

## PHYTOCHEMICAL ANALYSIS OF DIFFERENT VARIETIES OF BANANA BRACTS AND THEIR APPLICATIONS

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### ABSTRACT

A banana is an edible fruit which is consumed all over the world. *Musa* species are grown in tropical regions. They are also used to make fiber and banana wine. A banana plant grows above the ground and are normally tall and fairly sturdy. There are number of varieties in bananas. Bananas can be also called “plantains”, because some variety of bananas are also used for cooking. The fruit is variable in size, shape, color. Botanically, it belongs to the family Musaceae. Bananas come from two wild species namely *Musa acuminata* and *Musa balbisiana*. The scientific names of most cultivated bananas are *Musa acuminata*, *Musa balbisiana*, and *Musa-paradisical* for hybrid *Musa acuminata* *M. balbisiana*, depending on their genomic constitution. The edible banana cultivars are mostly derived from two wild species of genus *Musa* namely *Musa acuminata* and *Musa balbisiana*. *Musa acuminata* is a diverse species and consists of at least nine sub species while *Musa balbisiana* is less diverse and no sub species has been suggested so far. All the edible cultivars originated from these two species belong to various genome groups. They are different from each other depending on whether the clones are pure *acuminata* and *balbisiana*, diploid or triploid derivative and whether they are diploid, triploid or tetraploid hybrids of two wild species. On the basis of 15 vegetative and reproductive morphological characters, the differences between *Musa acuminata* and *Musa balbisiana* could clearly be discerned. The present study analysis the Phytochemical properties of three different Varieties of Banana Bracts.

**KEYWORDS:** Banana, Plantains, Phytochemical Properties, *Musa acuminata* and *Musa balbisiana*.

### INTRODUCTION

Bananas are good source of carbohydrate, fibre, minerals and vitamins. Unripe bananas have higher starch content. Banana fruit is composed of soft, easily digestible flesh made up of simple sugars like fructose and sucrose that upon consumption instantly replenishes energy and revitalizes the body. The fruit soluble contains good dietary fibre. Unripe bananas contain resistant starch, a type of carbohydrate that “resists” digestion in the small intestine. The starch acts as food for the growth of beneficial microbes in the digestive tract. Banana with high calorie also contain anti-oxidants. Fresh bananas are rich in potassium which are considered as an important component of cell and body fluids that helps control heart rate and blood pressure, countering bad effects of sodium. Banana calms nervous system, reduces stress and depression. This happens because banana contains tryptophan, which is a type of protein and body converts it into serotonin which makes a person to feel relaxed. Along with others fruits or vegetables, taking banana can reduce the risk colorectal cancer and in women breast cancer. Inflorescences are discarded in abundance in banana fields, yet the inflorescences are considered to be nutritional complements This part of the banana plant is used to make pie filling and salad. The dehydrated inflorescences have great nutritive components based on their high content of potassium and fiber. The nutritive component of inflorescence is not known and usually discarded or used as organic fertilizer (Catharina *et.al.*, 2015, Okareh *et.al.*, 2015 and Adeolu A.T and Enesi D.O, 2013) .

Phytochemicals are known to be non nutritive plant chemicals that have protective and disease preventing properties. Phytochemical test are also useful in the detection of bioactive principles and subsequently may lead to discoveries and development of the active ingredients so that they can be prevented from losing their potency and in general, most of these phytochemicals which present attract the personal exploitation (Sumathy *et.al.*, 2011 and Ross L Prentice, 2000) (Figure 1).



**Figure 1 : Banana Plant**

#### **SCIENTIFIC CLASSIFICATION**

Kingdom : Plantae  
Order : Zingiberales  
Family : Musaceae

#### **KARPURAVALLI (ABB)**

It is a popular variety grown for table purpose in medium rich soils. It is *Acuminata balbisiana* hybrids (ABB Genome). 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 (**Kanchana et.al., 2005**). The average bunch weight is 15 - 20 kg. The variety is also known as Vellapalayankodan, Kudumbavazhai etc (**Figure 2**).



