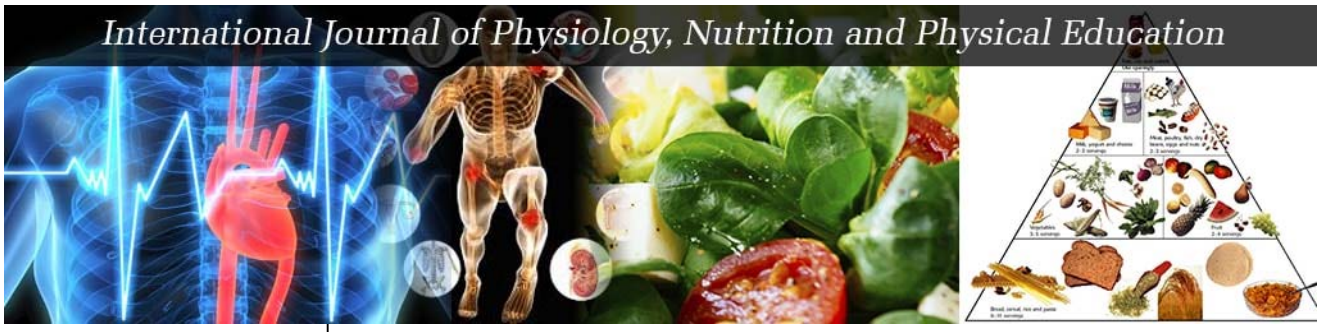

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To investigate which solvent extract (aqueous, methanol, acetone and hexane) of Apple banana is more potent content of phytocompound

Sayantani Maity, Koushik Das, Nilotpal Mandal

Abstract
Background of the Study: Banana is an edible fruit, botanically a berry produced by several kinds of large herbaceous flowering plants in the genus Musa (in some countries, bananas used for cooking may be called plantains). Banana are rich source of antioxidant containing polyphenolic compounds and flavonoids which prevent free radical damage, reducing risk of oxidative stress related degenerative diseases.
Objectives: The present study was carried out to investigate which solvent extract (aqueous, methanol, acetone and hexane) of Apple banana is more potent content of phytocompound banana available in the local market in Midnapore town.
Methods & Materials: Bananas were collected from local market then separate peel & pulp. Then cut all pulp in small pieces and kept at sunlight to prepare extract & ready for different test.
Results: Among four solvent extracts (aqueous, methanol, acetone and hexane) of Apple bananas alkaloid is present in high amount in aqueous and methanol extracts and small amount in acetone extract. Phytosterol is present in high amount hexane extract and in small amount in methanol and acetone extracts. Flavonoids are present in high amount in aqueous and methanol extracts.
Conclusion: Including anti-oxidant such as alkalide, flavonids, phytosterol, phenolic compounds & tanning are important for human health. Banana contains outstanding phytocompounds that are high in anti-oxidant, antimicrobial and anti-cancer properties. In all over India common people consume banana.

Keywords: Apple banana, Aqueous solvent extracts, Methanol solvent extracts, Acetone solvent extracts and Hexane solvent extracts

1. Introduction

A banana is an edible fruit, botanically a berry produced by several kinds of large herbaceous flowering plants in the genus *Musa i*n some countries, bananas used for cooking may be called plantains (Fingolo, 2012) [19]. The fruit is variable in size, color and firmness, but is usually elongated and curved, with soft flesh rich in starch covered with a rind which may be green, yellow, red, purple, or brown when ripe. The fruits grow in clusters hanging from the top of the plant. Almost all modern edible parthenocarpic (seedless) bananas come from two wild species – *Musa acuminata* and *Musa balbisiana*. The scientific names of most cultivated bananas are *Musa acuminata*, *Musa balbisiana*, and *Musa paradisiaca* for the hybrid *Musa acuminata*, *M. balbisian* depending on their genomic constitution. Worldwide, there is no sharp distinction between "bananas" and "plantains". The term "banana" is also used as the common name for the plants which produce the fruit (Fortunato, 2014) [20]. This can extend to other members of the genus *Musa* like the scarlet banana (*Musa coccinea*), pink banana (*Musa velutina*) and the Fe'i bananas. The banana fruits develop from the banana heart, in a large hanging cluster, made up of tiers (called "hands"), with up to 20 fruit to a tier. The hanging cluster is known as a bunch, comprising 3–20 tiers, or commercially as a "banana stem", and can weigh 30–50 kilograms (66–110 lb). Individual banana fruits (commonly known as a banana or "finger") average 125 grams (0.276 lb), of which approximately 75% is water and 25% dry matter. The classification of cultivated bananas has long been a problematic issue for taxonomists. Linnaeus originally placed bananas into two species based only on their uses as food: *Musa sapientum* for dessert bananas and *Musa paradisiaca* for plantains (Peroni-Okita, 2013) [35].

Banana Tree

1.1. Importance of Banana

1.1.1. Restore normal bowel Activity

Because the banana is rich in non-digestible fibers (including cellulose, hemi cellulose, and alpha glucans) it can help restore normal bowel activity and help with both constipation and diarrhea. Bananas normalize the colon's function to absorb large amounts of water for regular bowel movements. Their usefulness is due to their richness in pectin, which is water-absorbent and this gives them a bulk producing ability. Bananas are an exceptionally rich source of fructo oligosaccharide, a compound called a prebiotic because it nourishes probiotic (friendly) bacteria in the colon. These beneficial bacteria produce vitamins and digestive enzymes that improve our ability to absorb nutrients, plus compounds that protect us against unfriendly microorganisms. When fructo oligosaccharides are fermented by these friendly bacteria, not only do numbers of probiotic bacteria increase, but so does the body's ability to absorb calcium. For this reason, ingesting antibiotics harm these beneficial bacteria (Bhaskar, 2012) [9].

1.1.2. Protection from ulcers & Heartburn remedy

Bananas have long been recognized for their antacid effects that protect against stomach ulcers and ulcer damage. A flavonoid in the banana, eucocyanidin, has been found to significantly increase the thickness of the mucous membrane layer of the stomach. Since bananas help to neutralize acidity, they are also a great way to get rid of heartburn. In an animal study, a simple mixture of banana and milk significantly suppressed acid secretion (Miller, 2010) [32].

1.1.3. Cholesterol-lowering effect

Animal studies have shown that banana has the potential to lower cholesterol. It was suggested that the dietary fibre component in banana pulp was responsible for its cholesterol-lowering effect. The amount of dietary fibre in banana is relatively constant during banana ripening.

1.1.4. Protection against neurodegenerative diseases (Alzheimer's disease)

Researchers at Cornell University investigated the effects of apple, banana, and orange extracts on neuron cells and found that the phenolic phytochemicals of the fruits prevented neurotoxicity on the cells. Among the three fruits, apples contained the highest content of protective antioxidants, followed by bananas then oranges. These results suggest that fresh apples, banana, and orange in our daily di*et al*ong with other fruits may protect neuron cells against oxidative stress-induced neurotoxicity and may play an important role in reducing the risk of neurodegenerative disorders such as Alzheimer's disease (Bhaskar, 2011) [10]

1.1.5. Kidney Health

Bananas promote an overall improvement of the functional efficiency of kidneys. Benefits to the kidneys are again due to the high potassium content of bananas. A normal intake of potassium suppresses calcium excretion in the urine and minimizes the risk of kidney stones (Fingolo, 2012) [19].

