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ORIGNAL ARTICLE

Antibacterial and anti-oxidant potential of *Yucca elephantipes* and comparative safety profile of its various extracts

Samia Mahjbeen[1*], Yehya Amjad[1], Kashif Iqbal[1] and Irfan Hamid[2]

[1]*Institute of Pharmacy, Physiology and Pharmacology, University of Agriculture Faisalabad, Pakistan*
[2]*Cadson College of Pharmacy, Kharian, Pakistan*

Abstract

In the present study, different extracts of *yucca elephantipes* including aqueous, ethanolic and methanolic were evaluated for their antibacterial as well as antioxidant activities, while the toxicity studies were also carried out along them. Disc diffusion method was used to evaluate anti-bacterial activity of the extracts against certain bacteria including gram positive *S. aureus* and *B. subtillus* as well as gram negative *P. aeruginosa* and *E. Coli*. Results showed that plant extracts have excellent antibacterial activity against *E. coli* as compared to *S. aureus*. As far as *E. coli* is concerned, the activity of these extracts was found out to be more than the standard drug. Hence, we can conclude that the extracts of *yucca elephantipes* showed more activity against gram negative bacteria rather than gram positive. The *In vitro* antioxidant activity of aqueous, ethanol and methanol extracts was tested by DPPH scavenging activity, reducing power assay, total phenolic contents, and total flavonoid content. Highest amount of TPC was found in methanolic extracts (48.56 mg of gallic acid e/gE) while that of TFC was found in n-hexane (33.31 mg of catechin/gE). As far as reducing power assay is concerned, n-hexane exhibited the highest activity (33.07%) among all. Ethanolic extract of *yucca elephantipes* showed highest DPPH scavenging activity. Significant difference was observed between the anti -oxidant activity of ethanol, methanol and n-hexane. Different doses of extract 250mg/kg and 500mg/kg were orally administered to rats to evaluate the sub-acute toxicity. At the end of study, tissue samples and blood was collected for biochemical and hematological parameters. Hematological parameters showed that the high dose of methanolic extract decreased the level of RBCs, WBCs, PLT and HGB. These results suggested the use of *yucca elephantipes* as a valuable source of natural antibacterial and antioxidants.

Keywords

Antibacterial
Anti-oxidant
Extracts
Yucca elephantipes

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Introduction

Plants are substitute option for the treatment of many different diseases as they are efficacious, have low cost as well as safe for use (Lahlou, 2013). Yucca family comprises large number of plants which embraces *Yucca Schidigera*, *yucca alofolia*, *yucca elephantipes*, *Yucca Whipplei*, *Yucca eleta*. It was identified that these plants have various different activities as they work as anti-diabetic, antioxidant, anti-inflammatory and antibacterial. Crucial constituents of these plants are yuccaol, resveratrol, steroidal saponins (Patel, 2012). Y*ucca elephantipes* was used in this study and its common name is spineless yucca and it belongs to family Agavaceae. (Zhang *et al*., 2008).

Since the ancient times, people are using plant extracts for the treatment and prevention of certain problems and plants are the ridiculous source of antibacterial agents, the plant extracts are used for the management of contagious ailments because of their

***Corresponding author:** Email: sjabeen792@gmail.com

phytochemical profile that includes tannins, flavonoids, alkaloids and terpenoides (Khan *et al*., 2013).

Certain bacteria mainly *E. Coli, B. subtilis, S. aureus* and *P. aeruginosa* are the main source of contagious ailments in animals and humans. Plant extracts constrain the growth of bacteria via distraction of cell wall, nucleic acid and protein synthesis of bacteria. The synthetic antibiotics are costly and these bacteria develop resistance against them. Multiple drug resistance develops due to undiscerning use of antibiotics for the treatment of various infections. Many adverse effects are caused by antibiotics in animals and humans including allergic reactions, hyper sensitivity and immune suppression. It increases the need to look for new therapeutic options having high susceptibility against microbes (Bibi *et al*., 2011).

Oxidative stress is caused by overproduction of various free radicals. These free radicals mutilate to DNA, proteins and lipids that is concomitant with chronic progressive infections including diabetes, hypertension and cancer (Karagoz *et at*., 2015). Antioxidants are needed against them as they have the ability to give their own electrons to free radicals and oxidation chain reaction is broken when free radicals do not attack on the cells. Antioxidants can be naturally found in the vegetables and seeds e.g. vitamin E, certain phenolic compounds and ascorbic acid (Karlsson *et al*., 1995). Many of the medicinal plants are blessed with the antioxidant properties which halt the destruction that occurs as result of oxidative stress (karagoz *et al*., 2015).

Antioxidants are obtained from plant material by different extraction procedure which depends upon their chemistry and plant matrix distribution. Different constitutes of plant are separated by using polar solvents. Ethanol, Methanol and n-hexane are those chemicals which have been used for the extraction of the constituents present in different plants.