**Figure 2 : Karpuravalli**

#### **NENDRAN (AAB)**

It is a popular variety in Kerala where it is relished as a fruit as well as used for processing. It is *Acuminata-balbisiana* hybrids (AAB). Commercial cultivation of Nendran has picked up rapidly in Tamil Nadu in the recent past. Nendran is known to display considerable diversity in plant stature, pseudostem colour, presence or absence of male axis, bunch size, etc. Bunch has 5 - 6 hands weighing about 12-15 kg. Fruits have a distinct neck with thick green skin turning buff yellow on ripening. Fruits remain as starchy even on ripening. The variety is grown for both fruit and vegetable purpose. The long and thick fruits with good keeping quality make nendran widely acceptable among consumers. At international level the variety is known as plantain. It is also used for the preparation of banana chips (**Sheng et.al., 2011**). Nendran is highly susceptible to Banana Bract Mosaic Virus (BBMV), nematodes and borers (**Figure 3**).



**Figure 3 : Nendram**

### **POOVAN**

Poovan (Mysore AAB). It is a leading commercial cultivar grown throughout the country with location specific ecotypes like Palayankodan in Kerala, Poovan in Tamil Nadu, Karpura Chakkarakeli in Andhra Pradesh and Alpan in North Eastern Region. It is generally cultivated as a perennial crop. Tamil Nadu is the leading producer of Poovan cultivar owing to its climatic and marginal soil condition. Poovan is also commercially cultivated for leaf industry throughout Tamil Nadu and in certain parts of Kerala (**Saranya\_Gunasegaram *et.al.*, 2016**). Poovan is an important variety of banana grown for fruit purpose. Fruit is slightly acidic, firm and has typical sour-sweet aroma. Medium sized bunch, closely packed fruits, good keeping quality and resistant to fruit cracking is its plus points. But it is highly susceptible to Banana Bract Mosaic Viral (BBMV) disease and Banana Streak Virus, (BSV), which cause considerable reduction in yield (**Figure 4**).



**Figure 4 : Poovan**

### **NUTRITIONAL CONTENT OF BANANA FLOWERS**

Nutritional content of banana flowers in 100 g

- 51 kcal
- 6 g Protein
- 1, 07 mg Vitamin E
- 7 mg of Fiber
- 6 g Fat
- 9 g Carbohydrates
- 56 mg Calcium
- 3 mg Phosphorus
- 3 mg Potassium
- 7 mg of Magnesium
- 4 mg Iron
- 13 mg Copper

Banana flowers also contains Vitamin A Benefits, Vitamin B1, and Vitamin C. Because it has a very good nutritional content for the body, there are many benefits of banana flower that you can get as we process them in cooking (**Vishnu Priya *et.al.*, 2016**, **Ogbonna Obiageli *et.al.*, 2016**, **Umamaheswari *et.al.*, 2017**, **Sharmila *et.al.*, 2013**, **Nataraj Logayanaki *et.al.*, 2010** and **Sayantani Maiti *et.al.*, 2016**).

## **MATERIALS AND METHODOLOGY**

### **COLLECTION OF SAMPLES**

#### **Sample 1**

The bract sample was collected from home garden and Thirunelveli district. The bracts were washed with distilled water and dried under the sunlight for 2 weeks. Then it was stored in a air tight container for further use.

#### **Sample 2 and 3**

The bract sample was collected from Kerala district. The bracts were washed with distilled water and chopped into pieces for further extraction. Qualitative and Quantitative Analysis was carried out for Alkaloids, Glycosides, Phenols, Tannins, Flavonoids, Steroids, Carbohydrates, Proteins, Saponins and Terpenoids. Antibacterial, Antifungal, Anticoagulant and Thrombolytic Activity were assessed. In Vitro Antioxidant Activity was carried out using DPPH method. IC50 Value, Anti – inflammatory Activity, Anti – Diabetic Activity, Anti – Larval Activity, Cytotoxicity Activity and Anti- Cancer Activity by MTT Assay method were carried out.

## **RESULTS AND DISSCUSSION**

### **EXTRACTION**

1 gram of the Karpuravalli sample which was powdered and stored was weighed and was incubated in 4 solvents aqueous, chloroform, ethanol, and petroleum ether. The samples were incubated overnight (24hrs). After incubation time the samples were filtered with filter paper and the extracts were stored in glass bottle (Figure 5).



**Figure 5 : Incubation of Dried Sample**

The other two sample bracts (Nendram and Poovan) were chopped and weighed 10g, and were incubated in solvents like aqueous, chloroform, ethanol and petroleum ether. The samples were incubated overnight (24hrs). After incubation time the samples were filtered with filter paper and the extracts were stored in glass bottle (Figure 6).