1.2. Different Types of Banana all over India

1.2.1. Apple Banana

Apple bananas are exceptionally sweet, hence their other name, Candy Apple Banana. They are grown in the rainy tropical forests in Hawaii. Their flesh is firm and has a slight pinkish tone. The sweet, moist flesh is perfect for snacking or using in desserts and is particularly well suited to adding to fruit salads and other raw preparations since it doesn't brown as quickly as other banana varieties.

Apple Banana

1.2.2. Cavendish Banana

It is a popular commercial cultivar grown extensively for table and processing purpose in the states Maharashtra, Gujarat, Bihar and West Bengal. It is also popular in Tamil Nadu, Karnataka and Andhra Pradesh. 'Basrai' is the leading commercial variety of Cavendish group and is a leading commercial variety of Maharashtra. The plant stature is Dwarf making it less prone to wind damage. The bunch size, the fruit length and size is quite good though the keeping quality is rather poor. The average bunch weight with 6-7 hands and with about 13 fruits per hand is about 15-25 kg

Cavendish Banana

1.2.3. Saba Banana

Stands out as the most important fruit crop in the Philippines, constituting a significant portion in the country's export revenue. Among the many banana cultivars grown throughout the, saba (Musa balbisiana) is considered as one of the leaders in terms of production and trade. Processed products derived from saba are gaining wide acceptance both in the domestic and international market. Not to forget the fact that banana is also crop of social importance. It is one of the important sources of food in the rural areas where saba banana, in particular, is often used to extend, supplement or substitute staple food such as rice and corn.

Saba Banana

1.2.4. William Banana

South Pacific region. With this information, the ability to identity illegally introduced clones or the newer ones being evaluated for resistance to black Sigatoka will be enhanced. Identifying varieties by deduction is far easier than by induction. That is to say, if the full range of varieties in a locality is known, for example by reference to photographs, then a specimen with unique morphological features can be identified readily. However, difficulties occur when plants grown in an environment markedly different from that ton which the observer is accustomed are presented for identification. Problems in identification also arise when the observer is exposed to a new variety, and no bunches are available for inspection.

William Banana

1.2.5. Red Banana

Red banana is the most relished and highly prized variety of Kerala and Tamil Nadu. Its commercial cultivation is prominent in Kanyakumari and Tirunelveli districts of Tamil Nadu. It is also popular in Karnataka, Andhra Pradesh and to some extent in Western and Central India. In Bihar and other regions, it is popular as Lal Velchi while in Karnataka as Chandra Bale. The colour of the pseudostem, petiole, midrib and fruit rind is purplish red. It is a robust plant with bunches weighing 20-30 kg under good management practices.

Red Banana

1.2.6. Monthan

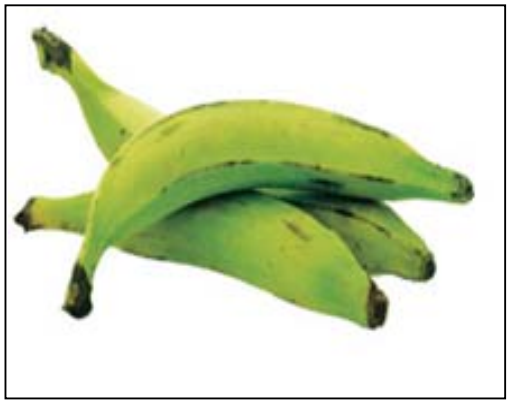
It is a widely cultivated variety for processing. Monthan is a fairly tall and robust plant bearing bunches of 18-20 kg after 12 months. Fruits are bold, stocky, knobbed and pale green in colour. The skin is usually green. The new prolific 'Monthan' type clones of economic value namely 'Kanchi Vazhai' and 'Chakkia' are recently becoming popular in Tamil Nadu. Apart from its culinary use of fruits, pseudostem core is a highly relished vegetable with many medicinal properties.

Monthan Banana

1.2.7. Karpuravalli

It is a popular variety grown for table purpose in medium rich soils. Its commercial cultivation is spread over in Central and Southern districts of Tamil Nadu and Kerala. In Bihar, cultivation is in patches under the name 'Kanthali'. Karpuravalli is a tall, robust plant well suited to marginal lands and soils, produced under low input conditions. It is also the sweetest among Indian bananas. Karpuravalli is occasionally seeded depending on the seasonal variability. Its ash coated golden yellow and sweet fruits have good keeping quality.

Karpuravalli Banana



Cooking Banana

1.2.8. Cooking Bananas

Cooking bananas, like plantains, are better thought of as potatoes than as bananas. They can be roasted, steamed, fried into chips, and otherwise used like any starchy vegetable. Plantains contain more starch and less sugar than dessert bananas and are therefore cooked or otherwise processed before being eaten. They are always cooked or fried when eaten green. At this stage, the pulp is hard and the peel often so stiff, it has to be cut with a knife to be removed. Mature plantains can be peeled like typical dessert bananas, the pulp is softer than in immature, green fruit and some of the starch has been converted to sugar. They can be eaten raw, but are not as tasty as dessert bananas, so are usually cooked.

1.3. Phytochemicals

Phytochemicals are non-nutritive plant chemicals that have protective or disease preventive properties. They are nonessential nutrients, meaning that they are not required by the human body for sustaining life. It is well-known that plant produce these chemicals to protect themselves but recent research demonstrate that they can also protect humans against diseases. There are more than thousand known phytochemicals. Some of the well-known phytochemicals are lycopene in tomatoes, isoflavones in soy and flavanoids in fruits (Ayoola, 2006) [6]