Despite so many pharmacological properties, herbal remedies also possess some toxic effects. Toxicity profile is important and it can be established by evaluating sub-acute, acute and chronic toxicity (Olaniyan *et al*., 2016). The evaluation of sub-acute toxicity tells about the overall toxicity of the substance to the different organs at low doses for prolonged exposure. The result of this test helps in dose selection. The concern of this study was to evaluate the sub-acute toxicity of *Yucca elephantipes* (Gandhare *et al*., 2013).

Analgesic, anti-pyretic and anti-inflammatory effects of this plant were formerly scrutinized in mice but no one investigated toxicity, antibacterial and anti-oxidant activities of plant extracts of *Yucca elephantipes*.

Materials and Methods

The anti-bacterial, anti-oxidant and sub-acute toxicity of *Yucca elephantipes* (giant yucca) were evaluated in albino rats. The experimental protocol is as follow:

Animals: Twenty-five healthy albino rats were purchased from the animal market of Faisalabad, Pakistan. Then for study, they were kept in animal room of Institute of Physiology and Pharmacology, University of Agriculture, Faisalabad, Pakistan.

Preparation of plant extracts: *Yucca elephantipes* was obtained from local botanical garden. These were first identified and then authenticated by the Department of Botany at University of agriculture, Faisalabad. Distilled water was used to rinse the leaves in order to remove the dirt. These leaves were then dried in shade. To get fine powder, the leaves were grinded using an electric grinder. By using soxhlet apparatus, the dried powder was extracted using distilled water and its extracts were made concentrated by gradually evaporating the respective solvent on the hot water bath. These extracts were than used to feed to albino mice (Kandiah *et al.*, 2010).

Chemicals and reagents: Chemicals and reagents that were used for the experimentation were purchased from sigma brand. 1,1-Diphenyl-2-picrylhydrazyl radical (DPPH, 90%), linoleic acid, gallic acid, Folin-Ciocalteu reagent. All the other chemicals (analytical grade) used in this trial i.e., sodium nitrate, aluminium chloride, dipotassium hydrogen phosphate, sodium hydroxide, potassium dihydrogen phosphate, ammonia, mercuric chloride, potassium iodide, sodium hydroxide, copper sulphate, ferric chloride, acetic anhydride, sulphuric acid, acetone, chloroform, glacial acetic acid, benzene were purchased from Merck (Darmstadt, Germany).

Dose selection: The plant extract was administered to animal at doses of 125 mg/kg, 500 mg/kg of ethanol, methanol and n-hexane extracts.

Grouping of animals: Albino rats were divided into 3 groups, each group having 4 rats. Washout period of 10 days was given to the animals before the start of each activity.

Work plan: The research work plan was designed to evaluated antibacterial activity, antioxidant activity and Sub-acute toxicity.

Antibacterial Activity: According to the standard method anti-bacterial activity of ethanol, methanol and n-hexane extracts of fresh plant material were determined. Ethanol, methanol and n-hexane extract were evaluated for their antibacterial activity against gram positive bacteria (*S. aureus*, *B. subtilis*) as well as gram negative bacteria (*E. coli, P. aeruginosa*) by using disc diffusion method.

Antioxidant Activity: TPC, DPPH scavenging activity, total flavonoid contents as well as reducing power were used to evaluate antioxidant activity of plant extracts.

Evaluation of TPC: Folin-Ciocalteu was the method used to evaluate TPC in methanol, n-hexane and ethanol (Sultana *et al*., 2009). Folin-Ciocalteu reagent were used to assess total amount of TPC. 4ml of sodium carbonate solution (20%) and 5ml of Folin- Ciocalteu reagent were mixed with 300mg/ml gallic acid solutions and 1ml aliquots of 50, 100, 150, 200, and 250 in ethanol for the formation of calibration curve. It was incubated at room temperature for about 1 hr and absorbance was recorded at 765nm. In plant extract Folin –Ciocalteu and deionized were added. Then mixture was placed at room temperature for around 10 mins and after that 20% Na2CO3 was added. The mixtures was heated for 20 min on water bath at 40°C and then ice bath was used to cool it. Absorbance was measured at 755nm by using spectrophotometer. All the samples were examined for about three times and then the results were calculated. TPC was expressed in grams. Total phenolic content in 1 gram of extract was calculated using the bellow mentioned formula:

T=C×V/M Where T is the total phenolic contents in mg (GAE/g of extract).

C = gallic acid concentration calculated using the calibration curve (mg/ml).

V = extract's volume (ml). M = extract's weight (grams).

Evaluation of total flavonoid contents (TFC): Spectrophotometric method was used to evaluate TFC (Sultana *et al*., 2009). Dilution of the extracts was done individually using measured amount of distilled water (around 4 ml) and it also had $NaNO_2$ solution around 0.3 ml. After 5min, 0.3ml of AlCl3 and at 6min 2ml of (1.0M) NaOH were added respectively. Water was added in flask in calculated amount of 2.4 ml and it was mixed well. After incubation for 15 min. absorbance of mixture were observed at 510 nm. Three readings were taken for each sample and results averaged. TFC were calculated by using catechin calibration curve (R2=0.9835). TFC of the extracts were expressed as catechin equivalents (CE) from the linear regression curve of catechin.

