Estimation Of Nutrient Analysis Of Varieties Of Banana Available In Tamil Nadu

By

SOUNDARYA.M

(17PFD019)

A THESIS SUBMITTED TO

AVINASHILINGAM INSTITUTE FOR HOME SCIENCE AND HIGHER EDUCATION FOR WOMEN

COIMBATORE – 641043

IN PARTIAL FULFILLMENT OF THE REQUIREMENT FOR THE

MASTER'S DEGREE IN

FOOD SERVICE MANAGEMENT AND DIETETICS

APRIL, 2019

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Saradha Ramadas 25.04.2019.

SIGNATURE OF THE HEAD OF THE DEPARTMENT

SIGNATURE OF THE SUPERVISOR

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INTRODUCTION

TIME FLIES LIKE AN ARROW; FRUIT FLIES LIKE A BANANA

-GROUCHO MARX

India is the largest producer of banana in the world. In India , banana ranks second next to mango in area and production, occupying an area of about 83 lakh hectares with an annual production of 46.26 lakh tons. The important banana growing states are Maharashtra, Tamil Nadu, Andhra Pradesh, Kerala, Karnataka, West Bengal, Bihar And Gujarat.(Rajendran.,2018).

Banana is one of the important fruits of the world, especially of the tropics. It is often called as "Apple of paradise". Banana accounts for the highest production among the fruits and contributes to 31 percent of the total production. In India it is cultivated in 802.6 hac. area with the total production of 29724.6 MT. It is the most popular fresh fruit all over the world and its name comes from the Arabic word 'banan',which means finger.(Ruchi Sharma et al.,2017)

Tamil Nadu, Maharashtra, Karnataka, Gujarat, Andhra Pradesh, Assam and Madhya Pradesh are the major banana growing states in India. Tamil Nadu accounts for 27.7 percent of total production of banana followed by Maharashtra (14.4percent , Gujarat(13.4percent), Andhra Pradesh (9.3 percent), Karnataka (7.6 percent),Madhya Pradesh (5.8 percent), Bihar (5.1 percent), Uttar Pradesh (4.5percent), West Bengal (3.4 percent) and Assam (2.4 percent). (Mahanthi Kishore.,2013)

The varieties of banana grown in Andhra Pradesh are Dwarf Cavendish, Robusta, Rasthali, Amritpant, Thellachakrakeli, Karpoora Poovan, Chakrakeli, Monthan and Yenagu Bontha. In Assam, there are 13 varieties such as Jahaji (Dwarf Cavendish), Chini Champa, Malbhog, Borjahaji (Robusta), Honda, Manjahaji, Chinia (Manohar), Kanchkol, Bhimkol, Jatikol, Digjowa, Kulpait, Bharat Moni. In bihar, there are 8 varieties of banana including Dwarf Cavendish, Alpon, Chinia , Chini Champa, Malbhig, Muthia, Kothia , Gauria. In Gujarat, it almost contains 8 varieties they are Dwarf Cavendish, Lacatan, Harichal (Lokhandi), Gandevi

Selection, Basrai, Robusta, G-9, Harichal, Shrimati. In Jharkhand 2 varieties of banana was cultivating they are Basrai, Singapuri. In Karnataka, totally 6 varieties, they are Dwarf Cavendish, Robusta, Rasthali, Poovan, Monthan, Elakkibale. In kerala, 6 varieties are Nendran (Plantain), Palayankodan (Poovan), Rasthali, Monthan, Red Banana, Robusta. In Orissa, 4 varieties were grown, they are Dwarf Cavendish, Robusta, Champa, Patkapura (Rasthali). In Maharastra, 9 varieties are available , they are Dwarf Cavendish, Basrai, Robusta, Lal Velchi, Safed Velchi, Rajeli Nendran, Grand Naine, Shreemanti, Red Banana. In West Bengal, totally 6 varieties were cultivating, they are Champa, Mortman , Dwarf Cavendish, Giant Governor, Kanthali, Singapuri.(National Horticulture Board- DATA BASE)

There are large numbers of banana varieties growing in different parts of Tamil Nadu. They include Virupakshi, Robusta, Red Banana, Poovan, Rasthali, Nendran, Monthan, Karpuravalli, Sakkai, Peyan, Matti.(Nazreen.,2016).

The genus name Musa is thought to be derived from the Arabic name for the plant (mouz) which in turn, may have been applied in honour of Antonius Musa(63-14 BC), physician to Octavius Augustus, first emperor of Rome (Hyam and Panhurst 1995). The name ‘banana’ is derived from the Arabic banan , finger (Boning 2006). While many revisions of taxonomy of banana had taken place a taxonomic advisory group for Musa was formed by the International Network for banana and plantain. (Ploetz et al.2007)

Size, 2–9 m (6.6–30 ft) tall at maturity. Habitat ,Widely adapted, growing at elevations of 0–920 m (0–3000 ft) or more, de-pending on latitude; mean annual temperatures of 26–30°C (79–86°F); annual rainfall of 2000 mm (80 in) or higher for commercial production. Vegetation, Associated with a wide range of tropical lowland forest plants, as well as numerous cultivated tropical plants. Soils, Grows in a wide range of soils, preferably well drained. Growth rate, Each stalk grows rapidly until flowering. Main agroforestry uses Crop shade, mulch, living fence .Main products Staple food, fodder, fiber. Yields Up to 40,000 kg of fruit per hectare (35,000 lb/ac) annually in commercial or-chards. Intercropping ,Traditionally grown in mixed cropping systems throughout the Pacific. Invasive potential, Banana and plantain are not considered to be invasive.(Scot et al.,2006).

Ripening is a process consists of a set of biochemical and physical changes which gives an edible fruit. Banana is one of mostly consumed fruit in the world and Softening of the texture, yellowing of peel, reduction of astringency and increase of sweetness are major organoleptic changes which can be noted in banana ripening. These changes occur as a result of series of biochemical changes in peel and flesh of banana fruit.(Madhuwanthi et al .,2016)

The chemical composition of banana contains Energy (kcal) 81, Protein 1.2g, Fat 0.1 g, Fiber 1.4 g, Sodium (Na) <0.5 mg, Potassium (K) 330 mg, Calcium (Ca) 6 mg, Magnesium (Mg) 27 mg, Phosphorus (P) 23 mg, Vitamin-C 9 mg. (Mark Roe et al., 2013).

There was significant linear correlation between phenolics concentration and frapinin fusions. The strongest antioxidant properties when measured with the frap assay had pachainadam ,poovan, rasthali and karpooravalli. The best results were obtained from this samples high phenolic concentration, very high frap(>20mm/L)and pac>3.(Sathish Kumar.,2015)

The highest beta carotene was found in variety Red banana (21.19 µg/100g) and was significantly different from other varieties. The lowest beta carotene content was noticed in variety Nendran (2.19 µg/100g). The ascorbic acid content of the banana varieties was observed to range between 1.52 -5.35 mg/100g. The highest ascorbic acid was observed in variety Red banana (5.35 mg) and the lowest for variety Robusta (1.52 mg). The dopamine content of the different banana varieties was observed to range between 3.2-13.3 mg/100g. The highest dopamine content was observed in variety Robusta (13.3 mg) and the lowest for variety the Rasakadali (3.2g). The antioxidant activity of the banana varieties ranged between 41.2-49.2 µg/ml, 44.4-51.6 µg/ml and 46.4-54.8 µg/ml in petroleum ether, methanol and aqueous medium respectively. Highest antioxidant activity was reported in variety Padatti with an IC50value of 41.2 µg/ml and 46.4 µg/ml in petroleum ether and aqueous medium respectively. Where as in methanol solvent, highest activity was exhibited by variety Red banana with an IC50value of 44.4 µg/ml.(Siji et al.,2017).

Plantain peel had the highest lipid content (37.53 ± 0.08%) and protein content (5.79 ± 0.04%), while banana peel had the highest ash content (9.83 ± 0.06%) and moisture content (13.49 ± 0.17%) ($P<0.05$). For the mineral composition, plantain peel had the highest amount of

most of the minerals analyzed (Ca, Mg, K, P, Zn, Fe, Na, Cu, Cr, Pb, Ni and Mn) ($P<0.05$). Banana and plantain peels can serve as good sources of nutrients in animal feeds preparation, as they are high in lipid, protein, ash and essential minerals content. Plantain and banana peels are good sources of nutrients for the production of animal feeds. Also, the presence of good level of mineral elements showed their reliability in correcting nutritional disorders and also in the manufacture of organic fertilizer.(Abubakar etal.,2016)

The chemical composition of banana peel such as moisture, protein, crude fat and total carbohydrates were 88.10, 13.42, 7.57, 10.44 and 68.31 g/100g respectively. For mineral content, potassium is the major element found in banana peel was (9.39 %) followed by magnesium, calcium, sodium and phosphorus were (0.71, 0.44, 0.18 and 0.09 %), respectively. Also, the content of micro element including iron, manganese, zinc and copper were 96.50, 35.01, 27.95 and 3.37 ppm, respectively.(Ahmed M.Aboul Enein et al.,2016).

Nendran and Morris had lower moisture compared to Red banana and Poovan. All banana cultivars were acidic (pH between 4.5 and 5.6), Poovan being most acidic, while Karpooravalli was least acidic. Nendran contained the maximum fructan, about two to three times of the other cultivars. It is to be noted that all these four varieties are traditionally valued for their health promoting characteristics and Nendran and Hill banana are used as weaning food (Shalini et al.,2015).

Based on the HPLC results carbendazim is finding in Hill banana (0.007 mg kg−1), Monthan (0.019 mg kg−1), Nendran (0.002 mg kg−1), Pachanadan (0.007 mg kg−1), Poovan (0.016 mg kg−1), Rasthali (0.017 mg kg−1) and Robusta (0.11 mg kg−1) and carbendazim is not finding Karpuravalli, Ney poovan and Red banana. Endosulfan, Chloropyrifos and Carbendazim in Robusta Banana sample are identified by matching their retention times and characteristic ion. TIC chromatogram for a positive Robusta Banana sample(Parathaman.,2012).

The peels of cultivars Red Banana and Karpooravalli are rich source of bioactive compounds, such as carotenoids (beta-carotene), anti-oxidative enzymes and carbohydrate contents. Karpooravalli cultivar of banana showed the maximum accumulation of carotenoids content (68lgg)1d.w.) in peels. This cultivar of banana is also rich in beta-carotene(143.12lg per 100 g) and carbohydrate content in terms of total starch and sugars. The Red Banana ranked

highest and second highest in the total carotenoid contents for pulp and peels, respectively, and beta-carotene was estimated to be the highest in Red Banana both in the case of peels (241.91lg per 100 g) and pulp(117.2lg per 100 g) (Ajay Arora et al.,2008).

The best antioxidant activity of extract is banana peel extract with IC50 value 64.03 ppm. Banana peel extract with the highest antioxidant activity when formulated into lotion has significant decrease of antioxidant activity(Natalia alamsyah.,2016).

The banana is of great nutritional value. It has a rare combination of energy value, tissue-building elements, protein, vitamins and minerals Bananas can also be included in a diet for high blood pressure as they contain potassium which helps to reduce and control high blood pressure. It is a good source of Vitamin C which helps to rebuild the immune system. Bananas are also relatively easy to digest as compared to other foods and so they are invaluable to those with compromised immune systems. Vitamin C also increases the absorption of iron and increases the formation of blood, these two health benefits of bananas make it ideally suited for those with anemia or blood related problems(Sampath Kumar.,2012).

Banana is rich in fructose and sucrose. It replenishes energy and revitalizes the body instantly. Therefore banana is most useful for athletes. It also supplements food in the treatment plan for underweight children. A good amount of soluble dietary fiber helps normal bowel movements. It is also a very good source of vitamin-B6 (pyridoxine). Pyridoxine is an important B-complex vitamin. It plays a supportive role in the treatment of neuritis and anemia. Moreover, it helps to decrease homocystine (one of the causative factors in coronary artery disease (CHD) and stroke episodes) level inside body.(Rajesh .,2017)

The banana peel is rich in phytochemical compounds than its pulp. The antifungal, antibiotic properties of banana peel can put to be good use. The peel is used for home remedy for treating several skin problems including allergies and skin irritations (Akamine et al.,2009)

The peel of the fruit contains various antioxidant compounds such as gallocatechin and dopamine (Kanazawa et al., 2000). Plants have been valuable source of natural products for various human beneficial products and maintaining human health, especially in the last decades, with more intensive studies for natural therapies.

