International Journal of Innovation Sciences and Research
Vol.5, No, 06, pp. 778-785, June- 2016

Available online at
http://www.ijisr.com

RESEARCH ARTICLE

PHYTOCHEMICAL SCREENING, ANTIOXIDANT AND ANTIMICROBIAL ACTIVITY OF *MORINGA OLEIFERA* LEAF EXTRACT

[1,*]Rabiu Sani Shawai and [2]Rita Singh

[1]Student of M. Tech Biotechnology, Department of Biotechnology, Sharda University, Greater Noida Uttar Pradesh
[2]Professor Department of Biotechnology, Sharda University, Greater Noida Uttar Pradesh

Accepted 20th May, 2016; Published Online 30th June, 2016

ABSTRACT

Moringa oleifera commonly known as Moringa is an exceptionally nutritious vegetable tree with a variety of potentially medicinal importance, it is even termed as Miracle tree due to the various applications it posses. This present study was designed to investigate the antimicrobial and antioxidant activity of *Moringa oleifera* leaf extract dissolve in different solvents (Aqueous, Hydroethanolic and Hydromethanolic) at different concentrations, and also to analyze the presence of Phytochemicals. The phytochemical screening indicates the presence of Alkaloids, Terpenoids, Cardiac glycoside, Flavanoid, Phenol, and Tannins among others. The leaf extract shows a broad spectrum of antibacterial and antifungal activity on potentially phathogenic microorganism including *Escherichia coli, Staphylococcus aureus, Klebciella species and Candida albican* at different concentrations of extract. Maximum zone of inhibition was found to be 13.30 mm and 9.00 mm and the minimum zone of inhibition was found to be 7.60 mm and 8.60 mm in both bacterial and fungal strains respectively. Hydroethanolic extract was found to have the maximum zone of inhibition of 13.30 mm at concentration of 1000 µg/ml in *Escherichia coli* and minimum zone of inhibition to be 7.6 mm in *Escherichia coli* at concentration of 750 µg/ml. Also the plant shows antioxidant activity with decrease in DPPH concentration due to scavenging activity of MO extract. The scavenging effect of MO extracts on DPPH was found to be 63.12% at 1000 µg/ml compare with the standard BHA 86.9%. In H_2O_2 the highest % inhibition of MO was found to be 74% compared with standard BHA 91% thus this shows that MO leaf extract have hydrogen scavenging activity and also reducing power capacity was observed with increase in concentration and absorbance.

Key Words: Antioxidant, Antimicrobial, Phytochemical, Reducing Power, Hydroethanolic, Hydromethanolic, Aqueous, Alkaloids, Flavanoids.

INTRODUCTION

Plants are known to exist thousand years ago and have been an integral part of traditional and indigenous medical systems across the globe since ancient times. Medicinal plants have their values in the substances present in various plants tissue with their specific physiological actions in human body (Tamanna Telreje, 2011). A large proportion of the drugs used in modern medicine are either directly isolated from plants or synthetically modified from a lead compound of natural source. Medicinal plants have been known to exist since centuries but their importance as a source of vital drugs remains unknown until the establishment of human civilizations (Ababutain, 2011) which was followed by the ancient medical literature such as the *Ebers Papyrus* of ancient Egyptician, *Sushruta samhita* and *Rig Veda* in Ayurveda, *Pen Tsao* of the Chinese and Diascoride's *De Materia Medica* (Snehadri Sinha *et al*., 2013). Thus, Plant products or Natural substances of plant origin play an important role in drug development program of pharmaceutical industries (Ijeh Ifeoma *et al*., 2011).

Corresponding author: Rabiu Sani Shawai
Student of M. Tech Biotechnology, Department of Biotechnology, Sharda University, Greater Noida Uttar Pradesh, India.