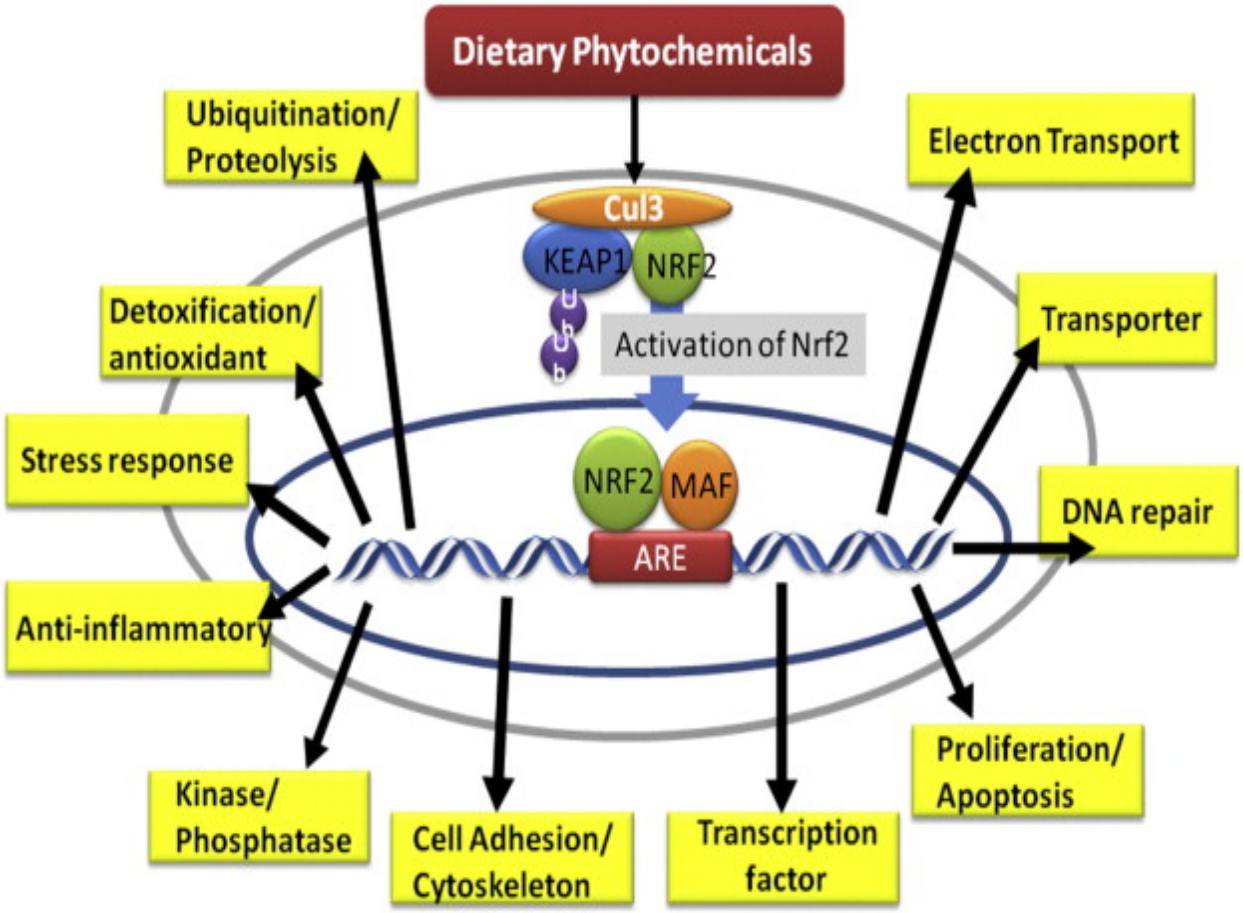


Fig 1.3: Dietary Phytochemicals and gene expression.

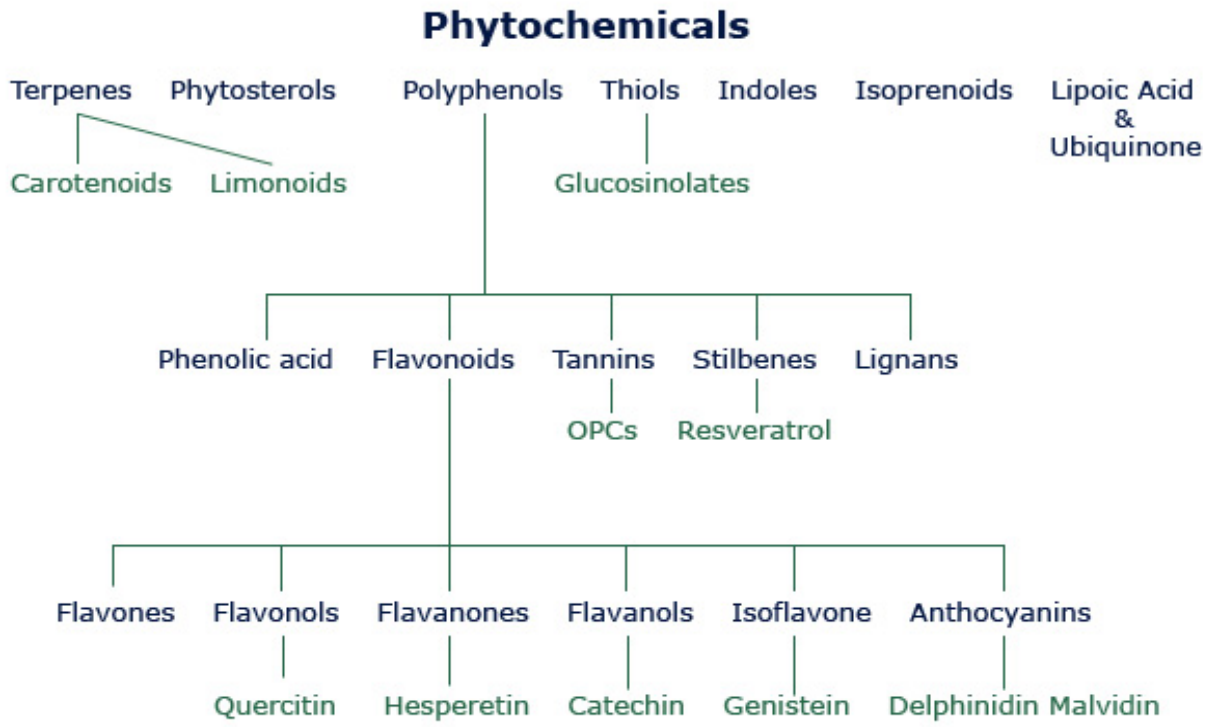


Fig 1.3.1: Different Phytochemicals from plants (Aliyu, 2014) [2]

1.3.1. Different types of phytochemicals and their work

There are many phytochemicals and each works differently. These are some possible actions:

1.3.1.1. Antioxidant

Most phytochemicals have antioxidant activity and protect our cells against oxidative damage and reduce the risk of developing certain types of cancer. Phytochemicals with antioxidant activity: allyl sulfides (onions, leeks, garlic), carotenoids (fruits, carrots), flavonoids (fruits, vegetables), polyphenols (tea, grapes).

1.3.1.2. Hormonal action

Isoflavones, found in soy, imitate human estrogens and help to reduce menopausal symptoms and osteoporosis.

1.3.1.3. Stimulation of enzymes

Indoles, which are found in cabbages, stimulate enzymes that make the estrogen less effective and could reduce the risk for breast cancer. Other phytochemicals, which interfere with enzymes, are protease inhibitors (soy and beans), terpenes (citrus fruits and cherries).

1.3.1.4. Interference with DNA replication

Saponins found in beans interfere with the replication of cell DNA, thereby preventing the multiplication of cancer cells. Capsaicin, found in hot peppers, protects DNA from carcinogens.

1.3.1.5. Anti-bacterial effect

The photochemical allicin from garlic has anti-bacterial properties.

1.3.1.6. Physical action

Some phytochemicals bind physically to cell walls thereby preventing the adhesion of pathogens to human cell walls. Proanthocyanidins are responsible for the anti-adhesion properties of cranberry. Consumption of cranberries will reduce the risk of urinary tract infections and will improve dental health.