The extraction of bioactive compounds from banana waste is an alternative method to ensure the efficient, inexpensive, and environmentally friendly use of this waste. These bioactive components can be used in foods, cosmetics, and in the pharmaceutical industries (Schmidt et al.,2014)

The most popular processed product is Nendran chips, which is still in cottage scale while some bigger manufactures are processed banana puree for export. However, there is scope for converting banana into several other processed products like figs, jam, jelly, powder, Flour, baby food, health drink, RTS beverages, wine, alcohol, sauce, pickles, chutneys, animal feed, fiber etc. several processing technologies for value added banana products have been developed at National Research Center for Banana. The post globalization world economy gives more weightage on processing and value addition. Thus, food preservation and proper low cost consumption to reduce malnutrition problem is possible through banana fruit. and it‘s by-products(Prashant et al.,2014).

Several products have been made from banana fibers, like Paper board, tissue paper etc., can be prepared out of banana pseudostem. Banana fiber is a natural bast fiber which has wide range of uses in handicraft product developments such as mat, rope and twines, but only 10% of its pseudo stem is being used for making products and remaining is waste or used as fertilizer. banana fiber possesses a lot of advantageous physical and chemical properties which can be used a very good raw material for the textile and packaging industry (Vigneshwaran et al.,2015).

Musa X paradisiacal var. Sapientum, an important commercial fruit item of the tropics, is known in India since time immemorial. Apart from its use as a valuable food item, banana fruits and the different part of plant find diverse uses in various folk practices, customs, religious rituals and medicine among the villagers and tribal communities of the country which are oral in tradition. medicinal applications of banana has shown that they are very effective and can be used by all as simple and safe home remedy for treating a number of common ailments(Pushpagadan et al.,1989).

The aim of this study is to determine the proximate analysis on species of banana in Tamil Nadu namely Poovan , Rasthali, Red banana, Karpooravalli, Virupakshi, Nadan, Monthan, Nendran, Matti, Peyan.

.The objectives of this study are:

To determine the proximate analysis of the banana powder.

To determine the proximate analysis of the banana peel powder.

REVIEW OF THE LITERATURE

The literature to the pretending to the present study entitled on “ESTIMATION OF NUTRIENT ANALYSIS OFVARIETIES OF BANANA AVAILABLE IN TAMILNADU” is discussed under the following headings

A. BOTANICAL DESCRIPTION
B. TRADITIONAL AND MEDICINAL PROPERTIES
C. VARIETIES OF BANANA
D. POST HARVEST LOSSES
E. VARIOUS STAGES OF RIPENING
F. NUTRITIONAL COMPOSITION
G. BANANA AND ITS BY-PRODUCT
H. CULINARY PRODUCTS

A.BOTANICAL DESCRIPTION

TAXONOMICAL CLASSIFICATION: *Musa* species

There are five taxonomic sections in the genus *Musa*, two of which contain edible bananas.(Mohammad Zafar Imam et al.,2011).

Kingdom : Plantae
Division : Magnoliophyta
Class : Liliopsida
Order : Zingiberales
Family : Musaceae
Genus : Musa
Species : Musa paradisiaca, Musa sapientum

COMMON NAMES

Banana, dessert banana, plantain, cooking banana(English) pacific islands *aga*(ripe banana) (Chamorro) *chota*(Chamorro, Guam, Northern Marianas) *leka, jaina* (Indian derivation)(Fiji) *mai'a*(Hawaii'i), Panama (New Zealand: maori) *meika* (cook islands*) meika*, mei'a (French Polynesia) *sianine* (introduced cultivars), *Hopa* (native)(tonga)*sou* (Solomon islands) tebanana (Kiribati *) uchu* (chuuk) *uht* (pohnpei*) usr* (kosrae)banana cultivars have a host of common names in different islands.(Scott et al.,2006)

B.TRADITIONAL AND MEDICINAL PROPERTIES

Savithiri Maharani Budiman et al(2012) said that all the parts of the musa species has some medical applications, the flowers in bronchitis, dysentry and on ulcers, the cooked flowers are given to diabetes; the astringent plant sap in cases of hysteria, epilepsy, leprosy, fevers, hemorrhages, acute dysentery and diarrhea and it is also applied on hemorrhoids, insect and other stings and bites.

Sampath kumar(2012) explained that a single banana provides with 23 percent of the potassium that to be need on daily basis and it is beneficiary the muscles as it helps to prevent muscle spams and it neutralize the acidity of gastric juices, and thereby it is reducing ulcer irritation by coating the lining of the stomach and also he states that banana gives an instant energy and it can stimulate the production of hemoglobin the blood and it can helps in anemia.

The banana flower is rich source of various vitamins, flavonoids and proteins. The banana flower has been used in traditional medicine to treat bronchitis, constipation and ulcer problems. It eases menstrual cramps. The extracts of banana flower have antioxidant properties that prevent free radicals and control cell and tissue damage. (Kumar and Bhowmik., 2012).

Forster et al., (2003) states that the nutritive value of banana can be useful for the weight gain process and also for the weight reduction and more possible of constipation , bowel problems, anemia, blood pressure heart problems, anemia morning sickness nervous disorders etc

Consumption of small fruits has been associated with diverse health benefits, such as prevention of heart disease, hypertension, certain forms of cancer and other degenerative or age-

related diseases (Santos-Buelga and Scalbert, 2000; Hummer and Barney, 2002). These beneficial health effects of fruits could mostly be due to their particularly high concentrations of natural antioxidants (Wang et al., 1996), including phenolic compounds, ascorbic acid and carotenoids.

ANTIOXIDANT EFFECTS:

Poongodi et al. (2012) conducted a study on the antioxidant activity of the pulp extracts of nine varieties of banana, via Kadali, Karpooravalli, Monthan, Pachainadan , Poovan, Rasthali, Robusta and Sevvazhai. The total antioxidant capacity of banana pulp extracts was expressed as number of equivalents of ascorbic acid. According to the results, different pulp extracts exhibited various degrees of antioxidant capacity. The ethanol extracts of variety Rasathali banana showed highest μmol g-1antioxidant activity in the range of 6.60 μmol g-1compared to other varieties of banana pulp, whereas ethanolic extract of poovan banana showed least activity in the range of 3.80 μmol g-1.

The variations in the antioxidant potential reported by various authors can be attributed to differences in cultivars, extraction procedures, geographical location and prevailing conditions such as soil, temperature, sunlight, horticulture practices and soon (Kim et al., 2001)

Roa et al (2015) presented the partial antibiotic spectrum of extracts obtained from the pulp and skins of green, naturally ripened, and ethylene-ripened bananas, and from banana leaves and petioles by means of solvent extracts (aqueous, methanol and petroleum-ether). Antifungal activity was exhibited by all extracts. Very little, if any, measurable antibacterial activity in either the pulp or skins of green bananas was detected, but there was appreciable antibacterial activity in the pulp and skins of ripe bananas.

Qusti et al. (2010) and Miller et al. (2000) conducted a study on antioxidant activity of fresh fruits using DPPH assay and found that plant variety, growing condition, maturity, season, geographic location, fertilizer application, soil type, storage conditions and amount of sunlight received are some of the factors which affect the DPPH assay.

Partha, (2007) said that musa sapientum is been used in the treatment of over excess menstruation. Ghani, 2003 and partha, 2007 conducted a study on antioxidants effects on

diffenrent banana parts and he said that the fruit of musa sapientum and musa paradisiaca is used in the treatment of diarrhea , dysentery, intestinal lesions in ulcerative colitis, diabetes etc.

Aniti blessings Onuoha et al.(,2016) reported that the banana is considered to be a rich and a good source of potassium, which is an important component of the body cells and fluids from it can helps in controlling the rate of heart beat and blood pressure.

Someya, et al. (2002) identified gallocatechin in banana peel at a concentration of 160mg/100g DW. Variation in ripening and growth stages causes certain changes in polyphenolic content. She has evaluated the antioxidant activity in banana peel, measured as the effect of lipid auto-oxidation, in relation to its gallocatechin content.

Mokbel and Hashinaga, (2005) reported that unripe banana peel displayed high antioxidant activity as increasing the polarity, the extracts exhibited stronger antioxidant activity. Polyphenols or flavanones and flavonoids play important roles in these activities and Glycoside and monosaccharide components in water soluble extracts displayed significant antioxidant and antimicrobial activity.

Arora, et al. (2008) reported that antioxidant activity and bioactive compound get affected on varying the cultivar of banana. Red Banana and Karpooravalli are rich source of bioactive compounds, such as carotenoids (beta-carotene), antioxidative enzymes and carbohydrate contents.

Montelongo, et al. (2010) evaluated that the polarity of the solvent and that of the different antioxidant compounds affects the efficiency of the extraction and the activity of the obtained extracts. Acetone: water most efficiently extracted all extractable components (54 ± 4%), phenolic compounds (3.3 ± 0.8%), and anthocyanin compounds (434 ± 97 lg cyanidin 3-glucoside equivalents/100 g freeze dried banana peel). From the above results, they had concluded that banana, a tropical plant, may protect itself from the oxidative stress caused by strong sunshine and high temperature by producing large amounts of antioxidant.

ANTIMICROBIAL ACTIVITY

The use of natural antimicrobial compounds is important not only in the preservation of food borne diseases but also safe for human consumption (Conner, 1993). According to Shan, et

al. (2007) consumers too have questioning the safety of foods containing the synthetic antibacterial agent as preservatives. Therefore, there has been increasing interest in developing new types of highly effective and non-toxic antibacterial agents from natural sources. Many studies showed that fruit peels contain various phenolics components which are effective against pathogenic microorganism (Anagnostopoulou, 2006).

Phenolics compounds like tannins and flavonoids have been reported for antimicrobial activity. Both are toxic to fungi, bacteria and viruses and inhibit their growth (Colak, et al. 2010).

Ahmad and Beg, (2001), reported that natural compounds in fruits and vegetables such as polyphenols, flavonoids and tannins shown very promising results in combating bacteria, fungus and viral.

The banana peel enhances the immune system which helps in wound healing and cure of gastrointestinal disorders. In addition, they also prevent oxidative stress as the growth and ripening proceed. However, very few literatures have been published for antimicrobial property of banana peel (Mokbel, 2005)

C.VARIETIES OF BANANA IN TAMILNADU

According to National Horticulture Board, The varieties of banana available in Tamil Nadu are

1. POOVAN
2. RED BANANA
3. RASTHALI
4. NENDRAN
5. MONTHAN-
6. NADAN
7. KARPOORAVALI
8. VIRUPAKSHI
9. SAKKAI
10. PEYAN
11. MATTI

POOVAN

It is an important commercial variety of banana available in Tamil Nadu produced year round in large quantities plant tall and vigorous.

FRUIT-Medium size, cylindrical, pronounced ripple.

SKIN-Thin, Bright Yellow, Peels off easily.

PULP- Soft, Juicy, Yellow, Acid sweet taste, Good flavor.

RED BANANA

Its commercial cultivation is prominent in Kanya Kumari and Tirunelveli Districts of Tamil Nadu. Lesser grown Variety.

FRUIT- Large, Spindle, Shaped, Short pedicel, Blunt tip.

SKIN- Thick, leathery, Red colour, Peels easily.

PULP-Orange yellow color,Juicy,sweet, Moderate but distinct flavor.

RASTHALI

It is a delicious variety grown mostly in Erode and Tiruchirapalli districts.

FRUITS- Medium sized, Cyclindrical to spindle shaped , Week pedicel.

SKIN-Thin, Peels of easily , ivory, yellow in color

PULP-Sweet in Taste, sweet, firm, pleasant Aroma.

NENDRAN

Largely grown in Tiruchirapalli and Coimbatore Districts.

FRUITS- Large, Long, Thick.

SKIN- Thick and leathery, golden yellow, peels with difficulty.

PULP- Firm, flesh colored, core fairly, conspicuous mild flavor, medium sweet

.MONTHAN

It is suitable for cultivation for leaf production in Trichy and Tanjore districts of Tamil Nadu.