**Figure 6 : Incubation of Chopped samples**



**Figure 7 : Extraction of samples**

**QUALITATIVE ANALYSIS**

The Phytochemical tests for Karpuravalli, Nendrum and Poovan were done and the results observed are tabulated in **Table 1, 2 and 3.**

S. No.	Test	Solvents			
		Aqueous Extract	Chloroform	Ethanol	Petroleum Ether
1	Alkaloids	+	+	+	+
2	Glycosides	+	+	+	+
3	Phenols	+	+	+	+
4	Tannins	-	-	-	-
5	Flavonoids	-	-	-	-
6	Steroids	+	+	+	+
7	Carbohydrates	-	+	-	-
8	Proteins	+	+	+	+
9	Saponins	+	+	+	+
10	Terpenoids	-	+	-	+

**Table 1 : Qualitative Analysis of U1 Sample – KARPURAVALLI**

S. No.	Test	Solvents			
		Aqueous Extract	Chloroform	Ethanol	Petroleum Ether
1	Alkaloids	+	+	+	+
2	Glycosides	-	+	-	+
3	Phenols	+	+	+	+
4	Tannins	-	-	-	-
5	Flavonoids	-	-	-	-
6	Steroids	-	+	-	+
7	Carbohydrates	-	+	+	+
8	Proteins	-	+	-	+
9	Saponins	+	+	+	+
10	Terpenoids	-	+	-	+

**Table 2 : Qualitative Analysis of U2 Sample – NENDRUM**

S. No.	Test	Solvents			
		Aqueous Extract	Chloroform	Ethanol	Petroleum Ether
1	Alkaloids	+	+	+	+
2	Glycosides	-	+	-	+
3	Phenols	+	+	+	+
4	Tannins	-	-	-	-
5	Flavonoids	-	-	-	-
6	Steroids	-	+	-	+
7	Carbohydrates	-	+	+	+
8	Proteins	-	+	-	+
9	Saponins	+	+	+	+
10	Terpenoids	-	+	-	+

**Table 3 : Qualitative Analysis of U3 Sample – POOVAN**

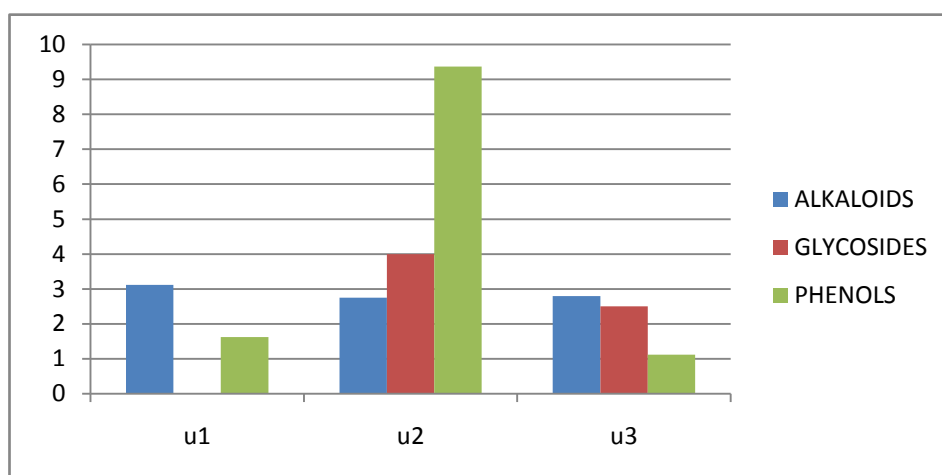
**QUANTITATIVE ANALYSIS**

The results obtained for Chloroform extract for all the three samples was found to be better than other extracts and hence the Estimation process of Phytochemicals was done in extraction of samples in chloroform solvent (**Table 4 and Graphs 1 - 3**).