Evaluation of reducing power: The reducing power of the extracts was determined by making some slight modifications is the previously reported procedure (sultana *et al*., 2009). Potassium ferricyanide ($K_3Fe(CN)$ (5.0 ml, 1.0%) and sodium phosphate buffer having details as 5.0 ml, 0.2 M, PH 6.6 was mixed with concentrated extract (2.5-10.0 mg): At 50°C this was incubated for 20 min. Trichloroacetic acid was added around 5 ml and the mixture was centrifuged for 10 min. Solutions's upper layer (5.0 ml) was vaccated after centrifugation and diluted with 5.0 ml of distilled water as well as ferric chloride (1.0 ml, 0.1%), Spectrophotometer was used to read absorbance at 700 nm. Increased reducing power of sample indicates increased the absorbance of reaction mixture. This procedure was repeated thrice. Then the percentage reducing activity of the concerned sample was calculated by using the following method:

Reducing power of sample = (Ac-Ao) / Ao × 100

Where Ao = Blank absorbance

Ac = Absorbance of added sample concentration

2.8.4 Evaluation of DPPH scavenging assay: The plant extract was evaluated for antioxidant activity by DPPH scavenging activity according to the method already reported by Sultana *et al*., (2009). 25µg/ml of dry powder was dissolved in the solvent than DPPH was added into the solution and kept for 30 mints in the dark. At 517nm, absorbance was noted. High radical scavenging activity indicated low absorbance of reaction mixture. The solution was used as control when no extract was present in the solution. This procedure was repeated thrice. The method used to calculate the DPPH radical sample's percentage inhibition was as follows:

Q = (Ao – Ac)/Ao×100

Where: Ao = Absorbance of control

Ac = added sample concentration's absorbance

Q = percentage inhibition of the DPPH

Toxicity evaluation:

Dose selection: Methanolic extract was administered to animal at doses of 125 mg/kg and 500 mg/kg and to albino rats.

Grouping of animal: Grouping of animals is shown in Table 1.

Experimental Protocol: Twenty-five healthy albino rats of either sex were obtained. The rats were kept in special iron cage for one week at ambient temperature with 12/12 h period of light/dark. These rats were divided randomly into 3 different groups. The methanolic extract was dissolved in the common distilled water and was orally administered into the rats; daily for about 14 days to Groups 2 and 3 at different doses of 125 mg/kg and 500 mg/kg, Toxic effects and death were monitored daily. At the end of 14 days, the blood of these rats was collected into two separate type of tubes: One without any additives and other with EDTA. The anticoagulant blood (EDTA) was analyzed instantaneously for hematological parameters. To obtain the serum the other tube which contained no additive was centrifuged at 4000 rpm at 4°C for 10 min, for biochemical analysis this was stored at -20°C. At the end of 14 days the animal were sacrificed by execution and designated organs (liver and kidney) were separated out carefully. These organs were fixed in 10% formalin for histopathological examinations.

Blood analysis: Blood samples were collected in clot activator tubes and gel. Animal were sacrificed to collect the blood samples from jugular veins. By using auto analyzer hematological parameters including platelet counts, hemoglobin, RBCs and WBCs were determined. The biochemical parameters, serum creatinine, cholesterol and aspartate aminotransferase (AST) and (ALT) were determined and measured with a spectrophotometer.

Biochemical analysis: The serum was separated from blood and biochemical parameters were assessed by Serum level of Creatinine (mg/dl), total serum proteins, albumin, Urea (mg/dl) and globulin. The presence of creatinine in serum and blood urea nitrogen was measured spectrophotometrically using commercially available kits.

Results

The purpose of this study was to estimate anti-bacterial, antioxidant and toxicity activities of *yucca elephantipes*.

Anti-bacterial activity: Results showed that all these extracts were active against bacterial strains but less than standard antibiotic i.e., Ampicillin. It is evident from results that plant extracts showed excellent antibacterial activity against *E. coli* than *S. aureus*. The activity against *E. coli* was even more than the standard drug. Hence, we can conclude that extract were less activity against gram positive bacteria and more active against gram negative bacteria.

Antibacterial activity of ethanol, methanol and n-hexane extracts against *E. coli*: The inhibition zone revealed by 50mg/ml concentration of ethanol extract of *yucca elephantipes* against *E. coli* was 6.3 mm. The inhibition zone shown by 50 mg/ml concentration of methanolic extract against *E. coli* was 15 mm while, the inhibition zone revealed by 50mg/ml concentration of ethanolic extract against *E. coli* was 6.3 mm. Zone of inhibition expressed by standard antibiotic ampicillin was 12.5 mm against *E. coli*. Standard antibiotic ampicillin exhibited higher antibacterial activity as compared to *yucca elephantipes* plant extract. Figure 1 showed disc of *E. coli.*

Antibacterial activity of Ethanol, methanol and n-hexane extracts against *S. aureus*: The zone of inhibition exhibited by 50 mg/ml of ethanolic extracts of *yucca elephantipes* against *S. aureus* was 25 mm. The inhibition zone revealed by 50 mg/ml concentration of methanolic extract against *S. aureus* was 12.5 mm while the zone of inhibition showed by 50 mg/ml concentration of n-hexane extract against *S. aureus* was 50mm. Ampicillin showed zone of inhibition 3.25 mm against *S. aureus*. Standard antibiotic ampicillin exhibited lower antibacterial activity as compared to *yucca elephantipes*. Figure 2 showed disc of *S. aureus*.

