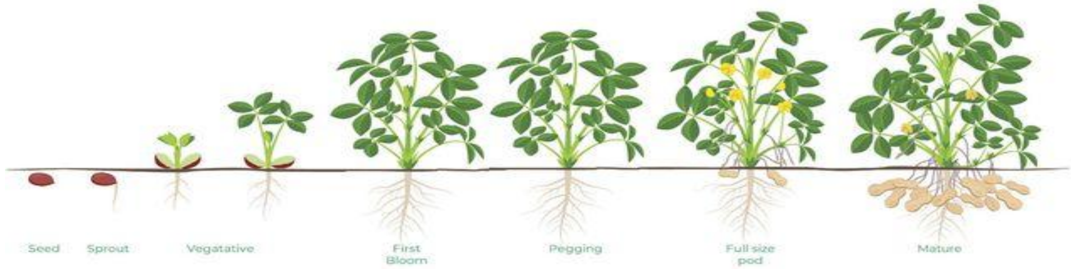

Figure No 5- Stages of Peanut Development

Harvesting:

Groundnut seeds are often planted at a depth of 4–7 cm at a rate of 60–80 kg/ha. Groundnut pods intended for sowing are often hand-shelled 1–2 weeks before sowing.0nly fully mature pods are selected. Before sowing, groundnut seed may be treated with a fungicide to control seeding disease. In general, sowing improves yields and seed quality.[3]

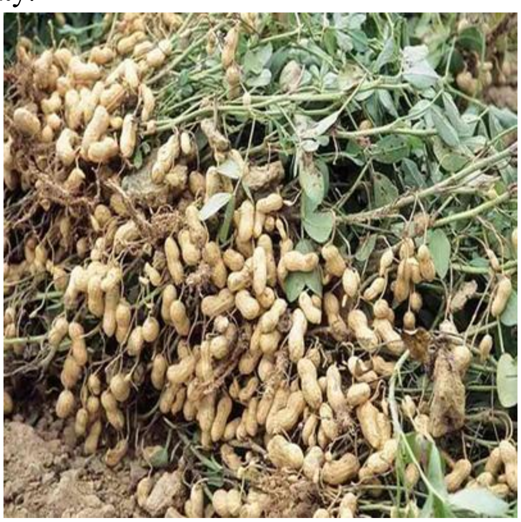

Figure No 6-Harvested Peanuts

TAXONOMY

- **Kingdom Plantae**: Plantes, Plant, Vegetal, plants
- **Subkingdom:** Viridiplantae
- **Infrakingdom:** Streptophyta- land plants
- **Superdivision:** Embryophyta
- **Division:** Tracheophyta – vascular plants, tracheophytes
- **Subdivision:** Spermatophytina – spermatophytes, seed plants
- **Class:** Magnoliopsida
- **Superorder:** Rosanae
- **Order:** Fables
- **Family:** Fabaceae –peas, legumes
- **Genus:** Arachis L.-peanut
- **Species:** Arachis hypogae L.-peanut.[4]

Uses of Peanut:

- In India seeds are used for respiratory problems and the husks of pods are boiled and the liquid is used to treat hypertension.
- They are rich in resavtrol that have been found to control cholesterol and circulatory diseases. Furthermore the red skins contain component called oligomeric procyanidins. This has proven to have anti-arteriosclerotic properties and helps prevent endometriosis.
- Togather, resavtrol and oligomeric procyanidins helps fight cancer.
- It contains phytoestrogen genisteins that help prevent hot flushes or depression related to PMS. Along with helping to prevent the formation of cancer cells, it also prevents vision loss and macular degeneration in diabetic patients.
- Peanuts possess galactogouge properties.

- Peanuts boost the immune system and prevent lymphatic disorders.
- Peanut oil obtained from cold pressing has medicinal uses Chemical components of peanut.
- Acids- Arachidic Acids, aspartic acid, behenic acid, cholorogenic acid, stearic acid, gadoleic acid, gentisic acid, lauric acid, linoleic acid, oleic acid, p-coumaric acid, palmitic, palmitoleic, ascorbic acid. Arachin Lecithin Flavonoid- quercetin.
- Amino acids- aspartic acid, glutamic acid, alanine, arginine, cysteine, phaenylalanine, methionine, proline, serine, tyrosine, glucine, lycine, leucine, isoleucine, histidine, threonine, tryptophan, valine .
- Minerals- aluminium, sulfur, cadmium, zinc, copper, boron, copper, iron, selenium, sodium, calcium, magnesium, phosphorus, potassium, Fat, Carbohydrates, cellulose, Vitamins- niacin, folacin, riboflavin, thiamin.[5]