Also the consumption of these plant products has brought about rapid development and improvement of health to Man, as well as animal, therefore these plants or its products are being used throughout the world for human and animal health care. Over 80% of the world's populations use plants as their primary source of medication. *Moringa oleifera* is a small tree usually 10m height and it is a native to India and also grows in tropical and subtropical regions , including Africa, Arabia, South Asia, South America, Himalaya region, Pakistan, the pacific and Caribbean Islands and widely cultivated and naturalized in tropical Africa, Malaysia, Philippine, Islandas, Mexico, Malabar and Srilanka. (Masurekar *et al*., 2014). It is an exceptionally nutritious vegetable tree with a variety of potential uses. *Moringa oleifera* commonly referred as Moringa and it belongs to the family Moringaceae with fourteen known species of these (Morton, 1991) *M.oleifera* is the most widely known and utilized species. It was commonly referred to as the "drumstick tree" or the "horseradish tree", to others it is known as the kelor tree. *Moringa* is derives from the Tamil word, "*Murungai"* or "*Malayalam*" or "*Murinna*" (Roloff *et al*., 2009). In Tamil Nadu, Moringa is known as "Murungakkai" Numerous other common names for Moringa exist in different languages worldwide. it is also called "*Zogale"* in Hausa language of Nigeria, "*Sainjna"* or "*Seguna*"

in Hindi, "*La ken"* in Chinese, "*Angela*" in Spanish, "*Moringueiro*" in Portuguese. *Moringa oleifera* is widely used traditionally for medicinal and nutritional purposes against various disease conditions in India and in most African countries particularly Nigeria (Furo and Ambali, 2013). They have been used virtually for all cultures and tribe for treatments of diseases due to their effectiveness, low cost and minimal site effect associated with the drugs derived from them. Plants have the ability to synthesize a widevarieties of chemical compounds which can be used to perform an important biological functions, and to use them as a defense against attack from predators such as insects, fungi and herbivorous mammals for them to survive (Trapti Rastogi, 2009)

MATERIALS AND METHODS

Collection and identification of plant Materials

Fresh leaves of *Moringa oleifera* were collected from Tugalphur market, Greater Noida Area, India and were identified by Indian Agricultural Research Institute (IAIR), PUSA New Delhi, India.

The leaves were then destalked, washed several time with tap water and once with sterile distilled water and dried in a shade at room temperature (20-25)^{o}C with constant turning to prevent fungal growth. An electric blender were used to crushed the dried leaves into powder and then stored at 4°C temperature in refrigerator in a well labeled airtight container for analysis.

Solvent Preparation

Methanolic and Ehanolic solvent were prepared in a ratio of thirty is to seventy (30:70) as a working solution (i.e 30% of distilled water and 70% of the Ethanol or Methanol) respectively to become hydro-ethanolic and hydro-methanolic. From these a working solutions with ratio of twenty is to eighty (20:80) were also prepared as extract solution which is to be used for extraction.

Plant Extract Preparation

50 gm of dried powdered leaves of *Moringa oleifera* were soaked in three different beakers labeled A, B and C containing 500 ml of aqueous solution, Hydro-Methanolic and Hydro-Ethanolic solvents respectively.

Quantitative Analysis of the Phytochemical Compounds Present In Leaf Extract of *Moringa Oleifera*

s/n	Phytochemical	Type of test	Concentration of extract and chemicals	Result and colour
1	Alkaloids	Wagner's test	10ml of extract + few drops of Wagner's reagent	Reddish brown precipitate
2.	Ascorbic acid		5ml of extract+2ml of H_2O+ $NaHCO_3$ +$FeSO_4$ and shake well+ 5ml dil H_2SO_4	Deep violet colour
3.	Carbohydrate	Molisch's Test Iodine test	3ml of E+ 2ml Molisch reagent and shake +2ml Conc. H_2SO_4 3ml of extract + 1ml of iodine	Violet ring at interphase. Purple colour at interphase
4.	Flavanoids	Lead acetate test Shinoda test	1ml of E + 1ml of 10% $Pb(C_2H_3O_2)_2$. 10ml of Extract + Pinch of Magnesium + 1-2 drop of Conc HCl	Yellow precipitate Pink colour
5.	Glycoside	Salkowski's test Keller-Kiliani test	2ml of Extract + 2ml CCl_4 + 2ml H_2SO_4 2ml of extract + 2ml C_2H4O_2 + drop of $FeCl_3$ + 1ml Conc. H_2SO_4	Reddish brown Brown ring at the interphase

Continue....................