1.4. Flavonoids

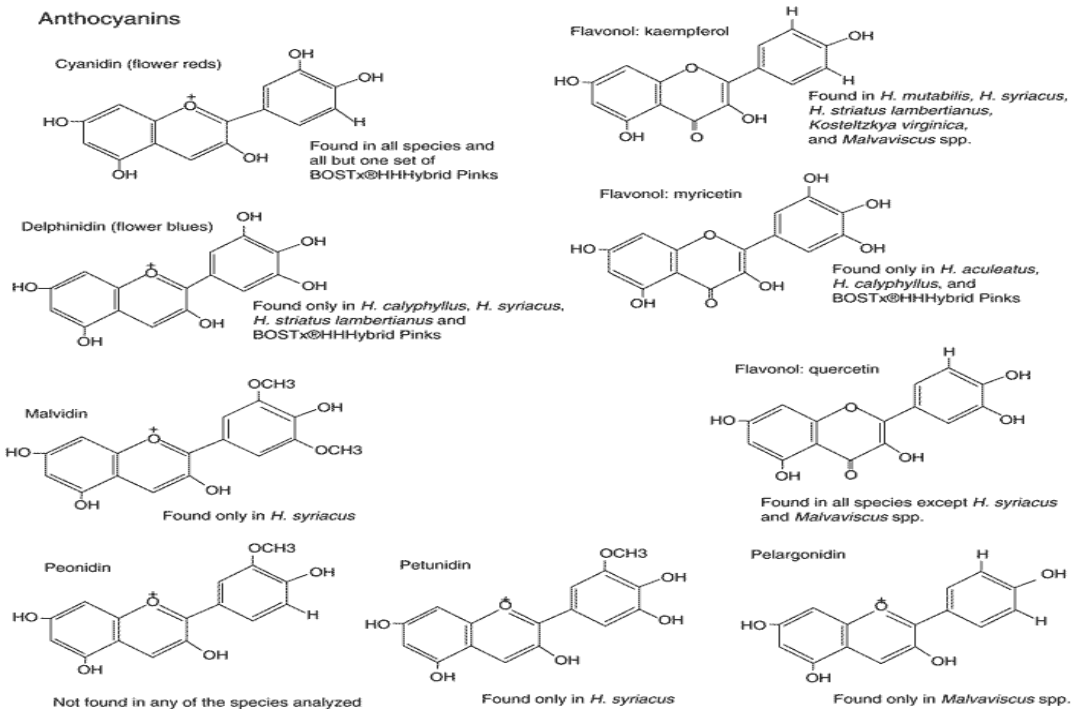
Flavonoids (Tajuddeen, 2014) [39], also collectively known as Vitamin P and citrin, are a class of plant secondary metabolites. According to the IUPAC nomenclature, they can be classified into:

1. "Flavonoids", derived from 2-phenylchromen-4-one (2-phenyl-1,4-benzopyrone) structure (examples: quercetin, rutin).
2. "Iso-flavonoids", derived from 3-phenylchromen-4-one (3-phenyl-1,4-benzopyrone) structure
3. "Neo-flavonoids", derived from 4-phenylcoumarine (4-phenyl-1,2-benzopyrone) structure.

The three flavonoid classes above are all ketone-containing compounds, and as such, are flavonoids and flavonols. This class was the first to be termed "bioflavonoids." The terms flavonoid and bioflavonoid have also been more loosely used to describe non-ketone polyhydroxy polyphenol compounds which are more specifically termed flavanoids, flavan-3-ols, or catechins (although catechins are actually a subgroup of flavanoids).

1.4.1. Flavonoids are widely distributed in plants fulfilling many functions.

Flavonoids are the most important plant pigments for flower coloration producing yellow or red/blue pigmentation in petals designed to attract pollinator animals.



1.5.Nutraceuticals

Nutraceutical, a portmanteau of the words "nutrition" and "pharmaceutical" and was coined by Dr. Stephen L. DeFelice, founder and chairman of the Foundation of Innovation Medicine (FIM), Crawford, New Jersey. The term is applied to products that range from isolated nutrients, dietary supplements and herbal products, specific diets, genetically modified food, and processed foods such as cereals, soups, and beverages.

In the US, the term has no meaning in the law, and "nutraceutical" products are regulated as drugs, dietary supplements, food ingredients, or food. The term is defined in Canadian law as referring to "a product isolated or purified from foods that is generally sold in medicinal forms not usually associated with food. A nutraceutical is demonstrated to have a physiological benefit or provide protection against chronic disease."(Nelson, 1999) [34].

1.5.1. Functions of Nutraceuticals

These are products derived from food sources that provide extra health benefits, in addition to the basic nutritional value found in foods. Depending on the jurisdiction, products may claim to prevent chronic diseases, improve health, delay the aging process, increase life expectancy, or support the structure or function of the body (Brower, 1998) [12].

Dietary supplements

A dietary supplement is a product that contains nutrients derived from food products that are concentrated in liquid or capsule form. In the US, the Dietary Supplement Health and Education Act (DSHEA) of 1994 defined the term: "A dietary supplement is a product taken by mouth that contains a "dietary ingredient" intended to supplement the diet. The "dietary ingredients" in these products may include: vitamins, minerals, herbsor other botanicals, amino acids, and substances such as enzymes, organ tissues, glandulars, and metabolites. Dietary supplements can also be extracts or concentrates, and may be found in many forms such as tablets, capsules, softgels, gelcaps, liquids, or powders (Elizabeth, 2002) [18].

Dietary supplements do not have to be approved by the U.S. Food and Drug Administration (FDA) before marketing, but companies must submit register their manufacturing facilities with the FDA. With a few well-defined exceptions, dietary supplements may only be marketed to support the structure or function of the body, and may not claim to treat a disease or condition, and must include a label that says: "These statements have not been evaluated by the Food and Drug Administration. This product is not intended to diagnose, treat, cure, or prevent any disease."

1.6. Solvents

A solvent is a substance in which some other substance, called a solute, can dissolve to form a solution. Both the solvent and the solute can be solid, liquid, or gas, but liquid solvents and liquid or solid solutes are the most common and useful. Such substances are commonly used in industrial chemical processes, in a variety of experiments and processes in chemistry, and in some household chemical products. Solvents are not universal — different types of substances must be used to dissolve different solutes. The amount of solute that can dissolve in a given substance depends heavily on the temperature, volume or mass ratio, and various chemical properties of the substances involved. The solubility, or tendency of a substances to dissolve in a given other substance, depends heavily on polarity, which is determined primarily by the distribution of electrons across a molecule. Liquid (such as water) in which other substances can be dissolved without chemically altering the solvent and the dissolved substance (called the solute).

Solvents are organic compounds based on the chemical element carbon. They produce effects similar to those of alcohol or anesthetics. For industrial use, inhalants are called solvents due to their capacity to dissolve many substances. With the introduction of the use of petroleum and its derivatives during the twentieth century, there are more and more commercial products that contain solvents: thinners, adhesives, cleaners, fuels, lubricants, etc. The most widely used industrial solvents are cements (trichloroethylene, tetrachloroethylene), adhesives (toluene, ethyl acetate and

various ketones), thinner (mineral spirits, benzene, acetone trichloroethylene, tetrachloroethylene) and paint or varnish remover (acetone, toluene, benzene, dichloromethane). Solvents are a heterogeneous group of volatile hydrocarbons derived from oil and gas whose boiling point is low so that they evaporate on contact with air. Their importance and usage pattern determine their classification: active solvents, co-solvents, latent solvents and diluents. The definition of solute concentration is the amount of solutes/particles that are dissolved in a solution. Together the solute and the solvent become the solution.

Naturally, in the laboratory solvents used to separate the different compounds like nutrients and phytochemicals by their polarity. As water is highly polar, so polar compounds (simple carbohydrate, protein and water soluble compounds) dissolved in it, as methanol is semi-polar, semi-polar compounds (phenols, flavonoids, alkaloids etc.) dissolved in it and hexane is non-polar so, non-polar compounds (sterols, terpenoids, tannins, glycosides etc.) dissolved in it.

2. Review and Literature

The banana is now produced in about 120 countries on the five continents, and is among the most cultivated of all fruits (Lassoudière, 2007). About 85% of banana production is used for local consumption or industrial purposes, and only 15% is exported (Lescot, 2006). Health awareness combined with novel functionality has increased the demand for banana-based products with good health benefits. The most abundant compounds in bananas such as carbohydrates, including starch, and soluble sugars have been studied, but few studies have focused on the kinetic accumulation of bioactive compounds. Reports of the chemical composition of the banana have shown that it is rich in minerals and dietary fiber, and is a good source of vitamins C and E (von Loesecke, 1950).