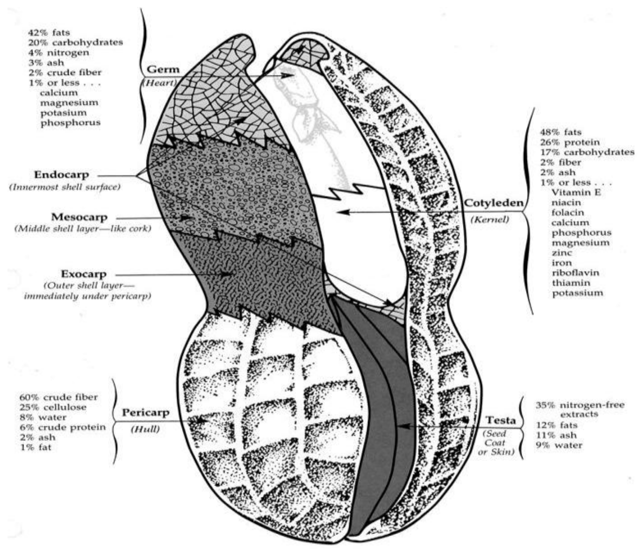

Figure No 6- Anatomy of peanut

As global peanut production has risen annually (both cultivation area and output exhibiting an upward trajectory from 2000 to 2023, peanut hull generation has correspondingly escalated. FAO statistics indicate global peanut production at tained 54,272,900.42 metric tons in 2023, with Asia dominating global production (60.87%), followed by Africa (29.06%), the Americas (9.03%), and Oceania (0.04%).[6] of the top five producers, China led with 19,230,700 tons, followed by India (10,296,708 tons), Nigeria (4,300,000 tons), the U.S. (2,671,670 tons), and Myanmar (1,795,642 tons). Using a conversion factor of 230–300 g hulls/ kg peanuts.[7] global peanut hull output in 2023 is estimated at 12,482.77–16,281.87 metric tons. Vast quantities of peanut hulls remain underutilized. Improperly disposed or stockpiled hulls contaminate soils, degrading structural integ rity and altering fertility dynamics. Rainfall- induced leaching or irrigation runoff transports hulls into surface waters, triggering eutrophication and disrupting aquatic ecosystems. Spontaneous fermentation releases toxic gases, contributing to air pollution and posing fire risks.

Recently, peanut shells have garnered significant scientific in terest due to their emerging potential value. Chemical analyses reveal a composition dominated by cellulose (48%), hemi cellulose (3%),[and lignin,[8] with notable contents of crude protein, essential minerals (Ca, P), and bioactive compounds including polyphenols and flavonoids.[9-10] Notably, luteolin a predominant flavonoid in peanut hulls—exerts antioxidant, anti- inflammatory, and lipid metabolism-modulating effects, contributing substantially to animal health improvement.[11]

Nevertheless, several constraints impede direct utilization in animal feed: low soluble crude protein, elevated non- protein nitrogen, minimal soluble true protein, excessive fiber content, poor digestibility, a high unusable cell wall proportion, scarcity of non- structural carbohydrates/pectin, and anti-nutritional factors like phytic and oxalic acids.[12]

Despite these challenges, their fibrous structure and nutrient profile position peanut hulls promising feed ingredient. Empirical evidence demonstrates that appropriately processed peanut hulls, when integrated into formulations, function as a cost- effective, efficient, and eco- friendly source of dietary fiber and energy.[13] To overcome these limitations, diverse processing technologies have been devised to elevate the nutritional quality and bioavail ability of peanut hulls. Physical interventions such as mechanical grinding effectively diminish fiber crystallinity, achieve a 26.65% reduction in crude fiber, a boost protein digestibility by 74.70%. [14] Alkali (NaOH) treatment coupled with extrusion cooking engenders a linear decline in neutral detergent fiber and doubles in vitro digestibility relative to con troll. [15]

India is one of the largest producers of groundnut. The export of groundnut from India is continuously increasing. Groundnuts are classified into four market-types (Runners, Spanish, Virginia and Valencia). The chemo preventive action of plant foods has been attributed to the presence of some biologically active phytochemicals. Groundnut seed contains 44 to 56% oil and 22 to 30% protein on a dry seed basis and is a rich source of minerals (P, Ca, Mg and K) and Vitamins (E, K and B group). [16]

Groundnut provides considerable amounts of mineral elements to supplement the dietary requirements of humans and farm animals.[16] Groundnuts are one of those plant foods that are a dietary source of phytochemicals. [17]

Array of nutrients and phytochemicals play an important role in mechanism responsible for its putative health benefits. Generation of free radicals or reactive oxygen species (ROS) during metabolism and other activities beyond the antioxidant capacity of a biological system gives rise to oxidative stress. Oxidative stress plays a role in heart diseases, neurodegenerative diseases, cancer and in the aging process. This concept is supported by increasing evidence that oxidative. [18]

MATERIALS AND METHOD –

Collection and processing of Sample material –

The fresh Peanuts have been procured from the local area shop in the month of February. All collected shell sample were grind using electric grinder. The fine powdered has been used for extraction with suitable solvents.