Comparative inhibition zones of different extracts of *yucca elephantipes*: Table: 2 shows Comparative inhibition zones of different extracts of yucca elephantipes.

Antioxidant activity

Total phenolic contents (TPC): Total phenolic content of the different extracts of *yucca elephantipes* were determined by Folin- Ciocalteu method. Methanolic extract showed higher amount of TPC followed by ethanolic extracts while n-hexane extract of *yucca elephantipes* had lowest TPC. Highest TPC was found in methanol (145.7 mg), followed by ethanol extract (142.66 mg extract) and lowest in n-hexane (108.2 mg). Figure 3 shows total phenolic contents (mgGAE/g of extract) in *yucca elephantipes* plant extract.

Total flavonoid contents (TFC): Total flavonoid contents of the different extracts of *yucca elephantipes* were determined by aluminum chloride colorimetric

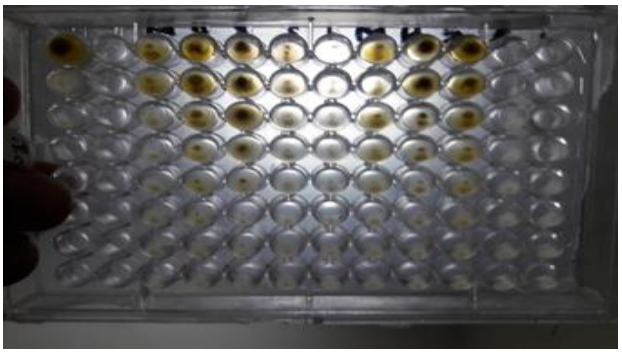

Figure 1: disc of *E. coli*.

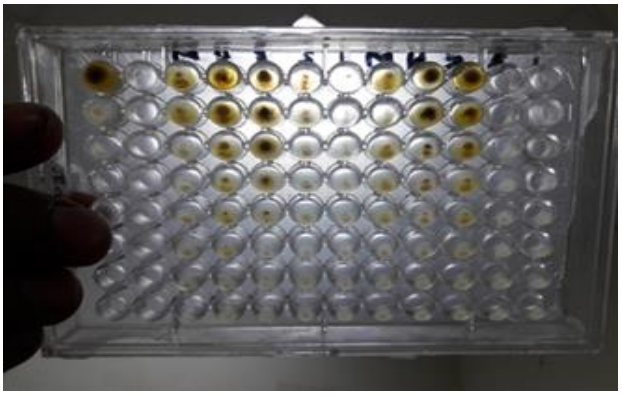

Figure 2: disc of *S. aureus.*

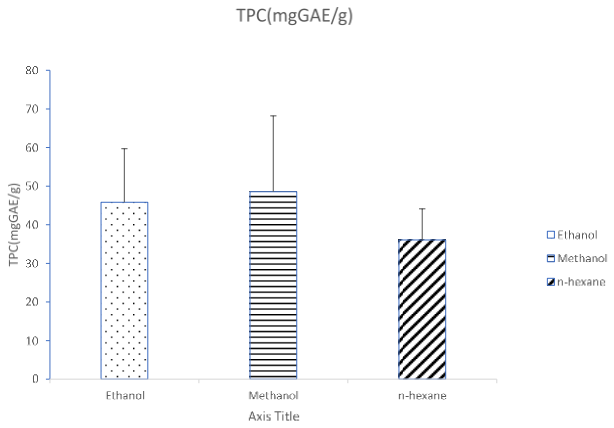

Figure 3: Total Phenolic contents (mgGAE/g of extract) in yucca elephantipes plant extract.

Table 1: Grouping of animals.

Groups	Doses
Control group	Routine diet +water
Treatment group(125mg/kg)	Routine diet + water + methanol extract of *yucca elephantipes*
Treatment group(500mg/kg)	Routine diet + water + methanol extract of *yucca elephantipes*

Table 2: Comparative inhibition zones of different extracts of yucca elephantipes

Plant Extract	*E. coli*	*S. aureus*
Ethanol	6.3	25
Methanol	6.3	12.5
n-hexane	6.3	50
Standard antibiotic Ampicillin	12.5	3.25

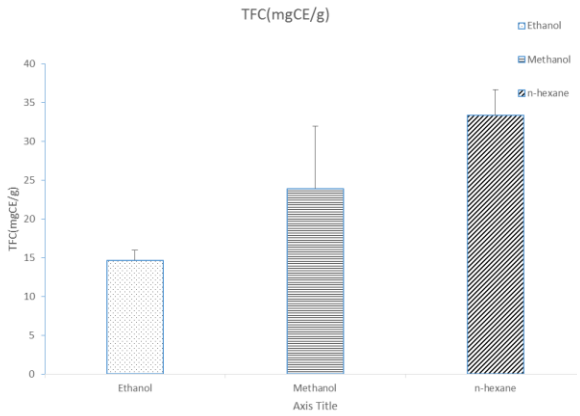

Figure 4: Total flavonoid contents (mg of catechin equivalent/g of extract) in *yucca elephantipes* extracts.