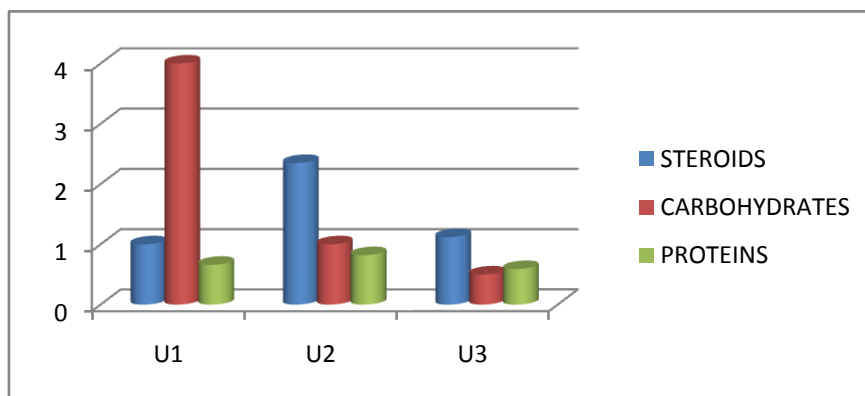


PHYTOCHEMICALS	U1	U2	U3
ALKALOIDS	0.39	0.33	0.35
GLYCOSIDES	-	0.80	0.50
PHENOLS	0.04	0.22	0.03
STEROIDS	0.48	1.09	0.68
CARBOHYDRATES	0.825	0.225	0.102
PROTEINS	0.82	1.00	0.72
SAPONINS	0.176	0.172	0.190
TERPENOIDS	0.58	0.56	0.68

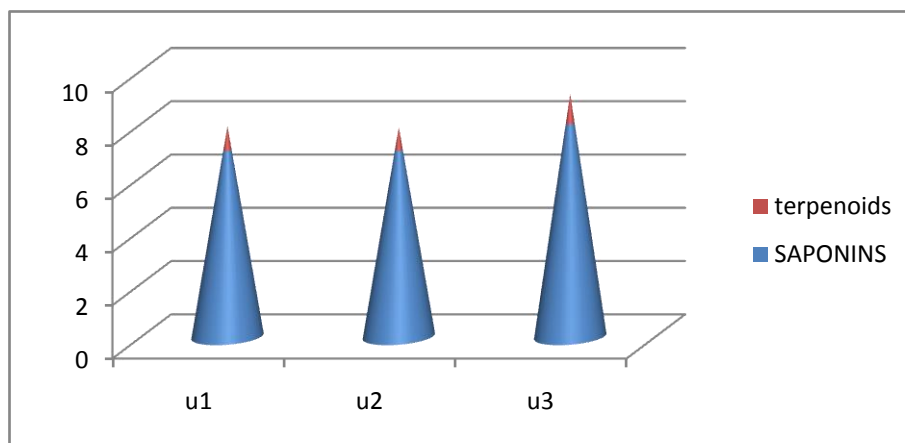
**Table 4 : Quantitative Analysis**



**Graph 1 : Quantitative Estimation of Alkaloids, Glycosides and Phenols**



**Graph 2 : Quantitative Estimation of Steroids, Carbohydrates and Proteins**

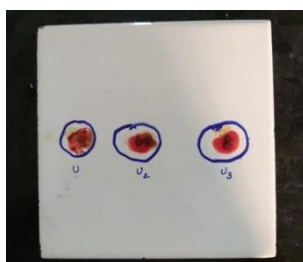


**Graph 3 : Quantitative Estimation of Terpenoids and Saponins**

### **APPLICATIONS OF BANANA BRACTS**

#### **THROMBOLYTIC ACTIVITY**

Thrombolytic activity test was done with 3 different banana bract samples. The clotted blood was placed on tile in 3 areas and added with samples. It was then incubated for 45 minutes. It was not found not to break the blood clot within 45 minutes. This revealed the Thrombolytic activity (**Figure 8**).



**Figure 8 : Thrombolytic Activity**

#### **ANTI-COAGULANT ACTIVITY**

The results observed in the banana bracts showed Anti-coagulant activity in all the 3 plantain bracts (Karpuravalli, Nendram and Poovan). These bracts contain good Anti-coagulant property (**Figure 9**).



**Figure 9 : Anticoagulant Activity**

#### **ANTI-LARVAE ACTIVITY**

Anti-larvae activity was done using mosquito larvae. Few drops of sample was poured in crucibles which had few larvae. It was observed continuously in the first 30 minutes. After which every 15 minutes was observed. Karpuravalli banana bract sample killed larvae in 30 seconds, and other two samples killed larvae in 2 minutes (**Figure 10A & B**).