Drying of Plant Sample –

After the collection of sample it needs to be dried to make the sample extract. In general the plant material should be dried at temperature below 30 degree C to avoid the decomposition of thermo labile compounds. So sun drying can be very effective but drawback is sometimes water molecules are absorbed by the sample and hence fungus growth can affect the phytochemical study. The seeds along with the test a were dried in the sun light thus chemical decomposition does not take place.

Grinding of Dried Sample –

Small amount of plant material can be milled using grinder or blender. But if the sample is in high amount then it is easier to get powdered sample by grinding from a spice mill. Grinding improves the efficiency of extraction by increasing surface area. It also decreases the amount of solvent required for the extraction. The dried samples were ground to coarse powder with a mechanical grinder (Blender) and powdered samples were kept in clean closed containers pending extraction. During grinding of samples, the grinder was thoroughly cleaned to avoid contamination with any remnant of previously ground material or other foreign matter deposited on the grinder.

Extraction of sample material –

Soxlet Method –

The alcoholic extract of sample material has been prepared by soxhlet method. 60g of each powdered sample material has been taken extracted with 80% ethanol, the extract has been filtered using whatman filter paper, and the filtrate has been collected.The filtrates were concentrated under reduced pressure and at the temperature 40degree C using rotatory evaporator. The concentrated extracts were placed in the dessicator to remove remaining solvent. The percentage yield of each extract was calculated.

Phytochemical screening

The ethanolic extracts of the Ground nuts were subjected to different chemical tests for the detection of different phytoconstituents using standard procedures

- **Test for Tannins:**

1 ml of the sample was taken in a test tube and then 1 ml of 0.008 M Potassium ferricyanide was added. 1 ml of 0.02 M Ferric chloride containing 0.1 N HCl was added and observed for blue-black colouration.

- **Test for Phlobatannins:**

When crude extract of each Ground nut sample was boiled with 2% aqueous HCl the deposition of a red precipitate was taken as evidence for the presence of phlobatannins**.**

- **Alkaloid Test:**

Two grams of extract were heated in a large test tube with 1% hydrochloric acid for 30 min in a boiling water bath. The suspensionis filtered into the test tube A and B as much. Test tube A added three drops of Dragendorff reagent and test tube B added three drops of Mayer reagent.

- **Flavonoid and Phenolic Compound Test:**

Five milligrams of extract was dissolved in 2 ml of 96% ethanol and then divided into two test tubes. Test tube A added three drops of 2% FeCl3 solution and test tube B added three drops of 0.2 N NaOH solution.

- **Test for Quinones:**

Dilute NaOH was added to 1ml of crude extract. Blue green or red coloration indicates the presence of quinines.

- **Test for Terpenoids (Salkowski test):**

5ml of extract was mixed with 2ml of chloroform and 3ml of concentrated H2SO4 was carefully added to form a layer. A reddish brown colouration of the inter face was formed to show positive results for the presence of terpenooids.

- **Test for Cardiac Glycosides (Keller-Killani test):**

5ml of extract was treated with 2ml of glacial acetic acid containing one drop of ferric chloride solution. This was underplayed with 1ml of concentrated H2SO4. A brown ring of the interface indicates a deoxysugar characteristic of cardinolides. A violet ring may appear below the brown ring, while in the acetic acid layer, greenish ring may form just gradually throughout thin layer.

Summary:

Peanut shells, often treated as agricultural waste, were investigated for their phytochemical composition and potential biological value. The preliminary study involved preparing extracts of peanut shells using solvents such as ethanol, methanol, or water, followed by standard qualitative phytochemical tests. The screening revealed the presence of several bioactive compounds, including:

Alkaloids

Flavonoids

Tannins

Phenolic compounds

Glycosides these phytochemicals are known for their antioxidant, antimicrobial, and anti-inflammatory properties. The study highlights that peanut shells, despite being discarded as waste, contain significant amounts of secondary metabolites that may have pharmaceutical and industrial applications.

CONCLUSION

The preliminary phytochemical screening of peanut shells demonstrates that they are a valuable source of bioactive compounds. The presence of important phytochemicals suggests their potential use in developing natural antioxidants, antimicrobial agents, and other therapeutic products. Thus, peanut shells can be considered a promising low-cost raw material for value-added applications, contributing to waste utilization and sustainable development. Further quantitative analysis and advanced studies are recommended to isolate and characterize the active compounds and evaluate their biological activities in detail.

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