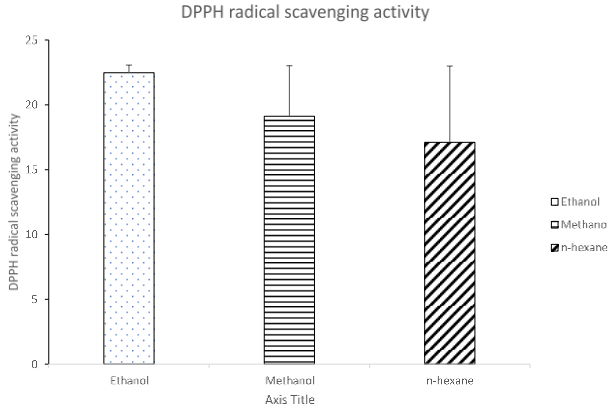

Figure 5: DPPH radical Scavenging activity of *Yucca elephantipes* plant extract.

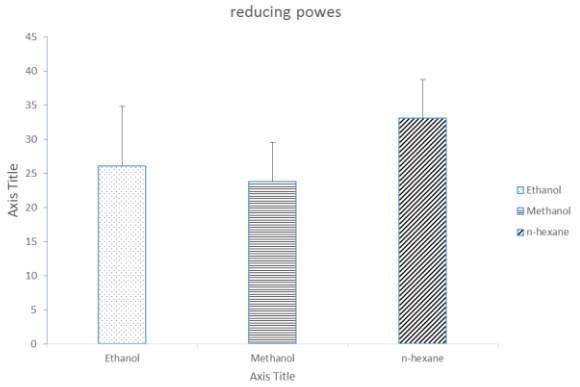

Figure 6: Ferric reducing power of yucca elephantipes extract.

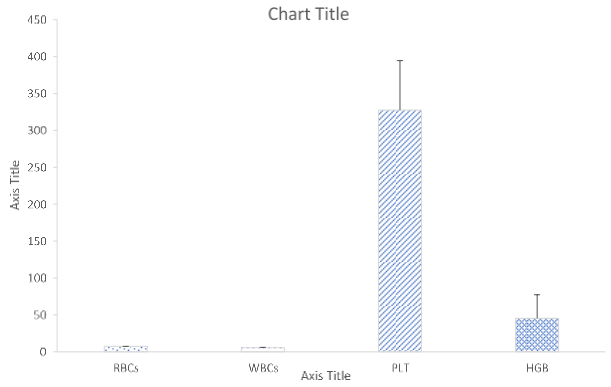

Figure 7: Control group for toxicity studies.

method which was measured spectrophotometrically. Catechin equivalent were used to express total flavonoids contents. N-hexane contained highest TFC (99.94 mg) followed by methanol extract (71.67 mg) and ethanol extract contained lowest TFC (43.98 mg). Figure 4 shows Total flavonoid contents (mg of catechin equivalent/g of extract) in *yucca elephantipes* extracts.

DPPH Scavenging Activity: DPPH values of different extracts of *yucca elephantipes* plant extracts are given in table. Methanolic extracts showed highest DPPH activity as compared to n-hexane extract showed the lowest percentage DPPH radical inhibition. Mean percentage DPPH radical inhibition for ethanol, methanol and n-hexane were found to be 67.43%, 87.36%, 51.32% respectively.

Table 3: Effects of administration of different extracts of yucca elephantipes plant on hematological parameters.

Groups	Parameters			
Control Normal saline	**RBCs**	**WBCs**	**Platelets**	**HGB**
C1	7.43	6.6	415	141
C2	7.21	4.1	131	13.6
C3	7.35	6.2	350	13.4
C4	7.41	5.1	413	14.0
Methanolic extract at 125mg/kg				
T1	7.39	5.8	293	14.0
T2	6.29	5.3	285	11.2
T3	6.46	4.9	159	13.7
T4	7.34	5.5	201	12.5
Methanolic extract at 500mg/kg				
t1	4.94	3.4	94	12.0
t2	6.26	2.1	24	9.2
t3	5.25	3.2	75	11.5
t4	4.64	2.7	83	10.7

Figure 5 shows DPPH radical Scavenging activity of *Yucca elephantipes* plant extract.

Reducing power assay: The results were expressed as % reducing activity of ethanol, methanol and n-hexane extracts. N-hexane showed highest ferric reducing power activity as compared to methanolic extract. Mean reducing power activity of n-hexane, methanol and ethanol extracts were found to be 78.19, 71.41 and 99.23%. Figure 6 shows Ferric reducing power of *yucca elephantipes* extract.