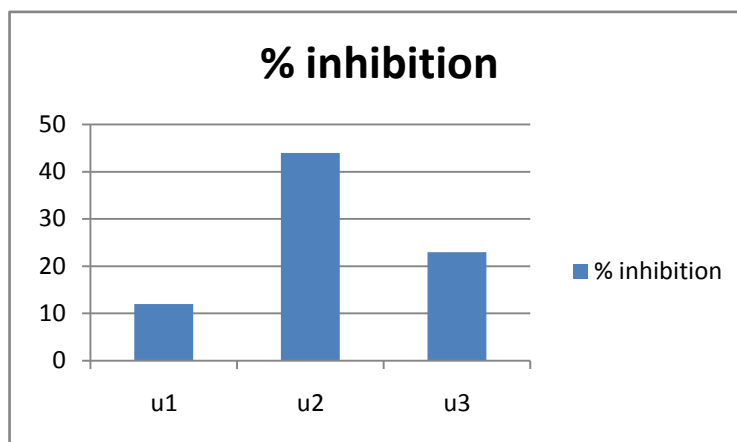
**Figure 10A : Anti-larval Activity before Sample Addition**



**Figure 10B : Anti-larval activity after Sample Addition**

**ANTI-INFLAMMATORY ACTIVITY**

The result of Anti-inflammatory activity of plantain bracts showed good inhibition percentage. Karpuravalli sample showed 12% inhibition, Nendram sample showed 44% inhibition and Poovan sample showed 23% inhibition (Graph 4).



**Graph 4 : Anti-inflammatory Activity**

**ANTI-OXIDANT ACTIVITY**

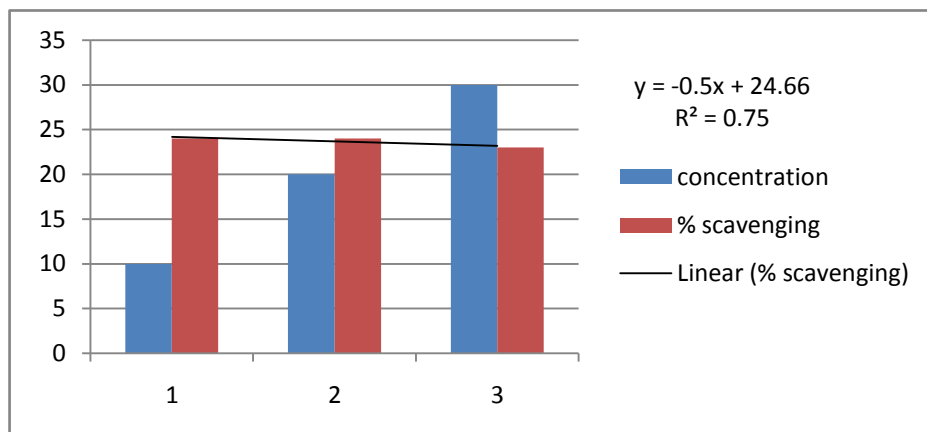
The result showed Anti-oxidant activity in bract samples. Nendram sample (chloroform extract) showed maximum inhibition and Anti-oxidant activity (33%) than all the 3 samples (Table 5 and Graphs 5 – 7).

Topic	Concentration (µl)	Absorbance (nm)	Inhibition %
Control	Positive	0.050	
Control	Negative	2	
Sample (u1)	10	1.52	24%
	20	1.52	24%
	30	1.56	22%
Sample (u2)	10	1.30	35%
	20	1.34	33%