Similarly, the antioxidants gallocatechin, catechin, and epicatechin were previously identified in banana (Someya *et al*., 2002).

The polyphenol content of bananas harvested after 400 degree days remained unchanged during ripening, while bananas harvested after 600 and 900 degree days exhibited a significant polyphenol increase. Although dopamine was the polyphenol with the highest concentration in banana peels during the green developmental stage and ripening, its kinetics differed from the total polyphenol profile. Our results showed that this matrix of choice (maturation, ripening, and climate) may allow selection of the banana (*M. acuminata*, AAA, Cavendish, cv. Grande Naine) status that willproduce optimal concentrations of identified compounds with human health relevance (Akinmoladun, 2007) [1].

The nutritional value of banana inflorescences (male flowers and bracts) has never been studied. Therefore, plant material of *Musa acuminata*, cultivar "ouro", was collected in Rio de Janeiro state, Brazil, and then submitted to chemical procedures to determine its nutritional composition. The experiment was arranged a completely randomized design and performed in triplicate. The sample composition analysis showed percentual average value for moisture, protein, fat and ash as 8.21, 14.50, 4.04 and 14.43, respectively. The dehydrated inflorescences were found to contain a significant nutritive complement based on their high content of potassium (5008.26 mg / 100 g) and fiber 49.83% (lignin, cellulose and hemicelluloses) revealing important functional and nutritional properties. In a parallel evaluation, the anatomical study revealed key elements for the recognition of *Musa acuminata* when reduced to fragments (Aliyu, 2014) [2].

Banana is a staple crop inmany regions where vitamin A deficiency is prevalent, making it a target for provitamin A biofortification. However, matrix effects may limit provitamin a bioavailability from bananas. The retinol bioefficacies of unripe and ripe bananas (study 1A), unripe high-provitamin A bananas (study 1B), and raw and cooked bananas (study 2) were determined in retinol depleted Mongolian gerbils (n = 97/study) using positive and negative controls. After feeding a retinol-deficient diet for 6 and 4wk in studies 1 and 2, respectively, customized diets containing 60, 30, or 15% banana were fed for 17 and 13 d, respectively. In study 1A, the hepatic retinol of the 60% ripe Cavendish group (0.52 6 0.13 mmol retinol/liver) differed from baseline (0.65 6 0.15 mmol retinol/liver) and was higher than the negative control group (0.3960.16 mmol retinol/liver; P < 0.0065). In study 1B, no groups differed from baseline (0.65 6 0.15 mmol retinol/liver; P = 0.20). In study 2, the 60% raw Butobe group (0.68 6 0.17 mmol retinol/liver) differed from the 60% cooked Butobe group (0.87 6 0.24 mmol retinol/liver); neither group differed from baseline (0.8060.27mmol retinol/liver; P < 0.0001). Total liver retinol was higher in the groups fed cooked bananas than in those fed raw (P= 0.0027). Body weights did not differ even though gerbils ate more green, ripe, and raw bananas than cooked, suggesting a greater indigestible component. In conclusion, thermal processing, but not ripening, improves the retinol bioefficacy of bananas (Elizabeth, 2002) [18].

The chemical composition of the lipophilic extract of ripe pulp of banana fruit from several banana cultivars belonging to the Musa acuminata and Musa balbisiana species (namely 'Chinese Cavendish', 'Giant Cavendish', 'Dwarf Red', 'Grand Nain', 'Eilon', 'Gruesa', 'Silver', 'Ricasa', 'Williams' and 'Zelig') was studied by gas chromatography-mass spectrometry for the first time. These results are a relevant contribution for the valorisation of these banana cultivars as sources of valuable phytochemicals (ω-3 and ω-6 fatty acids, and sterols) with well-established beneficial nutritional and health effects. (Vilela *et al*., 2014) [41]

3. Aims and Objectives

The Bananas are monocotyledonous plants in the genus Musa which belongs to the family Musaceae. The family Musaceae is one of the families of the order Zingiberales, which inclues approximately 1000 spices. It is an easy fruits to grow and low in cost. Bananas are also a healthy and high calorie and high in fibre food to cure fever, obesity, cancer, heart disease. Banana are rich sources of anti-oxidants containing carotenoids, polyphenolic compounds & flavonoids which prevent free radical damage, reducing the risk of oxidative stress related degenerative diseases way to cure highpertention like diseases. It is a common traditional food and also low in cost, consumed by all people and scientifically proved its different health benifits. But, many person consume it after meal.

The Present study was to evaluate the phytochemical screening among four types of solvents extracts (aqueous, methanol, acetone and hexane) of Apple banana.

The objectives of the project were:-

- To detect the presence of Tannin in the Apple Banana
- To analyze the presence of Carbohydrates in the Apple Banana
- To screen the presence of Alkaloids in the Apple Banana
- To find the presence of Phytosterols in the Apple Banana
- To screen the presence of Flavonoids in the Apple Banana

Ultimate objective is to find out which solvent extract (aqueous, methanol, acetone and hexane) of Apple banana is more potent content of phytocompounds and which further carried out future functional food research.

4. Method and Materials

4.1 Collection of Banana

Apple Bananas were collected from Midnapur Town (Local Market).

4.2 Preparation of solvent extracts for phytochemiocal screening

Separation of peel from banana and then weight

Banana pulps cut into pieces

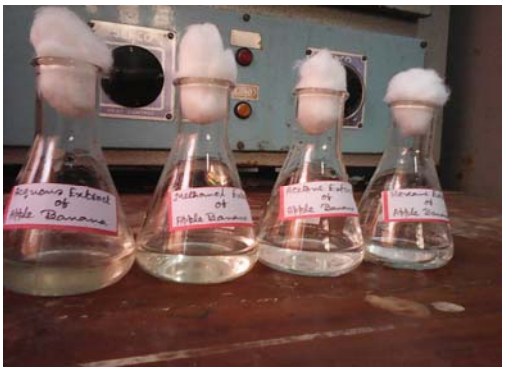
Cutting banana pulps dried in hot air oven

Then dried banana pulps grinded in mixture grinder

The pulp dust ready for the phytochemicals screening

The dust is dissolved in 4 different types of solvent extracts

Then the extracts were filtered



Then I started phytochemical screening

4.3 Phytochemical Screening
Phytochemical Screening were performed using standard procedures (Ayoola, 2006) [6].

4.3.1. Test for Tannins
Solvent extracts were taken in test tubes. A few drops of 10% ferric chloride (Merck) was added. Observation of brownish green or blue-black coloration.

4.3.2. Test for Alkaloids
Solvent extracts were taken in test tubes. Few drops of Dragendroff reagent were added. A white precipitate indicates the presence of deoxy sugars.

4.3.3. Test for Phytosterols
About 0.5g of extract was dissolve in 2ml of glacial acetic (Merck) containing one drop of 1% Fecl3 along with con.H2SO4 (Quligen). A brown ring obtained at the interphone indicated the presence of phytosterols. A violet ring appeared below the ring while in the acetic acid layer a greenish ring appeared just above ring and gradually spread throughout the layer.

4.3.4. Test for Flavonoids
2mls of dil. NaoH (Merck) was added to 2ml of the extract and shake well. Yellow colour indicates presence of flavonoids.

4.3.5. Test for Phenols
Equal volumes of extracts and Fecl3 were mixed very carefully. Deep bluish green solution indicates presence of phenols.