FRUITS- Large, Irregularly five sided , ridges prominent, Slightly curved, Broad at base tapering towards apex, Rominent knob like beak, Long pedicel.

SKIN- Thick, Tough, Peels with difficulty, Dark green turning straw yellow.

PULP- Firm, Cream colored, Core concepiecous, Medium Taste.

KARPOORAVALLI

It is a popular variety grown for table purpose in medium rich soils. Its commercial cultivation in speedover central and southern districts of Tamil Nadu.

FRUIT- Medium sized , Persistent even after ripening

SKIN- Medium, Thick, Yellow with ashy coating.

PULP- Sweet and juicy, Firm, Pleasant flavor.

This variety thrives even in alkanine solids.

VIRUPAKSHI

It is a premium variety grown in the lower Palani hills of Kodaikanal range and in Tamil Nadu. Perennial banana of high quality , grown in rainfall crop either as mixed with coffee or pure plantain.

FRUITS-Small to medium, Prominently ridged

SKIN-Thick, Leathery, Greenish Yellow and Turning Black when over ripe, Peels easily,

PULP- White or pale yellow, Dry, Sweet with delightful flavor.

Fruits ,strongly attached to pedicel even on ripening.

SAKKAI

It is commercially plantations is seen in Madurai, Tirunelveli , KanyaKumari Districts of Tamil Nadu.

FRUITS- Short, Stout, and have no knob. It is a dual purpose variety.

MATTI

It is a common variety of southern districts of Tamil Nadu. Plants less hardy.

FRUITS- Small, Long, Pronounced tip.

PULP- Good taste.

PEYAN

It is a common variety of southern districts of Tamil Nadu. The plants less hardy .

FRUITS-Broad, Long and Large, Irregularly five sided , ridges prominent, Slightly curved, Broad at base tapering towards apex, Rominent knob like beak, Long pedicel.

PULP- Good taste.

D.POST HARVEST LOSSES

Post production losses of banana can be reduced by adopting various post-harvest management practices that are currently in practice all over the world to prolong its shelf life. Post harvest management practices such as cleaning, sorting, and pre-storage treatments, viz. pre-cooling, chemical treatment for disinfection, modified atmospheric packaging, for banana are discussed in brief, in the following sections.(Debabandya Mohapatra et al., 2010)

E.VARIOUS STAGES OF RIPENING

Ripening is a natural physiological process that makes the fruit sweeter, more palatable, edible, nutritious, softer and attractive . It is associated with colour changes due to the pigments that are already present orare produced during ripening (Gupta, 2017). Fruits attain

their desirable flavour, quality, colour, and other textural properties during ripening (Bhattarai and Shrestha, 2005).

Adeyemi et al.(2009) conducted a study on the various stage of ripening of banana , he explained that musa contains a desirable amount of mineral components and also therefore it serve as a good source of mineral supplement in the diets for the animal and human consumption. Because of the musa, high nutritive content and the consumption rate, it has been designed to study the physio chemical changes of mineral element composition of various stages includes 3 types which more riped , unri ped and overriped.

Maduwanthi et al, (2017) conducted a study on the biochemical changes during ripening of banana and she denoted that the process of ripening consist of some biochemical changes and physical changes is the important factor which yield the edible fruit. During the ripening process, the features including softening of texture, yellowing of peel, reduction of astringency and increase of sweetener are the major changes noted during the process of ripening.

Abdullahinura et al(2018) conducted a study on the effects of artificial ripening using calcium carbide, shows that the calcium carbide increases the sensory characteristics of the musa , when it is uses as a ripening agent, significantly it does not affect the quality of the fruits and the higher concentration results to higher moisture in the riped banana.

Hou juncai et al (2015) conducted a study on the classification of ripening stages of bananas and he classified that bananas were divided into seven level ripening stages based includes stalk, middle and tip. It support vector machine method has been used in this study to classify the ripening stages by color values of banana. During ripening the musa, undergoes color change and textural transformation. The peel color will be changes form green to yellow due to the synthesis of few pigments. During the first visual assessment, quality of the banana plays the first influences and color acted as an important indicator of musa to influences customer acceptability. Ripening is the process by which fruits attain their desirable flavor , quality, color, palatable nature and other textural properties. Ripening is associated with change in composition i.e. conversion of starch to sugar.

F.NUTRTIONAL COMPOSITION

Banana starches presented differences in physico-chemical prop-erties that can be caused by starch granule size and morphology,as well as amylose/amylo pectin ratio.The thermal properties also exhibited some difference singelation temperatures and enthalpy,which could be correlated to the amylose content of the banana starches. Although the native banana starches presented high value s of resistant starch, it was substantially destroyed by cooking. Thus, inorder to take advantage o f the prebiotic properties of the resistant fraction,the banana starch should be used in its native state as additive for food products.(Utrilla-Coello et al.,2014)

Nutrients plays a significant role in production of high yield of good quality fruits. Providing appropriate quantities of nutrients in the right proportion when needed most is the essence of management of nutrients in successful banana cultivation (Vekatarao et al .,2017)

Bananas and Plantains are rich in nutrients , Starch , Sugar, and Vitamin A and C, Potassium, Calcium, Sodium and Magnesium(Doymaz et al.,2010). Plantains are nutritionally low protein food material but relatively high in Carbohydrates, Vitamin and Mineral (Offem et al .,1993).

Fruit composition can be strongly influenced by the variety and ripeness, and the major constituents of these fruits are sugar, Polysaccharides and organic acids, While N- Compounds and lipids are present in lesser amounts. Minor constituents include pigments and aroma substance to sensory quality , Vitamins and Minerals of nutritional importance(Tekalignkasa et al .,2017).

Sreedevi (2013) conducted a study on organically cultivated banana varieties like Nendran, Palayankodan and Rasakadali and found that vitamin C level was high in Rasakadali(6.46mg) followed by Nendran (6.4mg) and Palayankodan (3.33 mg).

It was reported that 246 volatile compounds have been identified in banana fruit, including 112 esters, 57 alcohols, 39 acids, 10 aldehydes, and 10 ketones, but only 12 compounds contribute significantly to banana aroma.(Aurore et al.,2011).

The ash content of banana increased from immature (0.63%) to green mature (0.70%) then later dropped at the ripe stage (0.32%) and he also reported that the ash content of ripening

plantain is affected by developmental stage and unripe plantain contains higher ash content as compared to ripe ones(Adeyemi et al.,2009).

In terms of the carbohydrate content, banana was high in the ripe stage this can be attributed to high level of sugar, starch and dietary fibers (Rodrigeuz et al., 2008).There is no significant difference observed at the stages of development. Although between the carbohydrate content of banana and plantain, saba banana and banana a significant difference was observed. The variation in carbohydrate contents during growth might be due to degradation of starch for synthesis of sugars(Sakyi dawson et al.,2008)

There was an increase in the protein content of plantain from the immature stage (0.87%) to ripe stage (4.37%), unlike banana with 0.18% at immature stage and 0.35% at ripe stage. The protein content of musa sapientum (saba) increased from 1.06% at immature stage to 1.57% at the green mature stage and later dropped to 1.05% at the ripe stage. Although a significant difference between banana and plantain was observed.(Pugalenthi et al.,2004).

Arora et al.(2008) determined the beta-carotene content in selected Indian banana varieties and reported karpooravalli banana cultivar had a high beta-carotene content (143.12 µg/100 g).

The fiber extractable pseudostem and fiber yield percentage was found to be 46.4% and 0.53% of the extractable pseudostem in dessert cultivars and 55.2% and 0.78%, respectively, in culinary types (Uma et al .,2003). Uma et al.(2005) studied the fibre yield and quality of six cultivars (Robusta, Poovan, Pachanadan, Karpuravali, Peyan and Saba). The fibre recovery percentage and cellulose content were high in Pachanadan (0.88% and 57.89%)

Fibre from the pseudostem and peduncle were extracted from the four varieties of banana in Tamil Nadu using the fiber extraction machine, (Preethi et al.,2013)reported that among all the four varieties Grand Naine, Poovan, Monthan, Nendran, The highest pseudostem and peduncle fiber were obtained from poovan banana (2.71 % and 1.09%). The lowest were found in Grand Naine (1.07% and 0.63%). The cellulose is the major component found in the nedran banana (60.27%) and nendran contains(59.23%).The other non cellulosic substance like hemicellulose , Lignin,and pectin were high in monthan contains (15.75%, 21.56% and 4.08%) pseudostem fiber.(Preethi et al.,2013).

Musa sapientum peels were analysed for minerals, nutritional and anti – nutritional contents. The result of mineral content indicate the concentrations (mg/g) of potassium, calcium, sodium, iron, manganese, bromine, rubidium, strontium, zirconium and niobium to be 78.10, 19.20, 24.30, 0.61, 76.20, 0.04, 0.21, 0.03, 0.02 and 0.02 respectively. The percentage concentrations of proteins, crude lipid, carbohydrate and crude fiber were 0.90, 1.70, 59.00 and 31.70 respectively. The concentration (mg/100g) of calcium, sodium, iron, and manganese were 19.20, 24.30, 0.61 and 76.20 respectively. The result agrees with Akinyoye (1991)that banana fruit has high concentration of potassium.

Peels of banana were removed and analyzed for their nutrients and anti-nutrients contents. The results showed that water content, crude protein contents, crude lipid contents, crude fiber, total ash contents and carbohydrate in banana peels were 50.5, 5.3, 1.6, 19.2, 8.8 and 14.6% respectively. The results indicate that if the peels are properly exploited and processed, they could be good ingredients and cheap source of carbohydrates for culture media.(Hasan et al.,2018)

The banana peel contains a high quality and cheap source of starch(13%), Crude protein(6-9 %), crude fat (3.8- 11%), vitamins, bioactive compounds and other micro nutrients such as potassium, phosphorus, calcium, magnesium(Panda et al.,2013).

IMPORTANT COMPOUNDS

Banana is highly nutritious and easily digestible than many other fruits. Digestion time of banana fruit is less (105 min) than apple (210 min). Bananas are popular for aroma, texture and easy to peel and eat, besides rich in potassium and calcium and low in sodium content (Wall et al .,2006). Moisture content in pulp increases during ripening process due to respiratory breakdown of starches into sugar and migration of moisture from peel to pulp(Debabandya Mohapatra, 2009).

Bananas protein (1-2.5%), depending on genometype, variety, altitude, and climate, increases over ripening process (3.8-4.2%)(Akaninwor et al.,2005). Fat content in pulp remains almost constant (1%)during ripening process (Emaga et al.,2007). Fat content in pulp remains almost constant (1%)during ripening process (Emaga et al., 2008). Bananas are rich in phenolic compounds andflavanoids, which have antioxidant properties. Astringent taste of unripe banana

is due to phenolic compounds. Bananas are rich in dopamine, an antioxidant (Alothman et al.,2009).

Browning is caused by poly phenoloxidase, mono phenol mono oxygenase ando-diphenoloxidase activities on dopamine, which produces tannins resulting in brown spots on peel. When stored below 13°C, brown patches develop on peel (wuyts et al.,2006).

Some amount of β-carotene (40-4960 µg/100g), found in pulp and peel of fruit, might explain colour changes from off white, yellow and, in some cases, orange colour of pulp (Englberger et al.,2003). Pulp is rich in vitamin A, B-vitamins (thiamine, 40µg; riboflavin, 70 µg; niacin, 610 µg; pantothenic acid,280 µg; pyridoxine, 470 µg; folic acid, 23 µg) and ascorbic acid (Aurore et al.,2009). Potassium is most abundant mineral present inedible portion of banana, followed by magnesium, calcium, and phosphorus.

G.BANANA AND ITS BY-PRODUCT

Banana by-products include the pseudostem, leaves, inflorescence, fruit stalk (floral stalk/rachis), rhizome and peels. Most of these by-products may serve as an undervalued commodity with a limited commercial value, application and in some cases, it is considered as an agricultural waste. The pseudostem and leaves are commonly left to rot in farms to replenish some of the nutrients in the soil. Young shoots, pseudostem piths and inflorescence, although be consumed as vegetables by the indigenous people in parts of South east Asia and Indo Malesian Region (Kennedy2009),

Khawas,(2016)reported that banana peel is a rich source of dietary fiber, protein, crude fat, lipid, pectin, essential amino acids, polyunsaturated fatty acids, and micronutrients. Studies have reported that all of the essential amino acid contents are higher than Food and Agricultural Organization standards, except for lysine. During the process of value added products development from culinary banana, the peel is a waste material of various fruits and vegetables processing units located in Northeast India and is possible to obtain banana peel sufficiently. A literature survey revealed that this biomaterial is unexploited in terms of its value and has enormous potential for industrial use. Hence, the use of this biomaterial will not only help in increasing value, but also helps with keeping the environment pollution free.