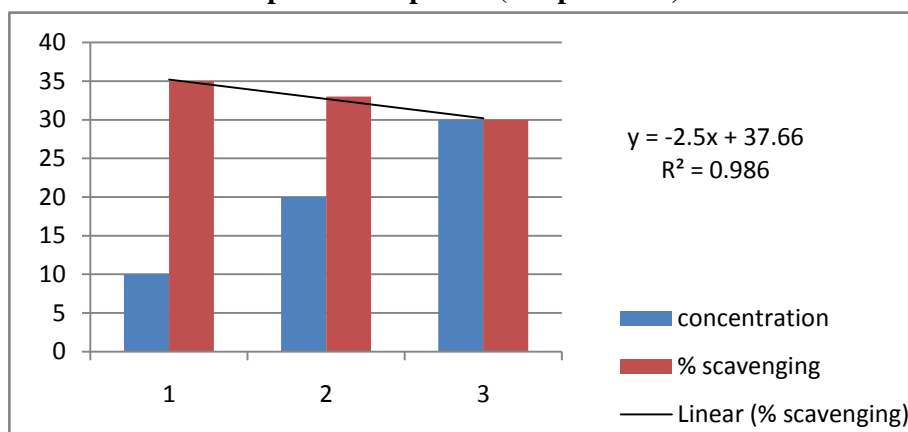


	30	1.40	30%
Sample (u3)	10	1.44	28%
	20	1.50	25%
	30	1.54	23%

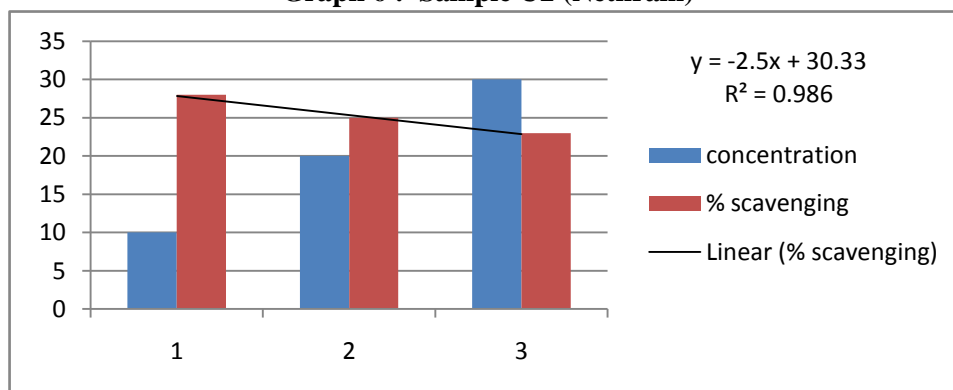
**Table 5 : Anti-oxidant Activity**



**Graph 5 : Sample U1 (Karpuravalli)**



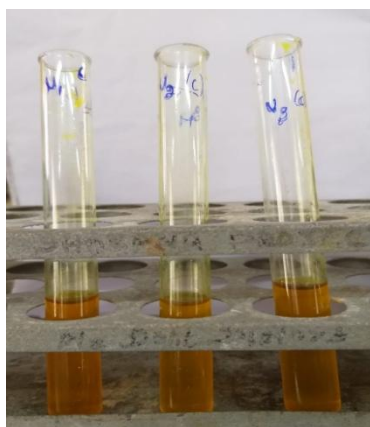
**Graph 6 : Sample U2 (Nethram)**



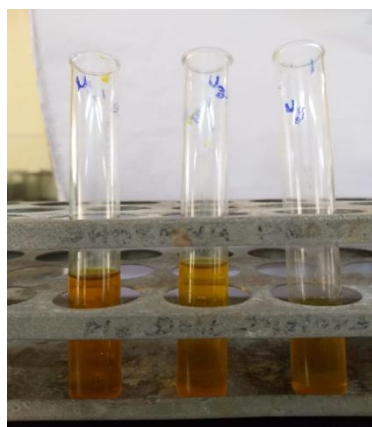
**Graph 7 : Sample U3 (Poovan)**

**ANTI-DIABETIC ACTIVITY**

The antidiabetic activity was tested by Amylase method in all the 3 samples (Karpuravalli, Nendram and Poovan). The total activity was calculated by the difference between control and sample values and standard graph was plotted (Figures 11 & 12 and Table 6).