4.3.6. Test for Carbohydrates
Solvent extracts were taken in test tubes. Few drops of Molisch's reagent were added. A reddish colour ring at interphases indicates the presence of carbohydrates.

5. Results

Table 5.1: Qualitative analysis of Presence of Tannins among Solvent Extracts (Aqueous, Methanol, Acetone and Hexane) of Apple Banana

Phytochemical Screening	Aqueous Extract	Methanol Extract	Acetone Extract	Hexane Extract
Ferric Chloride Test For Tannin	-	-	-	-

'+' Represent for Presence; '-' Represent for Absence

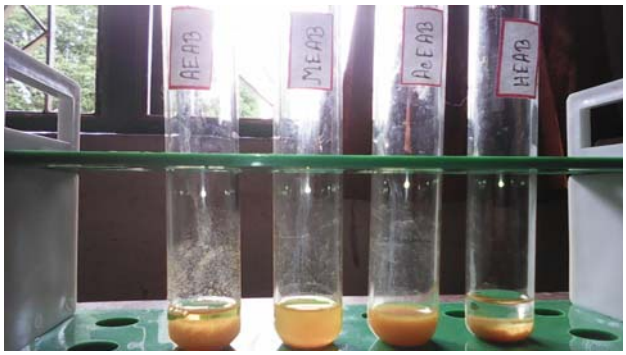


Fig 5.1: Ferric Chloride test for Tannins

Output of table no 5.1 represents the absence of tannins in aqueous, methanol, acetone and hexane extracts of Apple banana (Fig 5.1).

Table 5.2: Qualitative analysis of Presence of Carbohydrates among Solvent Extracts (Aqueous, Methanol, Acetone and Hexane) of Apple Banana

Phytochemical Screening	Aqueous Extract	Methanol Extract	Acetone Extract	Hexane Extract
Molisch's Test For Carbohydrates	+	+	+	+

'+' Represent for Presence; '-' Represent for Absence

Fig 5.2: Molisch's test for Carbohydrates

Output of table no 5.2 represents the presence of carbohydrates in aqueous, methanol, acetone and hexane solvent extract. So carbohydrate is highly polar compound dissolved in water (Fig 5.2).

Table 5.3: Qualitative analysis of Presence of Alkaloids among Solvent Extracts (Aqueous, Methanol, Acetone and Hexane) of Apple Banana

Phytochemical Screening	Aqueous Extract	Methanol Extract	Acetone Extract	Hexane Extract
Dragendroff's Test For Alkaloids	+	+	+	-

'+' Represent for Presence; '-' Represent for Absence

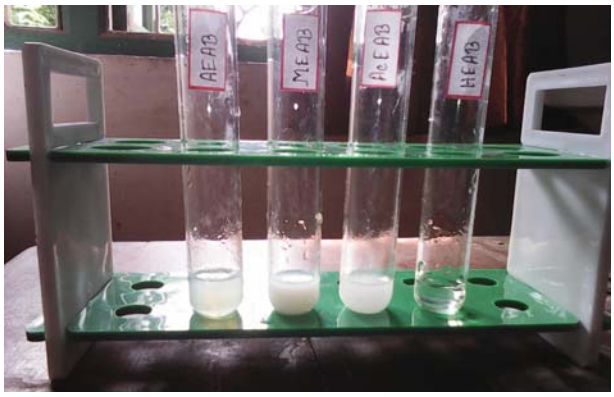


Fig 5.3: Dragendroff's test for Alkaloids

Output of table no 5.3 represents the presence of alkaloids in aqueous, methanol and acetone solvent extracts of Apple banana, but alkaloid is absent in hexane solvent extract. So, alkaloid is semi-polar compound dissolved in methanol (Fig 5.3).

Table 5.4: Qualitative analysis of Presence of Phytosterols among Solvent Extracts (Aqueous, Methanol, Acetone and Hexane) of Apple Banana

Phytochemical Screening	Aqueous Extract	Methanol Extract	Acetone Extract	Hexane Extract
Keller - Killiani Test For Phytosterols	-	+	+	+

'+' Represent for Presence; '-' Represent for Absence

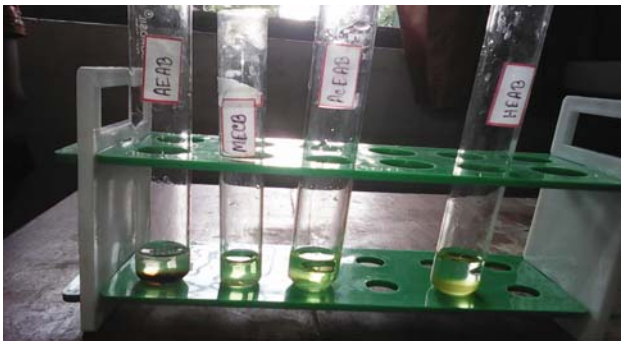


Fig 5.4: Keller-Killiani test for Phytosterols

Output of table no 5.4 represents the absence of phytosterols in aqueous solvent extract of Apple banana, but phytosterol is present in other solvent extracts i.e., methanol, acetone and hexane extract. So, phytosterol is non-polar compound dissolved in hexane (Fig 5.4).

Table 5.5: Qualitative analysis of Presence of Flavonoids among Solvent Extracts (Aqueous, Methanol, Acetone and Hexane) of Apple Banana

Phytochemical Screening	Aqueous Extract	Methanol Extract	Acetone Extract	Hexane Extract
Lead Acetate Test For Flavonoids	+	+	-	-

'+' Represent for Presence; '-' Represent for Absence

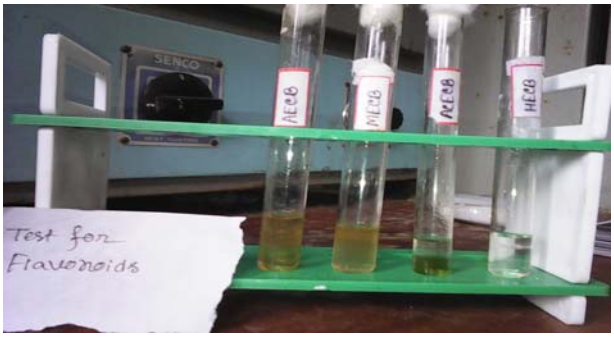


Fig 5.5: Lead Acetate test for Flavonoids

Output of table no 5.5 represents the presence of flavonoids in aqueous and methanol solvent extract of Apple banana, but flavonoi is absent in other solvent extracts i.e., acetone and hexane solvent extracts. So, flavonoid is semi-polar compound dissolved in methanol (Fig 5.5).

6. Discussion

Recently, focus on plant research has increased throughout world (Howlader *et al*., 2012) [22] Medicinal plants containing phytochemicals show a variety of pharmacological actions in human body (Akinmoladun *et al*., 2007) [1] and in our study, phytochemical screening showed the presence of different phytochemicals.

Phytochemicals are non-nutritive plant chemicals that have protective or disease preventive properties. They are nonessential nutrients, meaning that they are not required by the human body for sustaining life. It is well-known that plant produce these chemicals to protect themselves but recent research demonstrate that they can also protect humans against diseases. There are more than thousand known phytochemicals. Some of the well-known phytochemicals are lycopene in tomatoes, isoflavones in soy and flavanoids in fruits (Ayoola, 2006) [6].

The result of preliminary phytochemical screening carried out on the crude aqueous, methanol, acetone and hexane extracts revealed the presence of carbohydrates, alkaloids, phytosterols, flavonoids. These phytochemical constituents have been reported to be associated with different pharmacological activities of plants (Turker and Usta, 2008) [40].