6.	Phenols	Ferric chloride test	Extract diluted with 5ml dist. H_2O + drops of neutral 5% $FeCl_3$	Dark green colour
7.	Protein	Biuret test	5ml extract + equal volume 40% NaOH + two drops of 1% $CuSO_4$	Violet colour
8.	Saponins	Form test Honey comb test	0.5mg extract + 10ml dist. H_2O shake for 15min. 0.5mg + 5% $NaHCO_3$ shake and wait for 3min	Formation of form to 1cm length. Formation of honey comb
9.	Steroids	Salkowski's test	5mg of extract + 2ml of CCl_4 + equal volume of H_2SO_4	Upper layer turns red and lower turns yellow with green fluorescence
10.	Tannins	Ferric chloride test	0.5mg of powdered extract + boiled in 20ml of dist. H_2O and then Filtered. Add 0.1% $FeCl_3$	Brownish green or blue black colour
11.	Terpenoids	Salkowski's test	5ml of extract + 2ml of CCl_4 + Conc H_2SO_4	Reddish brown colour at the interphase

Table 3.2: Qualitative phytochemical analysis of *Moringa* leaf Extract

Phyto-chemical constituent	Solvents		
	Aqueous	Hydroethanolic	Hydromethanolic
Alkaloids	_	+	+
Ascorbic acid	++	++	++
Carbohydrate	++	++	++
Cardiac Glycoside	+	++	+++
Flavanoids	++	++	++
Phenols	+++	++	+
Protein and amino acid	+	+	+
Saponin	+++	+	+
Steroid	+	++	++
Tannins	++	+	++
Terpenoids	+	+	+

Table 3.3 shows Effect of Aqueous, Hydroethanolic and Hydromethanolic leaf Extract of Moringa oleifera on *Escherichia coli*

Concentration (µg/disc)	Zone of inhibition (mm) Mean ± SE		*Escherichia coli*	
	AQ	HM	HE	AMX
250	09.00 ± 0.57	12.00 ± 0.99	11.60 ± 0.88	30.33 ± 0.88
500	08.30 ± 0.33	11.30 ± 0.33	12.00 ± 0.57	30.00 ± 0.57
750	09.00 ± 0.57	11.60 ± 0.88	10.00 ± 0.88	28.60 ± 0.88
1000	08.60 ± 0.33	12.30 ± 1.20	13.30 ± 0.57	30.00 ± 0.57

Table 3.4 shows Effect of Aqueous, Hydroethanolic and Hydromethanolic leaf Extract of Moringa oleifera on *Klebsiella pneumonia*

Concentration (µg/disc)	Zone of inhibition (mm) Mean ± SE		*Klebsiella pneumonia*	
	AQ	HM	HE	AMX
250	09.00 ± 0.47	09.60 ± 0.27	09.00 ± 0.47	18.00 ± 0.47
500	09.00 ± 1.24	08.60 ± 0.72	09.00 ± 0.47	18.00 ± 0.47
750	09.30 ± 0.54	08.00 ± 0.00	09.30 ± 0.27	18.00 ± 0.81
1000	09.60 ± 0.27	08.30 ± 0.54	09.00 ± 0.47	15.33 ± 0.72

Table 3.5 shows Effect of Aqueous, Hydroethanolic and Hydromethanolic leaf Extract of Moringa oleifera on *Staphylococcus aureus*