Comparative antioxidant activities of ethanolic, methanolic and n-hexane extracts of yucca elephantipes: Table 3.2 shows Comparative antioxidant activities of ethanolic, methanolic and n-hexane extracts of yucca elephantipes.

Toxicity activities: Effects of administration of different extracts of yucca elephantipes plant on some hematological parameters are given in Table:

Table 3 showed effects of administration of different extracts of yucca elephantipes plant on hematological parameters.

The effects of administration of methanolic extract of this plant in experimental animal is shown in table: After 14 days methanolic extract of this plant was significant dose dependant the RBCs, WBCs, PLT, HGB of treatment group 1 at dose of 125mg/kg are with I the normal range but the methanolic extract at dose of 500mg/kg was administered to group 2 their RBCs, WBCs, PLT and HGB values are decreased.

Comparative hematological values of methanolic extracts of *Yucca elephantipes*

Figure 7 showed control group for toxicity studies.

Figure 8 showed effect of methanolic extract of yucca elephantipes on treatment group 1.

Figure 9 showed effect of methanolic extract of yucca elephantipes on treatment group 2.

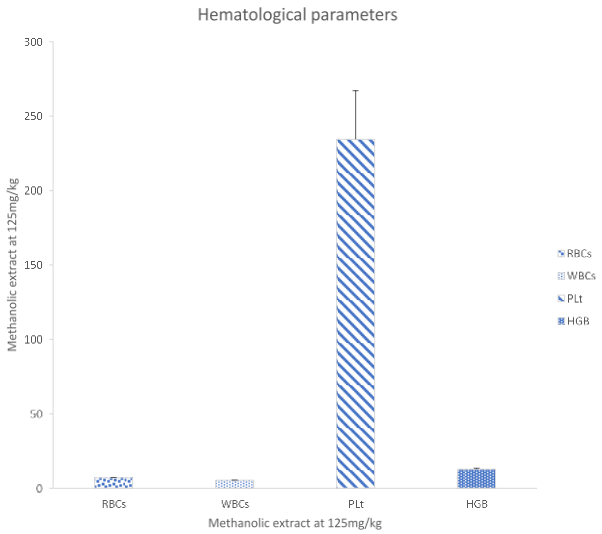

Figure 8: Effect of methanolic extract of yucca elephantipes on treatment group 1.

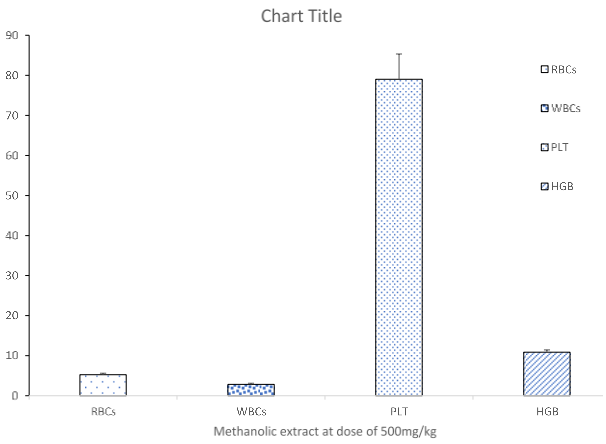

Figure 9: Effect of methanolic extract of yucca elephantipes on treatment group 2.

Biochemical study: Effect of methanolic extracts of yucca elephantipes on biochemical parameters in rats

Figure 10 showed effect of methanolic extracts of yucca elephantipes on Biochemical parameters in albino rats.

Figure 11 showed effect of methanolic extracts of yucca elephantipes on biochemical parameters in albino rats.

Discussion

This study was particularly aimed to evaluate anti-bacterial, anti-oxidant as well as toxicity activities of *yucca elephantipes*. Phytochemical analysis of plant indicates the presence of various constituents such as glycosides, saponins, alkaloids, proteins which are responsible for various activities.

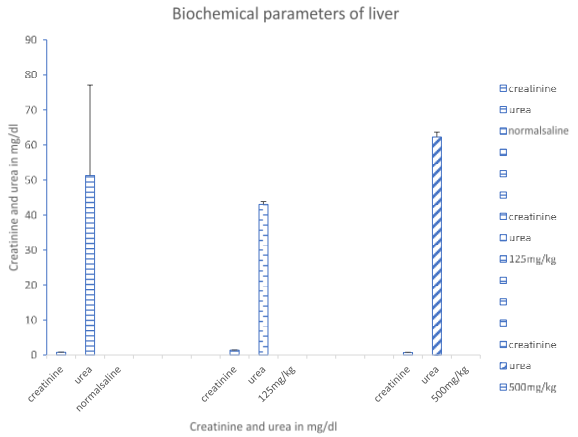

Figure 10: Effect of methanolic extracts of yucca elephantipes on Biochemical parameters in albino rats.