Polyphenolic compounds such as flavonoids are present in the solvent extracts (aqueous and methanol) of Apple banana. Flavonoids have antioxidant property. The presence of flavonoids are responsible for antioxidant activity of the banana extracts (Apu *et al*., 2013) [4]. For maintaining a healthy biological system, the balance between antioxidation and oxidation is believed to be critical (Amin *et al*., 2013) [37]. Hence, the extracts of this banana could be used for the prevention of free radical-mediated diseases (Majumder *et al*., 2014) [28].

Since the present study showed the presence of different bioactive secondary metabolites such as flavonoids, saponin, alkaloids, that singly or in combination may be responsible to treat microorganisms and insects. Flavonoids are present in aqueous and methanol extracts and alkaloids are present in aqueous, methanol and acetone extracts of Apple banana. For this reason, the banana extracts contain antimicrobial activity (Raju *et al*., 2013) [37].

Platelets play a significant role in the process of formation of thrombus on the endothelial surface (Dewan and Das, 2013) [16]. Many thrombolytic agents are applied to dissolve the clots that have already formed in the blood vessels but these drugs have few limitations which can lead to serious fatal consequences (Mannan *et al*., 2011) [29]. In this study, the extracts of plant showed significant thrombolytic activity compared to negative control. This thrombolytic activity may be due to the fact that the extracts are rich sources of alkaloids, flavonoids etc.which are said to exert clot lysis (Hoque *et al*., 2011) [23], (Dwivedi, 2007) [17]. The extracts of banana showed a significant anthelmintic activity. Phyto-constituents like alkaloids etc. may be responsible for anthelmintic property (Aziz *et al*., 2014) [7].

Phytosterols are present in the solvent extracts (methanol, acetone and hexane) of apple banana. Steroids, among other phytochemicals have been reported to possess anticonvulsant activity (Barua *et al*., 2013) [8]. For this reason, this banana contain anticonvulsant activity.

Alkaloids are present in the solvent extracts (aqueous, methanol and acetone) of apple banana. Alkaloids are used in medicines for reducing headache and fever. This are attributed for anti-bacterial and analgesic properties (Nair *et al*., 2005) [33]. For this reason, this banana contains antibacterial and analgesic properties.

Flavonoids show anti-allergic, anti-inflammatory, antimicrobial, and anticancer activities (Apu *et al*., 2010) [5]. Flavonoids are present in the solvent extracts (aqueous and methanol) of apple banana. For this reason, the banana extracts contain anti-inflammatory, anti-allergic, antimicrobial and anticancer properties.

7. Summary and Conclusion

The banana is an edible fruit, botanically a berry produced by several kinds of large herbaceous flowering plants in the genus *Musa i*n some countries, bananas used for cooking may be called plantains and others ripe banana like apple, saba, william, cavendish banana etc. ate raw. These are also a healthy and low calorie food to cure jaundice, urinary disorder, fever, insect bites and kidney disorders. Apple bananas are rich sources of anti-oxidants containing polyphenolic compounds & flavonoids which prevent free radical damage, reducing the risk of oxidative stress related degenerative diseases. Solvent extracts (aqueous and methanol) of Apple banana contain phytochemicals such as flavonoids, alkaloids etc. which are responsible to treat microorganisms and insects. Phyto-constituents like alkaloids may be responsible for anthelmintic property, present in aqueous, methanol and acetone extracts of this banana. Phytosterols which have been reported to possess anticonvulsant activity are present in methanol, acetone and hexane extracts of Apple banana. Alkaloids are also attributed for antibacterial and analgesic properties. Flavonoids also show anti-allergic, anti-inflammatory, anticancer activities. It is a common traditional food consumed by all people and scientifically proved its health effect. The Present study was to evaluate the phytocompounds such as alkaloids, flavonoids, phytosterols etc. in which among 4 types solvent extracts-aqueous, methanol, acetone and hexane of Apple banana. It has been revealed that Aqueous and methanol extracts of Apple banana are most potent content of phytocompounds than others 2 types solvent extracts (acetone and hexane) but all have different types of potentity.

8. Reference

1. Akinmoladun AC, lbukun EO, Afor E, Obuotor EM, Farombi EO. Phytochemical constituents and antioxidant activity of extract from the leaves of the Ocimum graticcimum. Scientific Research and Essays. 2007; 2: 163-166.
2. Aliyu MM, Musa AI, Kamal MJ, Mohammed MG. Phytochemical screening and anticonvulsant studies of ethyl acetate fraction of Globimetula braunii on laboratory animals. Asian Pac J Trop Biomed. 2014; 4(4):285-9.
3. Amin MN, Dewan SMR, Noor W and Shahid-Ud-Daula AFM. Characterization of chemical groups and determination of total phenolic content and in-vitro antioxidant activities of ethanolic extract of Ocimum sanctum leaves growing in Bangladesh. European Journal of Experimental Biology. 2013; 3(1): 449-454.
4. Apu AS, Chowdhury FA, Khatun F, Jamaluddin ATM, PathanAH and Pal A. Phytochemical Screening and In vitro Evaluation of Pharmacological Activities of Aphanamixis polystachya (Wall) Parker Fruit Extracts. Tropical Journal of Pharmaceutical Research. 2013; 12(1): 111-116.
5. Apu AS, Muhit MA, Tareq SM, Pathan AH, Jamaluddin ATM, Ahmed M. Antimicrobial activity and brine shrimp lethality bioassay of the leaves extract of Dilleniaindica Linn. J Young Pharm. 2010; 2(1): 50- 53.
6. Ayoola GA, Sofidiya T, Odukoya O, Coker H.A. Phytochemical screening and free radical scavenging activity of some Nigerian medicinal plants. J. Pharm. Sci. & Pharm. Pract. 2006; 8:133-6.
7. Aziz A, Raju GS, Das A, Ahmed J and Moghal MMR, Evaluation of In vitro Anthelmintic Activity, Total Phenolic Content and Cytotoxic Activity of Crinum latifolium L. (Family: Amaryllidaceae), Advanced Pharmaceutical Bulletin. 2014; 4(1): 15-19.
8. Barua CC, Begum SA, Barua AG, Borah RS, Lahkar M. Anxiolytic and anticonvulsant activity of methanol extract of leaves of Alternanthera brasiliana (L.) Kuntze (Amaranthaceae) in laboratory animals. Indian J Exp Biol 2013; 51(6): 450-457.
9. Bhaskar JJ, Chilkunda ND, Salimath PV. Banana (Musa sp. var. elakki bale) flower and pseudostem: dietary fiber and associated antioxidant capacity. J Agric Food Chem. 2012; 60(1): 427-32.
10. Bhaskar JJ, Shobha MS, Sambaiah K, Salimath PV. Beneficial effects of banana (Musa sp. var. elakki bale) flower and pseudostem on hyperglycemia and advanced glycation end-products (AGEs) in streptozotocin-induced diabetic rats. J Physiol Biochem. 2011; 67(3): 415-25.
11. Bresnahan KA, Arscott SA, Khanna H, Arinaitwe G, Dale J, Tushemereirwe W et al., Cooking enhances but the degree of ripeness does not affect provitamin A carotenoid bioavailability from bananas in Mongolian gerbils. J Nutr. 2012; 142(12): 2097-104.
12. Brower V. Nutraceuticals: poised for a healthy slice of the healthcare market? Nat Biotechnol. 1998; 16: 728–731.
13. Cheng Y, Prusoff WH. "Relationship between the inhibition constant (K_I) and the concentration of inhibitor which causes 50 per cent inhibition (I_{50}) of an enzymatic reaction". Biochem Pharmacol.1973; 22 (23): 3099–108.
14. China R, Dutta S, Sen S, Chakrabarti R, Bhowmik D, Ghosh S, Dhar P. In vitro antioxidant activity of different cultivars of banana flower (Musa paradicicus L.) extracts available in India. J Food Sci. 2011; 76(9): C1292-9.
15. Christelle BB, Olivier H, Didier MM, Dominique P, Abel H, Max R. Effect of physiological harvest stages on the composition of bioactive compounds in Cavendish bananas. J Zhejiang Univ-Sci B (Biomed & Biotechnol). 2013; 14(4): 270-278.
16. Dewan SMR and Das A. Investigation of in vitro thrombolytic potential and phytochemical nature of Crinum latifoliuml. Leaves growing in coastal region of bangladesh. International Journal of Biological & Pharmaceutical Research, 2013; 4(1): 1-7.
17. Dwivedi S. Terminalia arjuna Wight & Arn.- A useful drug for cardiovascular disorders. J. Ethnopharmacol. 2007; 114(2): 114-129.
18. Elizabeth AC. Over-the-counter products: nonprescription medi-cations, nutraceuticals, and herbal agents. Clin Obstet Gynecol. 2002; 45(1): 89-98.
19. Fingolo CE, Braga JM, Vieira AC, Moura MR, Kaplan MA. The natural impact of banana inflorescences (Musa acuminata) on human nutrition. An Acad Bras Cienc. 2012; 84(4): 891-8.
20. Fortunato AA, da Silva WL, Rodrigues FÁ. Phenylpropanoid pathway is potentiated by silicon in the roots of banana plants during the infection process of Fusarium oxysporum f. sp. cubense. Phytopathology. 2014; 104(6): 597-603.
21. Haslinda WH, Cheng LH, Chong LC, Noor Aziah AA. Chemical composition and physicochemical properties of green banana (Musaacuminata x balbisiana Colla cv. Awak) flour. Int J Food Sci Nutr. 2009; 60 Suppl 4: 232-9.
22. Howlader MSI, Sayeed MSB, Ahmed MU, Mohiuddin AK, Labu ZK, Bellah SF, Islam MS. Characterization of Chemical Groups and Study of Antioxidant, Antidiarrhoeal, Antimicrobial and Cytotoxic activities of