Concentration (µg/disc)		Zone of inhibition (mm) Mean ± SE	*Staphylococcus aureus*	
	AQ	HM	HE	AMP
250	11.60 ± 0.94	08.00 ±0.94	09.00 ± 0.81	27.6 ± 0.72
500	09.60 ± 0.35	07.60 ± 0.54	08.30 ± 0.54	27.6 ± 0.20
750	10.30 ± 0.71	08.00 ± 1.24	07.60 ± 0.27	28.00 ± 0.47
1000	09.60 ± 0.35	08.00 ± 0.94	08.00 ± 0.94	27.00 ± 0.94

Table 3.6 Effect of Aqueous, Hydroethanolic and Hydromethanolic leaf Extract of *Moringa oleifera* on *Candida albican*

Concentration (µg/disc)		Zone of inhibition (mm) Mean ± SE	*Candida albican*	
	AQ	HM	HE	AMC
250	08.60 ± 0.72	-	-	28.00 ± 0.47
500	09.3 0 ± 0.27	-	-	27.00 ± 0.81
750	09.30 ± 0.54	-	-	26.30 ± 0.72
1000	09.00 ± 0.27	-	-	27.00 ± 0.47

Table 3.7 show % Scavenging activities of *Moringa oleifera* Extract on different concentration against BHA standard

Conc. (µg/ml) MO	Anti-oxidant Activity (DPPH) %			
	BHA (Control)	Aqueous extract	HM	HE
100	64.48 ± 2.39	30.09 ± 5.26	31.78 ± 10.88	36.33 ± 4.98
200	69.78 ± 6.81	36.46 ± 4.62	38.18 ± 44.35	42.33 ± 3.98
400	78.31 ± 3.67	38.71 ± 2.63	46.07 ± 23.47	45.22 ± 1.81
600	80.52 ± 2.46	40.54 ± 3.77	48.13 ± 10.75	51.44 ± 1.29
800	81.19 ± 6.21	41.24 ± 0.98	53.79 ± 6.645	58.83 ± 3.90
1000	86.94 ± 3.42	52.32 ± 0.49	60.80 ± 1.229	63.12 ± 1.44

Table 3.8 Shows the % scavenging acitivities of concentrations of *Moringa oleifera* leaf extract against the standard BHA

Conc. (µg/ml) MO	Anti-oxidant Activity (H_2O_2) %			
	BHA (Control)	AQ	HE	HM
100	76.84 ± 2.91	40.19 ± 5.26	36.78 ± 10.88	34.37 ± 3.98
200	78.78 ± 8.01	46.46 ± 4.62	38.18 ± 44.35	39.33 ± 2.90
400	82.31 ± 4.67	48.11 ± 3.63	46.07 ± 23.47	40.22 ± 1.82
600	86.20 ± 3.46	50.44 ± 4.77	48.13 ± 10.75	51.14 ± 2.39
800	88.13 ± 4.21	51.24 ± 2.98	53.79 ± 6.645	68.30 ± 4.90
1000	91.84 ± 4.42	64.32 ± 1.49	60.80 ± 1.229	74.02 ± 2.45

Table 3.9 shows absorbance of MO extract and standard TC at different Concentration result as mean absorbance ± SD

Conc. (µg/ml) Moringa extracts	Reducing power expressed in absorbance			
	TC	AQ	HM	HE
100	0.12 ± 0.39	0.27 ± 0.26	0.16 ± 0.18	0.16 ± 0.68
200	0.15 ± 0.81	0.29 ± 0.62	0.18 ± 0.32	0.19 ± 0.98
400	0.27± 0.67	0.32 ± 0.63	0.20 ± 0.47	0.21 ± 0.81
600	0.44 ± 0.46	0.34 ± 0.77	0.22 ± 0.75	0.27± 0.26
800	0.63 ± 0.21	0.43 ± 0.97	0.25 ± 0.64	0.33 ± 0.38
1000	0.79 ± 0.42	0.48 ± 0.39	0.31 ± 0.22	0.38 ± 0.54

These samples were then heated in a hot plate for two hours in order to accumulate the secondary metabolite. Afterward the solutions were transferred into an orbital shaker for 48 hrs at room temperature. Then the extracts were then filtered using Watmann No.1 filter paper to remove the residue and the filtrate and then dried at 50°C in an oven for three days. The dried extracts were then stored at 4°C in three different sterile containers.