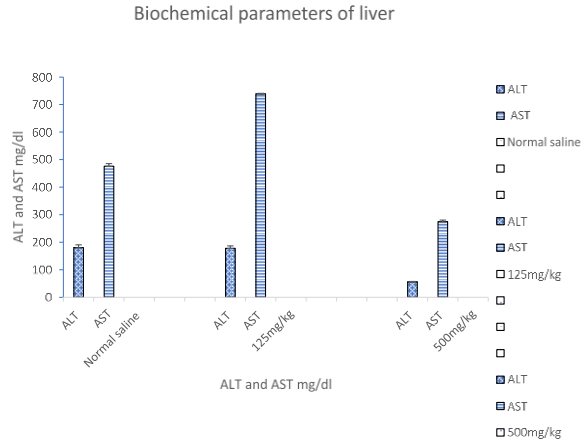

Figure 11: Effect of methanolic extracts of yucca elephantipes on biochemical parameters in albino rats.

Phenolic compounds are responsible for anti-inflammatory, antioxidant, anti-aging and cell proliferation activities. Flavonoids retain hydroxyl group. Flavonoids are produced when any microbial infection occurs in plants. These are active against microorganisms. The plant extracts also exhibited presence of saponins and alkaloids. Glycosides were also present in plant extract (Yadav and agarwala, 2011).

Yucca genus is comprised of around 40-45 different species. These originate often from Central America as well as North America. The basic purpose of their use is as ornamental plant. They are used as ornate plants. *Yucca elephantipes* is biggest among the other species and is also known as spineless yucca or giant yucca. Its height is approximately thirty feet. It has long leaves that may grow at length of around 4 feet. Their width is around 3 inches. These are evergreen and ornamental (Zhang *et al*., 2008).

Antibacterial activity: Results showed that the extracts of *yucca elephantipes* were active against both type of bacteria either it be gram negative such as *E. coli* or gram positive e.g. *S. aureus*.

In comparison to the previous study in which Rashid *et al*., (2014) demonstrated that Ethanolic extract of *Bauhinia vareigata* has antibacterial activity against gram positive bacteria (*S. aureus, Strep. pyogen*es) and gram negative (*E. coli* and *P. mirabilis*). Ethanolic extract of Bauhinia vareigata have high antibacterial activity and act on most of the bacterial strains as compared to standard antibiotic i.e. Ampicillin. Its zone of inhibition range from 21mm to 34mm. Results showed that ethanolic extract was most active against proteus mirabilis. It was previously reported that extract of sida rhombifolia (aqueous-methanol) was most active against bacterial strains. Their zone of inhibition against bacterial strains were ranging from 8.7-23.6mm were less as compared to standard antibiotic ampicillin.

It is evident from the results that *Yucca elephantipes* plant extracts showed extraordinary activity in case of *E. coli* rather than *S. aureus*. The activity of these extracts in case of *E. coli* is even better than the standard drug. Hence, we can conclude that extract are more active against gram negative type of bacteria.

Antioxidant activity

Total Phenolic Contents (TPC): Phenolic constituents of plant extract possess anti-oxidant activity. Phenols are the components that activate the enzymes which are liable for antioxidant activity. They also scavenge free radical, ease tocopherol radicals and also involved in the inhibition of oxidase enzymes, and participate to chelate the metal catalysts (Alia *et al*., 2003).

Total phenolic contents are very important for antioxidant activity as well as for biological activity of plant extracts. Due to this antioxidant property they are also used for the management of different infectious ailments. In this trial, *yucca elephantipes* plant extracts were found to have a highest total phenolic content (145.7-137.49 mgGAE/g) that was higher than n-hexane value (108.2). Results, showed that methanolic extracts *of yucca elephantipes* found to contain highest total phenolic contents.

Total flavonoid content (TFC): Total flavonoid contents possessed antioxidant activity and having some beneficial effects on the human's health. Through chelating and scavenging activity this flavonoid produces antioxidant activity (Kessler *et al*., 2003). In the present study, *yucca elephantipes* plant extract contain total flavonoid contents (71.67-99.94mgCE/g) that were higher than ethanolic extract of yucca elephantipes (43.98 mg CE/g). Results showed that n-hexane extract of yucca elephantipes contain highest level of flavonoid contents.

DPPH Scavenging Activity: The DPPH contain more potent antioxidant activity. DPPH radicals is stable organic radical and when a pair of electron is donated, it is converted into unstable diagrammatic molecule. At

517 nm DPPH solution gives absorption band. When an electron remove from purple color DPPH radical, its absorption is decreases and deep violet color solution of DPPH is converted to pale yellow. This indicates the antioxidant activity when absorption is decreased (Molyneux, 2004).

In the present study, *yucca elephantipes* plant extracts contained DPPH radical inhibition activity of ethanol and methanol extracts (67.43-87.36 %) that were higher than n-hexane extract (51.32). The results of this research were in accordance with early findings of Lee *et al*., (2003), who report that, the TPC, TFC values and percentage DPPH radical inhibition. Results showed that Methanolic extracts of *yucca elephantipes* contained highest DPPH activity which may be due to the presence of flavonoids and phenolic contents which are responsible for antioxidant activity.

Reducing power assay: Reducing power is used to evaluate antioxidant activity. They act as secondary and primary antioxidant and also electron donor, can ease the lipid peroxidation processes. Depending upon the reducing power, they convert yellow color of solution into blue and green color. Due to the presence of reducers, ferric cyanide converts to the ferrous form.