NUTRACEUTICAL POTENTIAL OF BANANA

Commercial pectin, a structural hetero polysaccharide classified under soluble dietary fiber, was produced mainly from fruits extract such as citrus peels, oranges, apples, and carrots. Comparing the quality of pectins isolated from various fruit wastes revealed that the pectin's methoxyl composition and gelling quality of banana is slightly lower than the pectin isolated from citrus peels such as pomelo and lime (Madhav and Pushpalatha.,2002).

Pectin could be produced from discarded banana peels via acid extraction and precipitation by using alcohols or ammonium salts. A study by Emaga et al. (2008) revealed that pectin content in banana peels was higher than plantain peels and both of these fruit peels provide a similar or slightly higher amount of extractable dietary fibers compared to other fruit peels implying a potential cheaper alternative source of pectins for banana producing countries, reducing their dependence on imported pectins.

The peels were reported to contain significant amount of potassium. An incorporation of banana peels at a ratio of 10 % into biscuits did not show significant differences in the overall color, aroma, and taste, which make it suitable for the production of low calorie food products with high dietary fiber content (Joshi 2007).

The preservative capability of banana peel water extract from similar banana variety in reducing lipid oxidation process in raw meat was comparable to synthetic antioxidant such as butylated hydroxy toluene (BHT). This result was well anticipated due to the fact of the existence of known antioxidative substance in banana peels as reported by Mokbel and Hashinaga (2005) as well as González-Montelongo et al.(2010).

Banana peels are noted to be a good substrate in producing ethanol and the contributing factors such as substrate concentration, fermentation parameters, and the type of fermenting organism do affect significantly the overall yield of ethanol (Manikandan et al. 2008).

Wilaipon (2009) reported that low cost banana peels bound with molasses under high press pressure are a potential raw material for making banana briquettes. These briquettes were made as an attempt to utilize agricultural waste such as the banana peel as a substitute for solid fossil fuels such as coals. Comparing to other agricultural waste briquettes such as sawdust, rice husk, peanut shell, coconut fibre and palm fibre in an earlier study by Ooi and Siddiqui (2000), briquettes made from banana peels had an outstandingly lower burning rate with equivalent briquette strength even when similar densification pressure is applied during processing.

Heavy metals are regarded as a threat to the environment and the availability of these hazardous metals in wastewater such lead, chromium, cadmium, mercury and zinc pose a great health threat to humans as it might contaminate the drinking water system. Heavy metals are hardly biodegradable and can easily accumulate in living tissues making it concentrated as it goes up the food chain (Metcheva et al.2010).

Numerous agricultural wastes were explored and most are found to have the potential as low-cost heavy metal absorbers (Kumar 2006). Cleaning the environment from the contamination of heavy metals is very costly and thus cheaper alternative absorbers from agricultural waste particularly from banana are highly considered.

Noeline et al. (2005) showed the formaldehyde polymerized banana pseudostem is an effective absorbent in cleaning lead (II) in batch reactors. Removal of lead (II) up to 99.0 % and above is achievable when all the required absorptive conditions are met. Banana pseudostem processed into carboxylated functionalized banana pseudostem (CBS), was also being reported to be a good mercury (II) absorber even in the presence of other ions and comparable in absorption capacity and binding energy to the commercially available carboxylic acid functionalized cation exchanger Amberlite IRC-50 (Anirudhan et al. 2007)

H..CULINARY PRODUCTS

Bananas represent a potential raw materials for food and non-food processing industries (Aurore et al.2009) and it can easily processed to several value added products like banana puree, dried banana blossoms, banana flour, banana Chips, banana wine, banana vinegar, banana

figs, banana sauce, sauce and paste from banana peeling, vinegar from banana peeling (Emaga et al.,2007)

Fruit juices are the most common and demanding products made out of most of the fruits. Generally, juices are extracted by simple crushing and / or grinding of fruits. Products evaluated included banana juice (Nair.,2000), ripe banana powder and products made from ripe banana powder such as banana biscuits, banana cake (Surendranath et al.,2004) and banana baby food (Jayachandran .,2000).

Banana being a highly perishable fruit, suffers from high post-harvest losses to the extent of about 30 to 40 per cent. Among the several techniques available for preservation or processing of banana, dehydration is widely adopted technique for banana and also banana processing industry to take advantage of market opportunities, consequently contribute to the improvement of living standards of farmers by improving employment opportunities. With this connection a study was conduct to estimate the recovery percentage, cost of investment and returns of banana processing products like banana crisps and banana papads (Venkata Subbaiah et al ., 2018).

BANANA CHIPS

Fried bananas chips are produced by deep-frying green unripe or partially ripe pulp slices. Wash the fruit, peel neatly and slice using a plantain slicer (kitchen wonder) into disc or longitudinal shapes. The fruit may be salted before or after slicing and then deep-fry in vegetable oil until crisp. To prevent sticking of pulp slices, the peeled fruit can be salted whole and then slice directly into the heated oil (Adeniji at al., 2007)

BANANA PUREE

Mature bananas are generally used for production of viscous food products as during ripening starch is converted into simple sugars and soften the fruit and point of maturity affects the final product quality. Bananas are either boiling water or steam blanched until a center temperature of 93°C is reached and generally it takes 10 to 15 min. Blanched bananas are then cooled and peeled. The blanched bananas are mashed and blended by using blender machines to obtain puree. The puree minimally placed in air to obtain banana puree with an attractive color, fine texture and retains its fruity flavor. Banana puree must be further treated with preservatives,

antioxidants, stabilizers and emulsifiers to ensure their preservation until the moment of final utilization and processing. The puree can be stored in frozen condition, tetra packed, aseptic packaging or canning. The puree is used for infant foods, as beverage, snack foods, jam, jellies, confectionary products and sauces.(Ravinder Singh et al.,2018).

BANANA JAM

Ripen banana having sweet taste, fine flavour and texture is suitable for production of excellent jam (Aurore et al.2009). It can be easily processed jam as other fruits. In one method for the preparation of jelly, fully ripe or over-ripe fruits are used. The banana slices are boiled for 1 h in 60° Brix sugar syrup at the rate of 1 lb of banana slice to 1 pint of syrup (454.01 g to 0.5681). The Ph should be adjusted to 3.5. Pectin may be added to improve the set. 200.02 lbs of sugar, 10 gallons of water and 12.2 ounces of cream of tartar. These are heated to 110°C and then 2.5 gallons of lemon juice (lime juice or citric acid can be used to replace the lemon juice to reduce the pH of the jam to 3.5) are added. The mixture is heated to 107°C until the correct consistency is obtained.

BANANA DRINK

Banana puree is used extensively in the processing of straight banana drink(Aurore et al.2009). This banana drink needs no dilution before consumption (Adeniji et al.2010). The product is pasteurized at 90°C to destroy microorganisms, molds and yeasts before bottling. Banana drink can also be canned or aseptically packed. The drink has the TSS content of 12-13°Brix and pH of 4.0. The drink may or may not be sweetened. The sweetening agent used can either be sucrose or a combination of sucrose and HFGS. In the enzymatic treated banana drink, pectinase and amylase are added after the acidification process to produce a clear drink. Preservatives like sodium benzoate, sodium nitrite, nitrates, Sulphur dioxide, carbon dioxide, copper carbonate and benzoic acid may be needed to extend the shelf life of fresh juice.

Leaves are used extensively for weaving baskets, mats, food wrapper for marketing and cooking, coverings over food, tablecloths, and plates for eating as well as cup of drinking soup (Mohapatra et al. 2010)

Value added fruit product is suitable for production by small-scale farmers and processors. Complete utilization of fruit crops is a key component to the success of small farm operations. Excess fruit crops can be dried (or processed in other manners) and be used to create many value-added products. Banana peel is an underutilized source of phenolic compounds. These peels are currently either used as fertilizer or discarded in many countries (Zhang et al. 2005).

BANANA FIBER

Banana fiber is used in manufacturing industries of handicrafts, home decorative, door mats, table mats, pooja and meditation mats. Paper made out of banana fiber is having very good export potential for 25 countries including European countries. Banana fiber has got very wide usage in the units like 100% chemical free tissue paper, filter paper, paper bags, craft papers, greeting cards, wedding cards, carry bags, nursery pouches, art papers, decorative papers, tissue papers, bond papers, paper products like pen stands, table decorative, land shades etc., Products that are made out of banana fiber has very good market. Banana fiber is also used in the production of Banana paper. Banana paper is used in two different senses: to refer to a paper made from the bark of the Banana plant, mainly used for artistic purposes, or paper made from Banana fiber, obtained from an industrialized process, from the stem and the non-usable fruits. This paper can be either hand-made or in industrial processes (Tamil Nadu Agricultural University.,2009)

BANANA FLOWER PICKLE (THOKKU)

The banana male bud is a waste material produced during crop production with less economic value. It is converted into a high value added product by making pickle (Thokku). The process involves removal of pistil, blanching, grinding and addition of spices and oil. The protocol and recipe was standardized. The product is tasty and stable for a year at room temperature. It can be adopted by food processing industries for commercial manufacture of pickles (Thokku). It is a low salt, low oil pickle suitable for all age groups. It is creation of wealth from waste and an additional source of income.(Narayana et al.,2009

It can be adopted by food processing industries for commercial manufacture of banana baby food and health drink. The product is rich in carbohydrate and energy. Baby food and health drink are highly energetic and nutritious, which may be used for growing children. It can be started with low investment. Banana flour can be prepared from matured fruits. The flour prepared from the fruits is fortified with milk, green gram and sugar for baby food preparation, while in health drink preparation, chocolate powder, barley powders and sugar are added with banana flour. The product is rich in carbohydrate and energy and also rich in minerals and protein. It will be useful for children as energetic and nutritious drink. It may generate rural employment**.**

Banana peel extract is classified as non-toxic to normal human cells criteria established by the National Cancer Standard Institute. (Someya, et al. 2002), therefore, it can be safely utilized as a natural source of antioxidants and enzyme to cure disease. Banana peel is also rich in pectin 99-22%. Taking this property number of non conventional product from banana can be made without the incorporation of any gel additive. Standardized and developed jellies from banana peel are deemed to be nutritive, health-beneficial, and more favorable than tablets or pills. Jelly is a favorite dessert among all age group, owing primarily to its digestibility and good texture (Lee, et al. 2010). This implies that the banana peel may also be a source of important nutrients, including minerals and amino acids. Similar results regarding the chemical compositions of banana and plantain peels were previously reported by Emaga, et al. (2007). Therefore, utilizing banana peels bioactive or phytochemical antioxidants extracted by suitable polar solvent in highly unsaturated food grade oil as an additive to prevent rancidity and stored it for long time period are both favorable and economically attractive.

Similar work has been done by Arawande et al(2010) to see the effects of citric acid and methanol extracts of banana and plantain peels on stability of refined soybean oil. The high value of soybean oil is because of its low level of cholesterol which makes it safer for human consumption.

Ullah et al(2003) studied that one of the major problems of storing refined soybean oil is the development of rancidity (oxidative) which leads to deterioration of the oil's quality due to the multiple unsaturated bonds in the predominant unsaturated fatty acids such as oleic acid,

linoleic acid and linolenic acid. These acids are very prone to oxidation (reaction with atmospheric oxygen) during storage of the oil thereby causing unnecessary economic loss. The oxidized oils not only deteriorate the taste of food to which they are added but are considered to create many health problems such as diarrhea, poor growth rate and aggravate coronary heart diseases (Ullah, et al. 2003).