Phytochemical Analysis

Phytochemical analysis was carried out qualitatively and quantitatively using different standard methods in order to

Fig. 1. Shows zone of inhibition in Staphyllococcus sp

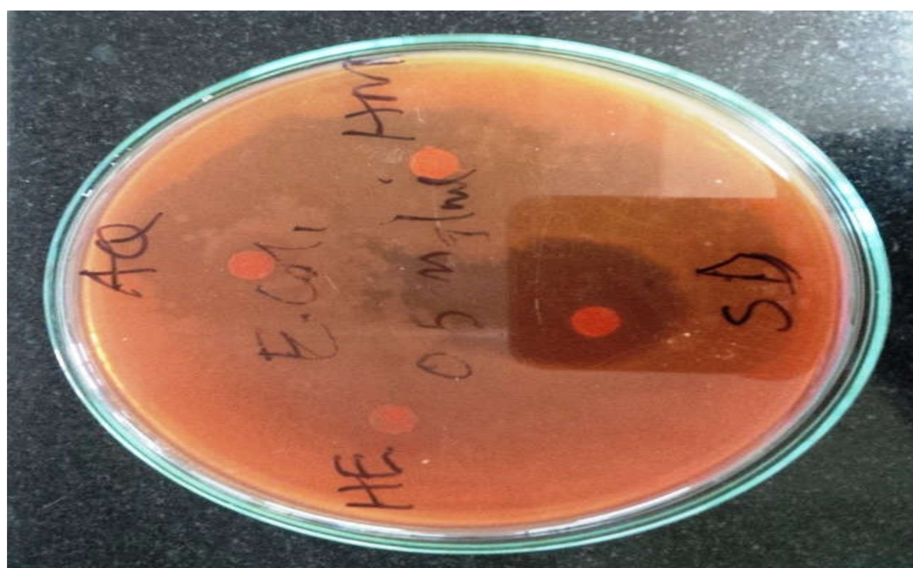

Fig. 2. Shows zone of inhibition in E. coli

determine presence or absence of primary and secondary metabolites in the Plant extract of Moringa leaves such as protein, carbohydrate, fats, ascorbic acid, terpenoids, cardiac glycoside, flavanoids, phenols, alkaloids, tannins, Saponins and steroids using Standard procedures described by (Edeoga *et al*., 2005; Geetha and Geetha, 2014) Sofowora (1993), Trease and Evans (1989) and Harborne (1973)

Determination of Antioxidant activities and Estimation of Phytochemical Compounds Present in Leaf Extract of Moringa Oleifera

Scavenging of Hydrogen Peroxide

A solution of hydrogen peroxide (40mM) were prepared in phosphate buffer (pH 7.4) and different concentrations were made by serial dilution to 1ml (100, 200, 400, 600, 800, 1000 µg/ml) of each of the extracts of Moringa leaves and (0.6 ml, 40 mM)of hydrogen peroxide solution were added to it. Absorbance of hydrogen peroxide at 230 nm was determined after 10 min. against a blank solution containing phosphate buffer without hydrogen peroxide. The percentage scavenging of hydrogen peroxide of each of the three extracts of Moringa and standard compounds were calculated using the following formula:

$$\% \text{ scavenged } (H_2O_2) = ((A_0 - A_1)/A_0) \times 100.$$

Where A_0 is the absorbance of the control, and A_1 is the absorbance in the presence of each of the three samples of Moringa and standards (Kumar *et al.,* 2007).