**Figure 11 : Control**



**Figure 12 : Samples (U1,U andU3)**

Sample	Total Activity
U1	3889 IU
U2	1389 IU
U3	1944.4 IU

**Table 6 : Anti-diabetic Activity**

**CYTOTOXIC ACTIVITY**

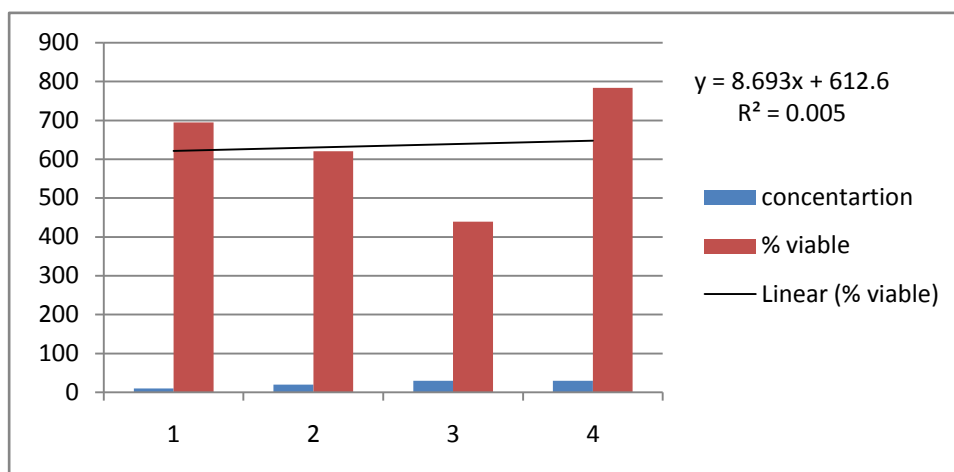
When VERO cells Lines were treated with Bract samples of Karpuravalli, Nendram and Poovam (chloroform extract), it did not show any Cytotoxicity (Figure 13, Table 7 and Graph 8).



**Figure 13 : Cytotoxicity Activity**

TOPIC	CONCENTRATION (µl)	% of cell viability in Vero Cell Lines
Control		100
Sample (U2)	30	783.80
Sample (U3)	10	694.39
	20	620.24
	30	438.94

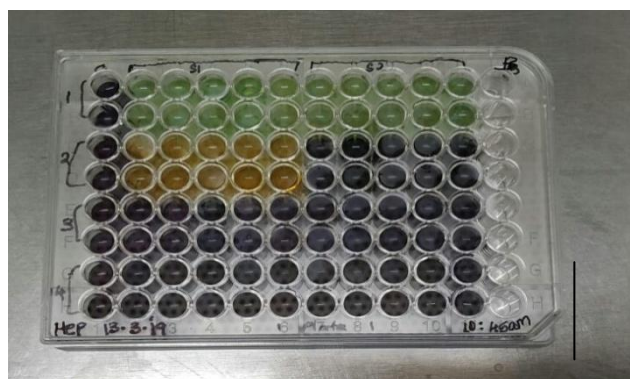
**Table 7 : Cytotoxicity Activity**



**Graph 8 : Cytotoxicity Activity**

**ANTICANCER ACTIVITY**

Hep2 cell lines were treated with the Bract samples of Karpooravalli, Nendram and Poovam (chloroform extract). It did not reveal any Anti- tumor Activity (**Figure 14**).



**Figure 14 : Anticancer Activity**

**CONCLUSION**

The 3 different plantain bracts of Karpuravalli, Nendram, and Poovam were subjected to extraction with 4 different solvents and was filtered using filter paper. From the present study, the 3 different plantain bracts of Karpuravalli, Nendram, and Poovam showed the presence of Phytochemical such as Alkaloids, Proteins, Carbohydrates, Saponins, Steroids, Terpenoides, Phenols and Glycosides. The Phytochemicals present were further quantified. The Antibacterial and Antifungal Activity was done for the plantain bracts of Karpuravalli, Nendram, and Poovam. Anti – larval Activity was done using mosquito larvae which showed good results. Within 30minutes all larvae were killed. Anti- inflammatory Activity of plantain bracts of Karpuravalli, Nendram, and Poovam plant (chloroform extract) had good inhibition. Anti – coagulant Activity was seen in the plantain bracts of plant Karpuravalli, Nendram and Poovan (chloroform extract). Anti -thrombolytic Activity done revealed absence of blood clot within 45 minutes. Anti – oxidant Activity showed Inhibition rate. Anti-cancerous Activity of Karpuravalli, Nendram, and Poovan (chloroform extract) did not show any inhibition. Cytotoxicity test with Vero Cell Lines proved non- toxic. Thus the 3 varieties of banana bracts which are thrown away as agricultural waste was studied to analyse the bioactive compounds and nutrients present in it. The bracts seemed to give good results when tested. These bioactive compounds are much needed as they can be used for drug formulation. The bracts showed good results towards its applications part. All these properties explains with evidence that banana bract can be used by people to treat and heal a number of Lifestyle diseases.

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