According to Gunstone and Norris (1983), Synthetic antioxidants such as Butylated Hydroxy Toluene (BHT), Butylated Hydroxy Anisole (BHA), Tertiary Butylated Hydroxy Quinone (TBHQ) and Propyl Gallate (PG) have been proved effective antioxidants against oil rancidity. But the use of most of these synthetic antioxidants as additives in foods have been discouraged international market due to their carcinogenicity, reduced food intake and growth inhibition (Carrasquerro, et al. 1998).

POTENTIAL USES OF BANANA

Banana peel is a rich source of starch (3%), crude protein (6-9%), crude fat (3.8-11%), total dietary fibre (43.2-49.7%) and polyunsaturated fatty acids, particularly lineoleic acid and α-linolenic acid, essential amino acids (leucine,valine, phenylalanine and threonine) and micronutrients (K,P,Ca,Mg). Except for lysine, content of all essential amino acids are higher than FAO standard. Maturation of fruits involves, increase in soluble sugar, decrease in starch and hemicellulose and slight increase in protein and lipid content. Degradation of starch and hemicellouses by endogenous enzyme may explain increase in soluble sugar content. Skins can also be utilised for extraction of banana oil that can be used for food flavoring. Banana peels are also a good source of lignin (6-12%), pectin(10-21%),cellulose (7.6-9.6%), hemicellouse (6.4-9.4%) and galactouroninc acid. Pectin extracted from banana peel also contains glucose, galactose, arabinose, rhamnose and xylose. Micronutrient (Fe and Zn) were found in higher concentration in peels compared to pulps. So, peel could be a good feed material for cattle and poultry. Banana peel can also be used in wine, ethanol production, as substrate for biogas production and as base material for pectin extraction. Peel ash can be used as fertilizer for banana plants and as source of alkali for soap production. Ethanol extract of M.sapientum peels can be used as an inhibitor for mild steel corrosion. Peel can also be used in wastewater treatment plants (Mohapatra et al., 2010).

METHODOLOGY

The methodology concerning to the study on the, IHEC/18-19/FSMD/19 " Estimation of nutrient analysis of varieties of banana available in Tamil Nadu" are followed under the following heading

D. Preparation of sample for chemical analysis from edible part of banana and its peel.
E. Preparation of sample with banana peel
F. Proximate Analysis of Banana and its peel

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A. PREPARATION OF SAMPLE

In order to prepare the ample for the chemical analysis, banana's were collected from the Banana vendors without any addition of preservatives and pesticides during cultivation . According to the National Horticulture Board, the important varieties of banana cultivated and available in Tamil Nadu are

- Poovan–*Musa Sapientum*
- Red Banana- *Musa Acuminata*
- Virupakshi- *Musa Sapientum*
- Rasthali- *Musa Acuminata*
- Nendran- *Musa Acuminata*
- Nadan-*Musa Acuminata*
- Monthan- *Musa Balbisiana*
- Karpooravali- *Musa Acuminata*
- Sakkai-*Musa Sapientum*
- Peyan-*Musa Acuminata*
- Matti-*Musa. Acuminata*

PREPARATION OF SAMPLES FROM BANANA EDIBLE PART

SELECTION OF SAMPLE

Banana was collected one day before of the process and stored in the room temperature. The well and good riped bananas without any damage and black spots were selected .The banana should be yellow in color. The selected banana sample were washed one time thoroughly in the distilled water to remove all the impurities , dust, etc. The well washed sample were neatly peeled without damaging the edible part of the fruits and it is neatly halved with the use of stainless steel knife. The halved sample were immersed in the 1 percent of sodium carbonate solution for 15 minutes to 20 minutes. The immersion of sample is to avoid the browning reaction,then the immersed sample were rinced well twicely with the lime water to neutralize the discoloration and it is washed once with the distilled water.

PROCESS OF CABINET DRYING

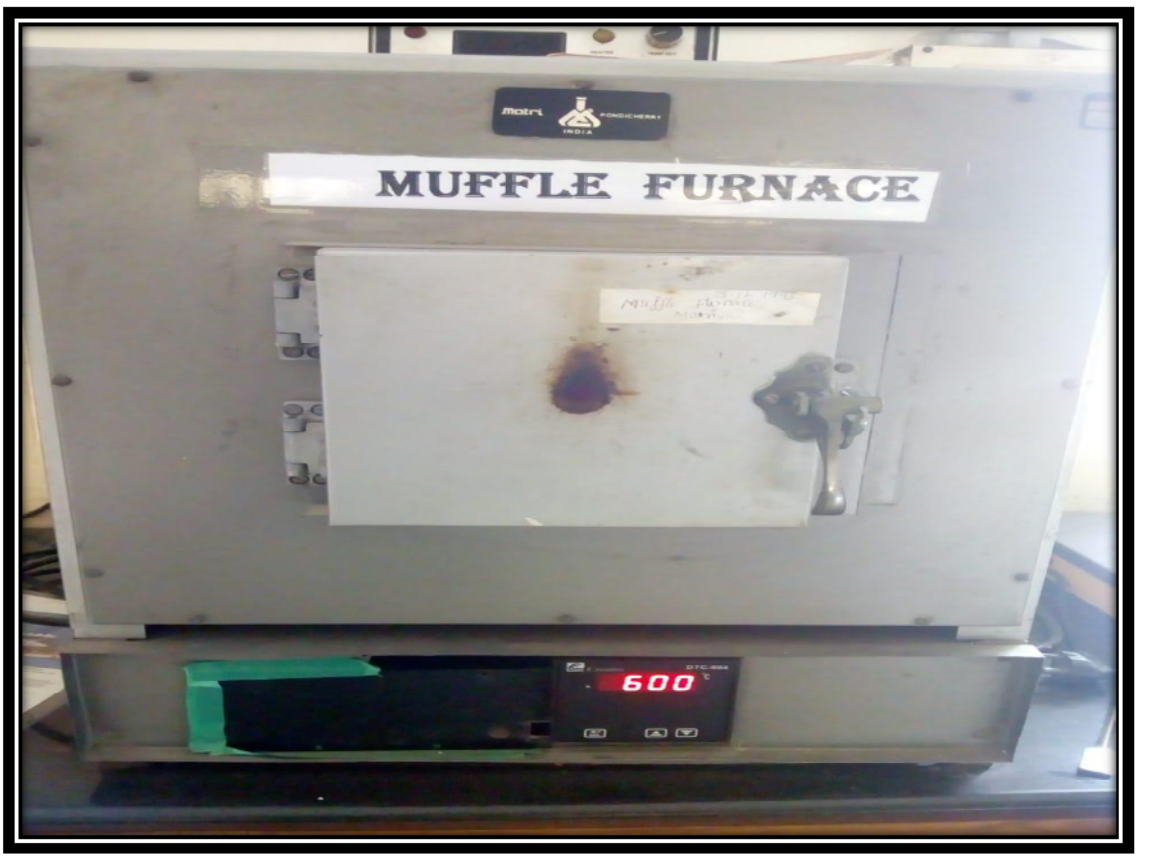
The pretreated sample were spread over the plates. It is then allowed for the drying im a cabinet dryer for 48 hours at the temperature of 60*C. The well dried sample were collected in the separate bag in the well manner and it is powdered using lab grinder without affecting its organoleptic properties. The powdered samples were used to determine the nutritive property by chemical method. The sample is diluted and centrifuged to collect the supernatant for few experiments like measurement of ascorbic acid.

FIGURE 1 CABINET DRYER

PREPARATION OF ASH

The sample were halved into small in size can be taken as such to prepare sample for analysis. But those which are big should be cut and portions of the edible materials is used. The non edible portions is rejected and the edible portions cut into small pieces. Sample are taken from the mixture of these pieces by quatering .using knife for preparing the ash sample. The edible part of the sample were heated for 1 hour until it become white ash in the crucible disc and it is kept in the muffle furnace for the preparation ash content at 600*C.

FIGURE 2 MUFFLE FURNACE



VARIETIES OF BANANA AVAILABLE IN TAMIL NADU

POOVAN

RASTHALI

RED BANANA

NENDRAN

NADAN

MONTHAN

VIRUPAKSHI

KARPOORAVALLI

PEYAN

MATTI

PREPARATION OF SAMPLES WITH BANANA PEEL

The collected banana was washed twicely in the distilled water and the peel was removed and cutted into small pieces. The peel of the fruit has been separated, washed with distilled water and is dried at temperature at 60°C . They are then made into powder form using lab grinder for making it easier to analyze nutritive property by chemical method. Then the sample is kept in desiccator which has silica gel at its bottom. The sample is diluted and centrifuged to collect the supernatant for few experiments like measurement of reducing sugars.

PROXIMATE ANALYSIS OF SAMPLES

CHEMICALS AND MATERIALS

Ten ripe varieties of banana available in Tamil Nadu used for the table purpose were selected for the study.The selected varieties are Poovan, Rasthali, Red Banana, Nendran, Nadan, Monthan, Karpooravalli, Virupakshi, Matti, Peyan. The banana varieties were procured at the time when the characteristics fruit color developed for each type. The fresh ripe bananas were peeled, cut into thin slices and dried in an cabinet drier at 60 □C for 12 h. Dried samples were ground, sieved and stored at room temperature (25 □C ± 2 □C) in air tight containers and the powdered sample were used for the analysis of chemical compositions. They were collected from the local vendors in Coimbatore(Poovan, Rathalil, Red Banana, Nendran, Nadan, Monthan, Karpooravalli, Virupakshi) and Kanya kumari districts(Peyan , Matti) to assess the proximate values such as energy, carbohydrate, fiber, vitamin–c, potassium and sodium in both the edible part and peel.

Quantitative Proximate analysis involves the determination of the percentage (%) constituents of the parameters below.

DETERMINATION OF ENERGY:

. The energy content was determined from the values of protein, fat and carbohydrates and multiplication of the content of these components with appropriate factors. One gram of carbohydrate or protein yield 4 kcal (16.8 KJ) and one gram of fat yield 9 kcal (37.8 KJ) (Gopalan et al., 2010).

DETERMINATION OF CARBOHYDRATES

The moisture content of the sample was determined gravimetrically by drying 5 g of the sample in a crucible to a constant weight at 120°C. The ash content of the sample was determined gravimetrically by ashing 2 g of each sample in a clean pre-weighed crucible in a furnace at 550°C for 24 hours. The protein content was determined using Kjeldahl method of nitrogen (N) analysis. Approximately 2g of each sample was digested with concentrated H 2SO 4 using K 2 SO 4 catalyst. The ammonia in the digested sample was then distilled into a standard boric acid and titrated with 0.1 M HCl. The crude protein of the sample was obtained using the

formula: crude protein = titre value x 1.4 x 50 x 100 x 65/(1000 x 10 x 1)N2. The total fat content of each sample was determined gravimetrically by Soxhlet solvent extraction technique and the residue was dried to a constant weight and calculated as % of ether extract = (wt of extract/wt of sample) x 100. Carbohydrate content was determined as

the difference: 100 –(moisture + ash + protein + fat + crude fibre).

DETERMINATION OF PROTEIN

The crude protein content of the samples was determined using micro-Kjeldahl method described by digesting 0.5 g of the sample with 10g of NaSO4, 20ml conc. H2SO4and 1g CuSO4in Kjeldahl flask and heated with Bunsen burner till solution digests completely (changes to bluish green). It was then poured into a beaker and allowed to solidify for 24hrs (colour turns to white). The digest was made up to 200 ml to dissolve the solidified sample and then allowed to cool in the refrigerator. 60ml of 40% (w/v) NaOH solution and two pieces of zinc metal were added. The mixture was poured into a round bottom flask of a distillation column. 100ml of 4% Boric acid and 2 drops of screened methyl red indicator were added into a labeled conical flask and placed on the receiving end of the distillatory apparatus.

A light pink color appeared when boric acid and screened methyl red indicator came in contact. When the whole liquid in the receiver reached 200ml on the conical flask, distillation was stopped by dismantling the distillatory apparatus.

The distillate (content on the conical flask) (200ml) was titrated with 0.1mH2SO4.Note ; Titration was stopped when the color of the distillate came to the initial color of the mixture of boric acid and screened methyl red indicator (pink)

% CRUDE PROTEIN CALCULATION

% Crude Protein = 100× T v × 0.0014 × 6.25/weight of the sampleTv =Titre value.