Potassium ferricyanide + Ferric chloride convert to Potassium ferricyanide +ferrous chloride.

Jayanthi *et al*., 2011 elaborate reducing power activity of ethyl acetate, acetone and petroleum ether extracts of *Eichhornia crassipes*. Petroleum ether exhibited higher reducing power activity. Results showed that n-hexane and ethanol (78.19-71.41) possessed highest reducing power assay as compared to methanol (71.41), that possessed lower reducing power assay.

Toxicities activity: In the trial conducted to evaluate acute toxicity, there were no signs of the toxicity. Even no mortality was observed in experimental animals after treatment with methanol leaf extracts of *yucca elephantipes* up to the dose of 125 mg/kg and 500 mg/kg. In this regard, methanol extract of *yucca elephantipes* were considered as non-toxic after the acute administration because the extracts were well abided and they didn't showed any adverse effects.

There were no changes in calculated BW and organ weights of experimental animals treated with the methanolic extracts of *yucca elephantipes* for 14 days, in comparison to that of the control. The increase in weight was normal. However, there was a significant increase in the calculated BW and no significant change in organ weights of experimental animals treated with the methanolic leaf extract of yucca elephantipes after 14 days, when compared to the control. This was evident in the increased values in percentage BW gained of experimental animals when compared to the control. Methanolic extract had a dose dependent increase on the BW but these adverse effects were not much strong to cause appetite loss in experimental animals. This signifies that the organ weights did not indicate any toxic or adverse effects from methanolic extracts of *yucca elephantipes*.

Analysis of full blood count carried out in experimental and control animals enabled us to understand the toxicity of these extracts on the hematopoietic system. Hematopoiesis is the process that is involved in the blood cells formation. Pluripotential stem cell is involved in derivation of all blood cells and they produce an immature cell that has the ability to convert into erythrocyte (RBC), leukocyte (WBC), or a thrombocyte (platelet). In this study, there was dose-dependent increase in all hematological parameters in experimental animals administered methanolic extract of yucca elephantipes after 14 days when compared to the control. The hematopoietic system was stimulated by this extract, leading to the decreased the production of WBC, RBC, platelets and HGB at dose of 250mg/kg. While when dose increased at500mg/kg were increased their parameters. The function of the WBC is to protect the body from infection by foreign organisms, while the RBC boosts the immune system by providing nourishment and oxygen and the PLT protect blood vessels from endothelial damage as well as initiate repair of these vessels during trauma. These observations are indicative of a strong immuno-stimulatory, antioxidant and endothelial protection activity of yucca elephantipes plant extracts. The increased and/or normal values of these parameters in experimental animals, are a validation of the immune stimulation by these leaf extracts. However, the dose-dependent decrease observed in PLT after the methanolic extract administration, which is supposed to indicate a breakdown in the endothelial protection or repair system, might be due to trauma.

Conclusion: Plants extract are substitute remedies for management of many infectious ailments due to their welfare, efficacy and low cost. There is increase in depletion of plant extracts. In Past, people used plants, in different ways, for the treatment and prevention of disease. After several steps of isolation, purification and relative safety profile. This led to synthetic drug development. In pharmaceutical research, natural products play an important because most of them present naturally or derived synthetically. Those medicines are obtained from plants on which different pharmacological and chemical studied are performed.

The present study was piloted to scrutinize the antibacterial, antioxidant and subacute toxicity of yucca elephantipes. To extract *yucca elephantipes* three solvents were used included Ethanol, Methanol and n-hexane. To evaluate antioxidant activity, TPC, DPPH radical scavenging activity, total flavonoid contents, reducing power assay were evaluated. Aluminum chloride colorimetric method was used to evaluate TFC

spectrophotometrically and results were expressed as catechin equivalent. Folin-ciocalteu method was used to evaluate TPC and results were represented as gallic acid equivalent. Disc diffusion method was used to evaluate antibacterial activity of ethanol, methanol and n-hexane extract of *yucca elephantipes* against gram negative and gram positive bacteria. Ampicillin was used as standard antibiotic.

Highest TPC were found in methanolic extract. Highest TFC and reducing power activity were found in N-hexane. Highest DPPH activity were found in ethanolic extract. All the extracts of *yucca elephantipes* showed antibacterial activity against all bacterial strains. It is evident from results that plant extracts showed excellent antibacterial activity against *E. coli* than *S. aureus.* The activity against *E. coli* was even more than standard drug. Hence, we can conclude that extracts have less activity against gram positive bacteria and more against gram negative bacteria.

Methanolic extract of *yucca elephantipes* at different doses caused no toxic effect in albino rats. At low dose, methanolic extract decreased WBCs, RBCs, PLT, HGB values but when high dose of methanolic extract was administered to albino rats, their WBCs, RBCs, PLT and HGB values were in the normal range. The results showed that all extracts of *yucca elephantipes* contained significant antioxidant and antibacterial activity and thus could be used as a substitute of synthetic antibacterial and antioxidant agents.

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