ethanolic extract of Diospyros blancoi (Family: Ebenaceae) Leaves. Journal of Pharmacy Research. 2012; 5(6): 3050-3052.
23. Hoque N, Imam MZ, Akter S, Mazumder MEH, Hasan SMR, Ahmed J, Rana MS. Antioxidant and antihyperglycemic activities of methanolic extract of Glinusop positifolius leaves. J App Pharm Sci. 2011; 1(7): 50-53.
24. Jamuna JB, Nandini CD. Feeding of banana flower and pseudostem to diabetic rats results in modulation of renal GLUTs, TGFβ, PKC and extracellular matrix components. Nutr Metab Cardiovasc Dis. 2014; 6: 623-31.
25. Kara A and Sara A. Cooking Enhances but the Degree of Ripeness Does Not Affect Provitamin A Carotenoid Bioavailability from Bananas in Mongolian Gerbils. J. Nutr. 2012; 142: 2097–2104.
26. Kumar GB, Srinivas L, Ganapathi TR. Iron fortification of banana by the expression of soybean ferritin. Biol Trace Elem Res. 2011; 142(2): 232-41.
27. Kumar V. Quality and storability of chicken nuggets formulated with green banana and soybean hulls flours. J Food Sci Technol. 2013; 50(6): 1058-68.
28. Majumder MS, Amin MN, Moghal MMR, Banik S, Kar A, and Hossain MM. Anthelmintic and Cytotoxic Activities of Two Medicinal Plants: Polygonum viscosum and Aphanamixis polystachya Growing in Bangladesh. J. Sci. Res. 2014; 6(2): 339-345.
29. Mannan A, Kawser MJ, Ahmed AMA, Islam NN, Alam SMM, Emon MAEK, Gupta SD. Assessment of antibacterial, thrombolytic and cytotoxic potential of Cassia alata seed oil. J App Pharm Sci. 2011; 1(9): 56-59.
30. Menezes EW, Tadini CC, Tribess TB, Zuleta A, Binaghi J, Pak N et at,. Chemical composition and nutritional value of unripe banana flour (Musaacuminata, var. Nanicão). Plant Foods Hum Nutr. 2011; 66(3): 231-7.
31. Mezquita C P, Urtuvia Gatica V, Ramírez Quintanilla V, Arcos Zavala R. [Product development on the basis of cereal and leguminous flours to coeliac disease in children aged 6-24 months; II: properties of the mixtures. Nutr Hosp. 2011; 26(1): 161-9.
32. Miller KC. Plasma potassium concentration and content changes after banana ingestion in exercised men. J Athl Train. 2010; 47(6): 648-54.
33. Nair R, Kalaria T, Sumitrachandra. Antibacterial activity some selected Indian medicinal flora. Turak J. Biol. 2005; 29: 41-47.
34. Nelson NJ. Purple carrots, margarine laced with wood pulp? Nutraceuticals move into the supermarket. J Natl Cancer Inst. 1999; 91: 755–757.
35. Peroni-Okita FH, Cardoso MB, Agopian RG, Louro RP, Nascimento JR, Purgatto E, Tavares MI, Lajolo FM,Cordenunsi BR. The cold storage of green bananas affects the starch degradation during ripening at higher temperature. Carbohydr Polym. 2013; 96(1): 137-47.
36. Phirke NV, Kothari RM, Chincholkar SB. Rhizobacteria in mycorrhizosphere improved plant health and yield of banana by offering proper nourishment and protection against diseases. Appl Biochem Biotechnol. 2008; 151(2-3): 441-51.
37. Raju GS, Moghal MMR, Dewan SMR, Amin MH, Billah MM. Characterization of phytoconstituents and evaluation of total phenolic content, anthelmintic, and antimicrobial activities of Solanum violaceum Ortega. Avicenna Journal of Phytomedicine. 2013; 3(4): 313-320.
38. Sucheta A Gaikwad et al J. DPPH free radical scavenging activity Chem. Pharm. Res. 2011, 3(4): 766-772.
39. Tajuddeen N, Sallau MS, Musa AM, Habila DJ, Yahaya SM. Flavonoids with antimicrobial activity from the stem bark of Commiphora pedunculata (Kotschy & Peyr.) Engl. Nat Prod Res. 2014; 13: 1-4.
40. Turker AU, Usta C. Biological screening of some Turkish medicinal plants for antimicrobial and toxicity studies. Nat Prod Res. 2008; 22: 136-146.
41. Vilela C, Santos SA, Villaverde JJ, Oliveira L, Nunes A, Cordeiro N, Freire CS, Silvestre AJ. Lipophilic phytochemicals from banana fruits of several Musa species. Food Chem. 2014; 162: 247-52.
42. Wang Z, Zhang J, Jia C, Liu J, Li Y, Yin X et al., De novo characterization of the banana root transcriptome and analysis of gene expression under Fusarium oxysporum f. sp. Cubense tropical race 4 infection. BMC Genomics. 2012 Nov 21;13:650.