DETERMINATION OF FATS

Fat was extracted using Soxhlet extraction method.The soxhlet extractor consists of reflux condenser, Heating mantle and n-hexane as the solvent Five grams of sample was wrapped very well in a filter paper and put in a soxhlet extractor. n-Hexane was put into a conical flask and a heating mantle was applied below it. The n-hexane evaporates and then cools in the condenser and went back into the conical flask. The system was recycled 8-9 times to achieve maximum yield of oil. After the recycling, the extractor was disconnected and a distillation apparatus set up to separate the solvent (n-hexane) from the oil. This was done so as to recover the solvent.The mixture containing oil and traces of the solvent after distillation was transferred into a weighed beaker and heated so that the remaining n-hexane escaped leaving only the oil. It was allowed to cool in desiccators and the beaker was re-weighed.

% FAT CONTENT Calculation

A.Weight of empty beaker =W1

B.Weight of beaker + oil =W2

C.Weight of oil = W2–W1D.

% Oil & Fat = (W2–W1)/ weight of sample × 100.

DETERMINATION OF FIBER

Crude fiber was determined by the Wende method

Acid treatment: Two grams of the sample was weighed into a 250ml conical flask. It was then soaked in 200ml of 1.25 %(v/v) H2SO4that is 1.25ml in 98.75ml of H2O and then heated for 30mins on a hot plate. The mixture was filtered and the residue washed with hot H2O until it is no more acidic, using pH paper.

Base treatment: The residue was re-soaked with 200ml of 1.25%NaOH (1.25g of NaOH dissolved with 10ml of H2O in a 100ml volumetric flask and made up to 100ml mark with H2O) and heated for another 30mins. The solution was filtered in a weighed filter paper and dried in an

oven after which the weight was noted. The filter paper containing the residue was transferred to a weighed empty Platinum crucible and burnt to ash using a Bunsen burner. After ashing, it was cooled in a desiccators containing silica and weighed again.

% CRUDE FIBER CALCULATION

Weight of sample = 2g

Weight of filter paper = Xg

Weight of residue + filter paper after oven dry

Weight of residue Weight of P.C only

Weight of P.C + ash after ashing

Weight of ash = weight of P.C + ash –weight of P.C

Weight of fiber = weight of residue –weight of ash

% crude fiber = weight of fiber/ (weight of sample) * 100/1

DETERMINATION OF ASCORBIC ACID

Five gram of the sample was weighed and soaked in the 4 percent of oxalic acid for 10 minutes. This was then ground in the mortar and transferred to centrifuge tubes by adding more oxalic acid. The solution was centrifuged and the supernatant clear liquid was transferred to a 100 m l standard flask and repeated the extraction with oxalic acid for 3 to 4 times. All the supernatant were collected and it is finally made up to the mask with acid. Extract was estimated titrimetrically using 2, 6 dichloro indophenol dye and by repeating the titration the concordant values were taken.

DETREMINATION OF MINERAL CONTENT

.To determine sodium, potassium, sample is made into ash by taking the 1 g of sample incubate at 105° C for 3 to 5 hours. To the sample 1 g of ash add 2 ml HCl,. mix well and read the value after 15 to 20 mins at the different nm of 589.6,768, 620nm.

RESULT AND DISCUSSION

The findings of the present study entitled "ESTIMATION OF NUTRIENT ANALYSIS OF VARIETIES OF BANANA AVAILABLE IN TAMILNADU " are discussed under the following headings

A. Proximate Analysis of edible part of banana
B. Proximate Analysis of edible part of peel

A. PROXIMATE ANALYSIS OF EDIBLE PART OF BANANA

POOVAN

Poovan , is a leading commercial cultivar grown throughout the country . In Tamil Nadu, it is the leading produce owing to its climatic and marginal soil condition. The chemical composition of the poovan banana such as Energy, Carbohydrate, Fiber, and mineral content such as Vitamin –C, Potassium, Sodium were determined in both the pulp and peel.

TABLE I, NUTRIENT CONTENT OF POOVAN

Nutrients/100g	Poovan(Pulp)	Poovan (Peel)
Energy (kcal)	372.36	365.04
Carbohydrate(g)	90.24	79.24
Fiber(g)	2.33	8.42
Vitamin-C(mg)	6.74	4.26
Potassium(mg)	335	86
Sodium(mg)	1.35	30

The above Table I, shows the chemical composition of the poovan banana of both the pulp and the peel .The result shows that the energy content of the pulp (111.25 kcal) is higher than that of peel (91.26 kcal). The carbohydrate is high in pulp (90.24g) when comparing the peel (79.24g) of poovan banana. The fiber content of the pulp (2.33g) is low when

comparing the peel (8.42g), followed by that the mineral composition , Potassium is high in the pulp (335mg) whereas in peel (86mg) the content was low and the sodium is low in pulp(1.35mg) and in which the sodium is high in peel (30mg). The ascorbic acid is high in the pulp (6.74mg) whereas in the peel (4.26mg) , it is low. It shows that the chemical composition in edible banana pulp and the peel varied according to the part of the banana considered. The edible part of the banana is the richest in nutrients, except for fiber. The peel of the banana is rich for fiber. The high fiber content indicates that peels could help to treat constipation and can improve health and well being. The appreciable content of potassium in banana pulp indicate that if the peel is taken it will help in the regulation of blood pressure etc. The high values shows that banana pulp is good source of nutrients.

RASTHALI

It is a medium tall variety ,commercially grown in Tamil Nadu, and in many other districts in India. It's unique fruit quality has made rasthali popular and highly prized cultivar for table purpose. Fruits are yellowish green throughout their development, but turn pale yellow to golden yellow after ripening. Fruit is tasty with a good aroma. The chemical composition of rasthali banana such as Energy, Carbohydrate, fiber, Vitamin-C, Potassium and Sodium for both the pulp and peel.

TABLE II, NUTRIENT CONTENT OF RASTHALI

Nutrients /100 gm	RASTHALI(PULP)	RASTHALI (PEEL)
Energy(kcal)	360.4	374.24
Carbohydrate(g)	88.10	82.11
Fiber(g)	4.2	0.84
Vitamin-C(mg)	10.2	3.52
Potassium(mg)	300	46
Sodium(mg)	0.75	16.8

From the above table 2, The chemical composition of the rasthali banana of both the pulp and peel were determined, The result shows that the energy content of the pulp 90.1 kcal and the peel is 91.26kcal. The carbohydrate content is high in the pulp (88.10g) whereas in peel (82.11g) is low. The fiber content in the pulp(4.2g)is higher than that of peel (0.84g) . The Mineral content, potassium was high in pulp(300mg) and the content in peel was 46mg , is low. The sodium content is low in pulp(0.75mg) and it was high in peel(16.8mg).The ascorbic acid is high in the pulp(10.2mg) whereas in peel (3.52mg) is low. The high values of the banana peel indicates that the banana peel is rich in nutrients, except for fiber. The values indicate that the peel could be a good source of carbohydrates and fibre. The high fibre content also indicates that the peels could help treat constipation and improve general health and well being..

RED BANANA

It is the most relished and highly prized variety of kerala and Tamil Nadu. Its commercial cultivation I prominent in Kanya kumari and Tirunelveli districts of Tamil Nadu. It is a robust plant with bunches weighing 20-30 kh under good management practices. The fruit are sweet, Yellow colored and with a pleasant aroma. It is highly susceptible to buchy to , fusarium and nematodes.

TABLE III, NUTRIENT CONTENT OF RED BANANA

NUTRIENTS /100g	RED BANANA (PULP)	RED BANANA(PEEL)
Energy(kcal)	366.56	361.36
Carbohydrate(g)	88.96	78.05
Fiber(g)	4.08	2
Vitamin-C(mg)	6.74	5.35
Potassium(mg)	313	65
Sodium(mg)	1.11	20.5

From the above table III, it is noted that the macro nutrients of banana edible part such as energy, Carbohydrate, Fiber are 366.56 k cal, 88.96g, 4.08g and minersals

such as potassium and sodium were 313mg and 1.11g. The Vitamin C content of Red banana edible part is 6.74mg. The peel of the banana contains energy (361.36 kcl, carbohydrate(78.09g) and fiber(2 g) and Vitamin- C (5.35 mg), potassium (65mg) and sodium(20.5 mg). From the result it shows that the red banana is rich in essential nutrients. and the high fiber content of pulp is good for constipation problem and other health problems.

NENDRAN

It is a popular variety in kerala where it is relished as a fruit as well as used for processing. It is highly susceptible to banana bract mosaic virus, Nematodes and borers

TABLE I, NUTRIENT CONTENT OF NENDRAN

Nutrient/100 g	NENDRAN(PULP)	NENDRAN(PEEL)
Energy	369	362.72
Carbohydrate	85.48	79.23
Fiber	4.2	0.72
Vitamin-c	9.76	3.36
Potassium	356	75
Sodium	1.12	23.2

From the above Table IV, it is noted that Nendran banana had highest nutritive value content of pulp when compared to the peel. The nutritive value of edible part such as energy, carbohydrate, fiber are 369 kcal, 85.48 g, 4.2g and its peel is 362.72 kcal, 79.23 g, 0.72 g. The Vitamin –C content of edible part is 9.76 mg and the peel were 3.36 mg.The minerals such as potassium and sodium of edible part are 356mg and 1.12mg,Wheareas in peel it contain

75mg and 23.2 mg.The edible part of banana contains many medicinal properties and it contains more essential nutrients. The peel has moderate amount of essential nutrients and it can be used for some home remedies .

NADAN

It is popular variety in Tamil Nadu grown especially for its cooling effects in hot tracts in summer. It could be used in the nendran plantains for gap filling and it tolerant to leaf spot and banana bunchy top virus diseases.

TABLE V, NUTRIENT CONTENT OF NADAN

Nutrients/100g	NADAN(PULP)	NADAN(PEEL)
Energy(kcal)	376.56	386.48
Carbohydrate(g)	86.98	83.62
Fiber(g)	4.02	0.72
Vitamin C(mg)	7.24	4.05
Potassium(mg)	335	60
Sodium(mg)	1.03	20.1

From the above Table V, The Nadan banana contains energy (376.56 kcal) , carbohydrate (86.98 g) , fiber(4.02g) , Vitamin –C (7.24 mg) , Potassium (335mg) and sodium (1.03 mg) in the dibble part , whereas in the peel, it contains 386.48 kcal of energy, 83.62 g of carbohydrate, 0.72g of fiber, 4.05 mg of Vitamin-C . The mineral content of potassium and sodium were 60mg and 20.1mg. The peel of the banana is essential in energy content and it contains more amount of sodium. The edible part of the banana is rich in potassium, ascorbic acid and fiber. Having high fiber in the edible part, it can improve the digestion system.

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 color. 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 is also cultivated for production of leaves in Trichy and Tanjore districts of Tamil Nadu. It has many desirable qualities like immunity to Banana Bunchy Top Virus (BBTV) diseases, salt.tolerance and normal bunch mass even under marginal condition, but it is highly susceptible to *Fusarium* wilt disease.

TABLE VI, NUTRIENT CONTENT OF MONTHAN

Nutrients/100 g	MONTHAN(PULP)	MONTHAN(PEEL)
Energy(kcal)	463	375.96
Carbohydrate(g)	84.95	83.59
Fiber(g)	8.21	1.4
Vitamin-C(mg)	8.06	1.73
Potassium(mg)	362	50
Sodium(mg)	1.25	20.5

Table 6 reveals that the sodium content of the peel is higher than that of pulp. Hence the edible part has more essential nutrient contents when compared to the peel of banana. Having approximate quantities of nutritive values in peel, it can be very useful in making the agro waste product material.

VIRUPAKSHI

It is an elite variety in South India especially grown for table purpose in Palani and Shevroy hills of Tamil Nadu under perennial cultivation. It is a vigorous and hardy variety though not a prolific one. Fruits show a typical curvature, possess a pleasant aroma and delightful taste. Virupakshi has the characteristic flavour only when they are cultivated in higher elevation. In the mixed cultivation it is well suited as a shade plant for young coffee. It has many ecotypes like 'Sirumalai' (grown on hills), 'Vannan', 'Kali' well suited for cultivation in plains. Perennial system of cultivation aggravates Banana Bunchy Top Virus (BBTV) diseases.

TABLE VII , NUTRIENT CONTENT OF VIRUPAKSHI

Nutrients/100 g	VIRUPAKSHI(PULP)	VIRUPAKSHI(PEEL)
Energy(kcal)	386.96	379.56
Carbohydrate(g)	89.54	81.22
Fiber(g)	3.6	2.6
Vitamin-C(g)	9.23	2.85
Potassium(g)	349	68
Sodium(g)	1.08	21

From the Table VII, Virupakshi Banana is loaded with fiber both soluble and insoluble. The soluble fiber has the tendency to slow down digestion and has satiety value. These all contribute to the proper functioning of the body . Bananas has low sodium content and high potassium content, and these properties contribute to making it an ideal for those undergoing this condition. All the essential nutritive values are high in the edible part of the banana whereas in the peel it contains low.

KARPOORAVALLI

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 is highly susceptible to wilt disease, tolerant to leaf spot disease and well suited for drought, salt affected areas and for low input conditions.

TABLE VIII, NUTRIENT CONTENT OF KARPOORAVALL

NUTRIENT /100g	KARPOORAVALLI (PULP)	KARPOORAVALLI(PEEL)
Energy	364.74 kcal	362.08k cal
Carbohydrate	86 g	78.11 g
Fiber	4.2g	1.10g
Vitamin-c	6.9mg	2.19mg
Potassium	305mg	48mg
Sodium	0.78mg	20.5mg

From the above table 8, In karpooravalli , there is not much difference in the energy content between pulp and peel. It is noted that 12 g of carbohydrate is higher in pulp.The fiber content of the edible part is almost higher than the peel. The essential nutritive values were high in the edible part compared to the peel. The high fiber content indicates that peels could helps treat constipation and can improve health and well being. The appreciable content of potassium

in banana pulp indicate that if the peel is taken it will help in the regulation of blood pressure etc. The high values shows that banana pulp is good source of nutrients.

MATTI

It is a common variety of southern districts of Tamil Nadu. The fruit is small, long and has pronounced tip. The taste of the fruit were good. The banana is mostly used for the table purpose and for the baby foods. It has more essential nutritive value and medicinal properties

TABLE IX, NUTRIENT CONTENT OF MATTI

Nutrient/100g	MATTI(PULP)	MATTI(PEEL)
Energy(kcal)	336.3	265.6
Carbohydrate(g)	76.5	51
Fiber(g)	8.2	1.6
Vitamin-C(g)	4.60	7.5
Potassium(g)	412	89
Sodium(g)	2.1	30

The chemical composition of the edible part of the banana contains more amount of essential nutrients and it contains 336.3 kcal of energy, 76.5 g of carbohydrate, and 8.2 g of fibre, Whereas in the peel it contains, 265.6 kcal of energy , 51 g of carbohydrate and 1.6 g of fiber are present. It shows that the edible part contains high nutritive value and it is used for the table purposes. It has more number of medicinal properties. Bananas have low salt content and high potassium content, and these properties contribute to making it an ideal for those undergoing this condition. All the essential nutritive values are high in the edible part of the banana except sodium.

PEYAN

It is available in southern districts of Tamil Nadu and it is used for the table purposes . In this Banana, various culinary products has been developed and is used for medicinal purposes.

TABLE X, AVERAGE CONTENT OF PEYAN

Nutrient/100g	PEYAN(PULP)	PEYAN(PEEL)
Energy(kcal)	327.8	265.3
Carbohydrat((g)	72.8	47.5
Fiber(g)	7.6	1.4
Vitamin-C(mg)	55	8.2
Potassium(mg)	452	94
Sodium(mg)	3	37

The edible part of banana, Peyan contains high amount of energy and high amount of carbohydrate when compared to the peel. The fiber content of the edible part is more than that of peel except peel. The potassium content was high in the edible part and sodium content was low in the edible part. It is used for many table purpose and it is used in many health problems. This common variety of banana is mostly available to baby foods and many culinary products can be developed. . Bananas have low salt content and high potassium content, and these properties contribute to making it an ideal for those undergoing this condition. All the essential nutritive values are high in the edible part of the banana except sodium.

Since the fiber content is identified as essential for various non communicable diseases and to identify the type of banana which has higher fiber , the following figure is showed for all the ten varieties of banana for both the edible and the pee

Varieties/100g	Pulp	Peel
Poovan	2.33	8.42
Rasthali	4.2	0.84
Red Banana	4.08	2
Nendran	4.2	0.72
Nadan	4.02	0.72
Monthan	8.21	1.4
Karpooravalli	4.2	1.10
Virupakshi	3.6	2.6
Matti	8.2	1.68
Peyan	7.6	1.41

TABLE XI , FIBER CONTENT OF 10 VARITIES OF BANANA

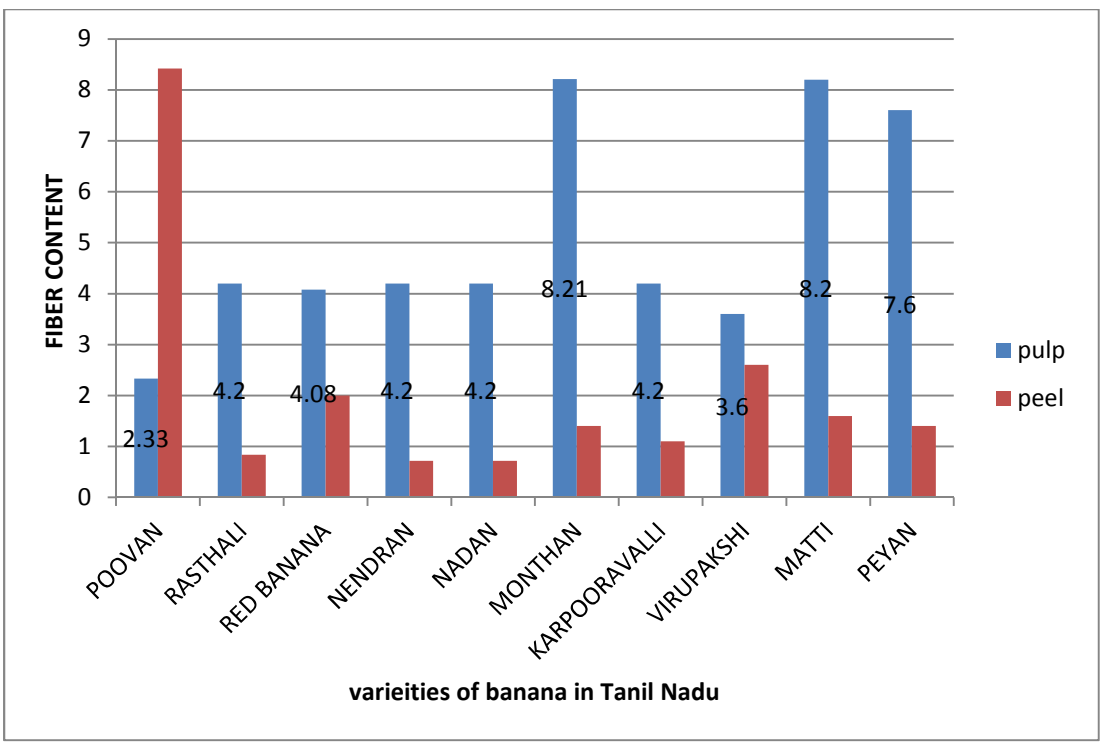


FIGURE 4: Fiber content of all the 10 varieties of banana

From the above figure, it shows that the higher content of fiber is present in the edible part of peyan banana comparing all other banana whereas in peel , virupakshi banana and matti banana contains similar amount of fiber content. Hence the result shows that the high content of fiber in the edible part can improve health and well being.The high content of fiber in peel indicates that it could help to treat constipation and other health problems.

Varieties	Pulp(mg)	Peel(mg)
Poovan	1.35	30
Rasthali	0.75	16.8
Red banana	1.11	20.5
Nendran	1.12	23.2
Nadan	1.03	20.1
Monthan	1.25	20.5
Karpooravalli	0.78	20.5
Virupakshi	1.08	21
Matti	2.1	30
Peyan	3	37

TABLE XII, SODIUM CONTENT OF VARITIES OF BANANA

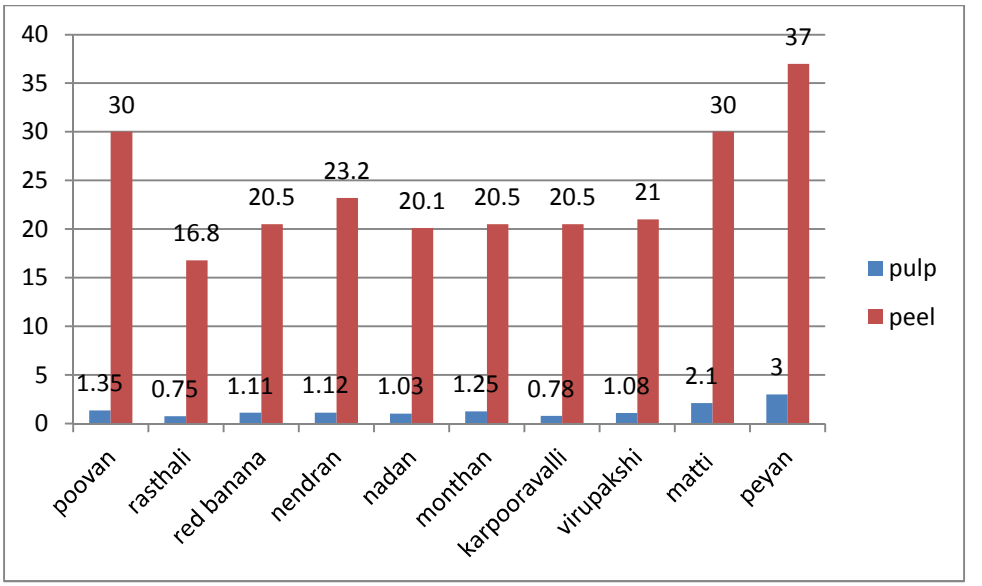


FIGURE 5, Sodium content of all the 10 varieties of banana

From the above figure, it is commonly observed that the low sodium food is needed for various health disorder. Inorder to understand the low level of sodium in both the pulp and peel of all the selected 10 varieties of banana is represented in the above figure.It shows that the edible part of banana contains low sodium when compared to all the peels.hence it can be used for medicinal purposes for various disease condition.

SUMMARY

Banana is a nutritious gold mine. They are high in vitamin B6, which helps fight infection and is essential for the synthesis of heme, the iron containing part of hemoglobin. They are also rich in potassium and are a great source of fibre. In recent years, considering the adverse impact of indiscriminate use of chemicals, new trend for organic production of banana is increasing in the country. A new name, i.e. "Green Foods" for this has been coined. Main banana growing states are TamilNadu, Maharashtra, Gujarat, Andhra Pradesh and Karnataka. There are large numbers of banana varieties growing in different parts of Tamil Nadu. They include Virupakshi, Robusta, Red Banana, Poovan, Rasthali, Nendran, Monthan, Karpuravalli, Sakkai, Peyan, Matti

The chemical composition of banana contains Energy (kcal) 81, Protein 1.2g, Fat 0.1 g, Fiber 1.4 g, Sodium (Na) <0.5 mg, Potassium (K) 330 mg, Calcium (Ca) 6 mg, Magnesium (Mg) 27 mg, Phosphorus (P) 23 mg, Vitamin-C 9 mg. (Mark Roe et al., 2013). In Karpuravali ,the carbohydrate content is 17% when extracted from water whereas in the ethanol extract only 0.5% of carbohydrate was present 40% of protein was present when extracted using water whereas in the ethanol extraction 0.5% has been present. In Karpuravali 45% of the fibre was found to be present when extracted from water; where as the extraction of ethanol yielded 98% of fibre. In Rasathali the calcium level is 1.3% in the extraction of ethanol were as in Karpuravali it is 0.6%. sodium level is 1.3% in Rasathali with ethanol extract and in Karpuravali ethanol extract 0.3% was present. In potassium 1.2% was present in Rasathaliextract where as in Karpuravali is 0.3% was present.

- The varieties of banana available in Tamil Nadu , totally 10 varieties such as poovan, Rasthali, Red banana, Karpooravalli, Virupakshi, Nadan, Monthan, Matti, Peyan had been collected and it is dried to prepare the powdered sample in both the pulp and peel.
- The banana pulp were dried under the cabinet drier and the sample were collected in the air tight bag so as to prevent from the loss of organoleptic properties.

- The peel of the banana were removed and it is dried in the cabinet drier, the well dried sample were powdered using the mixie and it is stored in the room temperature without affecting its organoleptic properties. The energy value was found out by using the values of proximate principles namely carbohydrate, protein and fat. The carbohydrate was analysed by calculating the value of moisture, ash, lipid and protein and substracting it with the sample values. The fiber was estimated by acid and alkali free test. The vitamin-c was estimated by dye factor method. The potassium and sodium was calculated by atomic adsorption spectrometry method.
- The findings of the study are summarized below.

  It shows that the edible part of all the banana, like Poovan, Rasthali, Red Banana, Nendran, Nadan, Monthan, Karpooravalli, Virupakshi, Matti, Peyan contain essential nutrients. These banana contains many medicinal properties and it is used for the development of many culinary products and value added products. The edible part of the banana is high in energy value and it contain more amount of potassium.
- With regards to Poovan banana ,the energy content of the pulp (111.25 kcal) is higher than that of peel (91.26 kcal). The carbohydrate is high in pulp (90.24g) compared to that peel (79.24g) of poovan banana. The fiber content of the pulp (2.33g) is low when compared to the peel (8.42g), followed by that the mineral composition , Potassium is high in the pulp (335mg) whereas in peel (86mg) the content was low and the sodium is low in pulp(1.35mg) and in which the sodium is high in peel (30mg). The ascorbic acid is high in the pulp (6.74mg) whereas in the peel (4.26mg) , it is low.
- In Rasthali, the energy content of the pulp(90.1 kcal) is low and the peel is (91.26kcal). The carbohydrate is high in the pulp(88.10g) whereas in peel(82.11g) it is low. The fiber content in the pulp(4.2g)is higher than that of peel (0.84g) . The Mineral content, potassium was high in pulp(300mg) whereas in peel (46mg) , it is low. The sodium content is low in pulp(0.75mg) and it is high in peel (16.8mg).The ascorbic acid is high in the pulp(10.2mg) whereas in peel it only 3.52mg .
- In red banana, the macro nutrients of banana edible part such as energy, Carbohydrate, Fiber (366.56 k cal, 88.96g, 4.08g), and minerlas such as potassium and sodium were 313mg and 1.11g. The vitamin c content of Red banana edible part were 6.74mg. The

peel of the banana contains 361.36 kcal of energy , carbohydrate (78.09g) and fiber(2 g) and vitamin- \c (5.35 mg), potassium (65mg) and sodium(20.5 mg).

- In the edible portion of Nendran banana was higher in pulp when compared to the peel. The nutritive value of edible part such as energy, carbohydrate, fiber are 369 kcal, 85.48 g, 4.2g and its peel is 362.72 kcal, 79.23 g, 0.72 g. The Vitamin – C content of edible part is 9.76 mg and the peel were 3.36 mg.The minerals such as potassium and sodium of edible part are 356mg and 1.12mg,Wheareas in peel it contains 75mg and 23.2 mg.
- Edible part of Monthan banana contains, high amount of energy. The carbohydrate content of edible part is little higher than that of peel. The High content of fiber in the edible part is essential in all the health problems like constipation . The culinary products can also be prepared in this banana and the edible part contains high amount of potassium.
- In karpooravalli , the edible part of the banana is little higher than the peel of the banana. The fiber content of the edible part is almost high. The essential nutritive values high in the edible part compared to the peel. The high fiber content indicates that peels could help to treat constipation and can improve health and well being.
- Virupakshi Banana is loaded with fiber both soluble and insoluble. The soluble fiber has the tendency to slow down digestion and keep you feeling full for a longer time. These all contribute to the proper functioning of the body.
- Matti banana contains more amount of essential nutrients and it contains 336 kcal of energy, 76.5 g of carbohydrate, and 8.2 g of fibre. Whereas in the peel it contains, 265 kcal of energy , 51 g of carbohydrate and 16.8 g of fiber. The mineral content such as potassium and sodium of the edible part contains 412 mg and 2.1 mg, whereas in peel it contains only 89 mg of potassium and 30 mg of sodium.
- In Peyan, banana, and it contains 327 kcal of energy, 72.8 g of carbohydrate, and 7.6 g of fiber. Whereas in the peel it contains, 265 kcal of energy , 47.5 g of carbohydrate and 14.1 g of fiber . The mineral content of the pulp is potassium(452mg) and sodium(3 mg) but in peel it contains 94 mg of potassium and 37 mg of sodium.
- Bananas have low salt content and high potassium content, and these properties contribute to making it an ideal for diabetics and renal patients condition. It indicates that the edible part contains more amount of nutritive value and also has many medicinal

properties. The peel always goes as waste and it is almost used for animal feeds in the processing industry. Hence from the above result it is proved that peel contains more amount of medicinal properties and can used for many value added products.

- From the bar figure4 and 5, the high content of fiber and low content of sodium in the edible part of the fruits were analysed. It shows that the fiber content is rich in all the edible part of the banana . The sodium content is low in all the edible part of the banana..

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ANNEXURE

Quantitative Proximate analysis involves the determination of the percentage (%) constituents of the parameters below.

DETERMINATION OF ENERGY:

. The energy content was determined from the values of protein, fat and carbohydrates and multiplication of the content of these components with appropriate factors. One gram of carbohydrate or protein yield 4 kcal (16.8 KJ) and one gram of fat yield 9 kcal (37.8 KJ) (Gopalan et al., 2010).

DETERMINATION OF CARBOHYDRATES

The moisture content of the sample was determined gravimetrically by drying 5 g of the sample in a crucible to a constant weight at 120°C. The ash content of the sample was determined gravimetrically by ashing 2 g of each sample in a clean pre-weighed crucible in a furnace at 550°C for 24 hours. The protein content was determined using Kjeldahl method of nitrogen (N) analysis. Approximately 2g of each sample was digested with concentrated H 2SO 4 using K 2 SO 4 catalyst. The ammonia in the digested sample was then distilled into a standard boric acid and titrated with 0.1 M HCl. The crude protein of the sample was obtained using the formula: crude protein = titre value x 1.4 x 50 x 100 x 65/(1000 x 10 x 1)N2. The total fat content of each sample was determined gravimetrically by Soxhlet solvent extraction technique and the residue was dried to a constant weight and calculated as % of ether extract = (wt of extract/wt of sample) x 100. Carbohydrate content was determined as

the difference: 100 –(moisture + ash + protein + fat + crude fibre).

DETERMINATION OF PROTEIN

The crude protein content of the samples was determined using micro-Kjeldahl method described by digesting 0.5 g of the sample with 10g of NaSO4, 20ml conc. H2SO4and 1g CuSO4in Kjeldahl flask and heated with Bunsen burner till solution digests completely (changes to bluish green). It was then poured into a beaker and allowed to solidify for 24hrs (colour turns to white). The digest was made up to 200 ml to dissolve the solidified sample and then allowed to cool in the refrigerator. 60ml of 40% (w/v) NaOH solution and two pieces of zinc metal were added. The mixture was poured into a round bottom flask of a distillation column. 100ml of 4% Boric acid and 2 drops of screened methyl red indicator were added into a labeled conical flask and placed on the receiving end of the distillatory apparatus.

A light pink color appeared when boric acid and screened methyl red indicator came in contact. When the whole liquid in the receiver reached 200ml on the conical flask, distillation was stopped by dismantling the distillatory apparatus.

The distillate (content on the conical flask) (200ml) was titrated with 0.1mH2SO4.Note ; Titration was stopped when the color of the distillate came to the initial color of the mixture of boric acid and screened methyl red indicator (pink)

% CRUDE PROTEIN CALCULATION

% Crude Protein = 100× T v × 0.0014 × 6.25/weight of the sampleTv =Titre value.

DETERMINATION OF FATS

Fat was extracted using Soxhlet extraction method.The soxhlet extractor consists of reflux condenser, Heating mantle and n-hexane as the solvent Five grams of sample was wrapped very well in a filter paper and put in a soxhlet extractor. n-Hexane was put into a conical flask and a heating mantle was applied below it. The n-hexane evaporates and then cools in the condenser and went back into the conical flask. The system was recycled 8-9 times to achieve maximum yield of oil. After the recycling, the extractor was disconnected and a distillation apparatus set up to separate the solvent (n-hexane) from the oil. This was done so as to recover the solvent.The mixture containing oil and traces of the solvent after distillation was transferred into a weighed beaker and heated so that the remaining n-hexane escaped leaving only the oil. It was allowed to cool in desiccators and the beaker was re-weighed.

% FAT CONTENT Calculation

A.Weight of empty beaker =W1

B.Weight of beaker + oil =W2

C.Weight of oil = W2–W1D.

% Oil & Fat = (W2–W1)/ weight of sample × 100.

DETERMINATION OF FIBER

Crude fiber was determined by the Wende method

Acid treatment: Two grams of the sample was weighed into a 250ml conical flask. It was then soaked in 200ml of 1.25 %(v/v) H2SO4that is 1.25ml in 98.75ml of H2O and then heated for 30mins on a hot plate. The mixture was filtered and the residue washed with hot H2O until it is no more acidic, using pH paper.

Base treatment: The residue was re-soaked with 200ml of 1.25%NaOH (1.25g of NaOH dissolved with 10ml of H2O in a 100ml volumetric flask and made up to 100ml mark with H2O) and heated for another 30mins. The solution was filtered in a weighed filter paper and dried in an oven after which the weight was noted. The filter paper containing the residue was transferred to a weighed empty Platinum crucible and burnt to ash using a Bunsen burner. After ashing, it was cooled in a desiccators containing silica and weighed again.

% CRUDE FIBER CALCULATION

Weight of sample = 2g

Weight of filter paper = Xg

Weight of residue + filter paper after oven dry

Weight of residue Weight of P.C only

Weight of P.C + ash after ashing

Weight of ash = weight of P.C + ash –weight of P.C

Weight of fiber = weight of residue –weight of ash

% crude fiber = weight of fiber/ (weight of sample) * 100/1

DETERMINATION OF ASCORBIC ACID

Five gram of the sample was weighed and soaked in the 4 percent of oxalic acid for 10 minutes. This was then ground in the mortar and transferred to centrifuge tubes by adding more oxalic acid. The solution was centrifuged and the supernatant clear liquid was transferred to a 100 m l standard flask and repeated the extraction with oxalic acid for 3 to 4 times. All the supernatant were collected and it is finally made up to the mask with acid. Extract was estimated titrimetrically using 2, 6 dichloro indophenol dye and by repeating the titration the concordant values were taken.

DETREMINATION OF MINERAL CONTENT

.To determine sodium, potassium, sample is made into ash by taking the 1 g of sample incubate at 105° C for 3 to 5 hours. To the sample 1 g of ash add 2 ml HCl,. mix well and read the value after 15 to 20 mins at the different nm of 589.6,768, 620nm.

INSTITUTIONAL HUMAN ETHICS COMMITTEE

Avinashilingam

Institute for Home Science and Higher Education for Women

Deemed to be University Under category 'A' By MHRD, (Estd. u/s 3 of UGC Act 1956)

Re Accredited with 'A' Grade By NAAC, Recognised by UGC Under Section 12 B

Coimbatore - 641043, Tamil Nadu, India

24 January 2018

To
Ms. M.Soundarya
Department of Food Service Management and Dietetics
Avinashilingam Institute for Home Science and
Higher Education for Women
Coimbatore – 641 043

Dear M. Soundarya,

Ref: Your proposal No. IHEC /18-19/FSMD/19 entitled "Estimation of Nutrient Analysis of Varieties of Banana Available in Tamil Nadu" submitted for approval to the IHEC on 30.09.18

The study entitled "Estimation of Nutrient Analysis of Varieties of Banana Available in Tamil Nadu" does not come under the purview of Institutional Human Ethics Committee as no human subjects are involved. If in case any human subjects are involved in the study hereafter you are requested to re-submit.

We wish you all the best in your research endeavours.

Regards,

S. Uma Mageshwari

Dr.S.Uma Mageshwari
Member Secretary

Institutional Human Ethics Committee