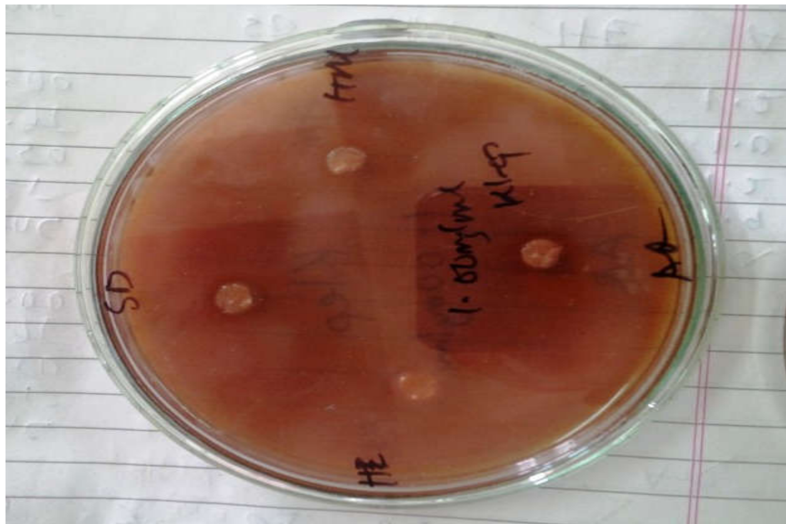

Fig. 3. shows zone of inhibition in Klepciella sp

Fig. 4. Shows zone of inhibition in Candida sp

Determination of DPPH Radical Scavenging activity

In this assay, 1 mL of varying concentrations (100, 200,400, 600, 800 and 1000 µg/ml) of each of the three extracts was mixed with 1 mL of methanolic solution of DPPH (0.2 mM). The mixture will be vortexed and incubated for 30 min. The optical densities of the solutions will be measured at 517 nm using Hitachi 2050 spectrophotometer, using BHA as the standard reference.

$$\text{Radical scavenging activity (\%)} = \frac{\text{Control Abs} - \text{Sample Abs x 100}}{\text{Control Abs}}$$

Determination of Reducing Power Assay

The reducing power of each of the three extracts of clove was determined as reported method by Oyaizu, (1986). Different concentrations of each of the three extracts ((100, 200, 400, 600, 800, 1000) µg/ml) in 1ml of methanol were mixed with phosphate buffer (2.5 ml, 0.2 M, pH 6.6) and potassium ferrocyanide (2.5 ml, 1%). The mixture was incubated at 50^0c for 20 min.

A portion (2.5 ml) of trichloroacetic acid (10%) was added to the mixture, which was then centrifuged at 3000 rpm for 10 min. The upper layer of the solution (2.5 ml) was also be mixed with distilled water (2.5 ml) and $FeCl_3$ (0.5 ml, 0.1%) and the absorbance was measured at 700 nm and compared with standards. Increased absorbance of the reaction mixture indicates increased reducing power.

Determination of Antimicrobial Activities

Source of Microorganism

The organism used where *Staphylococcus aureus, Escherichia coli and Klebsiella pneumonia* which are gram +ve and gram –ve bacterial strains respectively and *Candida albican* as a fungal strains. These microbes were obtained from Department of Microbiology Sharda Hospital, Greater Noida India.

Screening of Antibacterial and Antifungal Activities

The antimicrobial activities of *Moringa oleifera* leaves extract was determined using disc diffusion method following known

procedure. A disc of about 6mm in diameter where made from whatman's filter paper using a paper puncher and are transfer into a bijour bottle and sterilized in the oven at 121°C for 15min. Nutrient and MacConky agar were prepared using standard microbiological procedure and carefully poured in to sterile Petri dishes and are allowed to solidified. Later the plates were then streaked with 500µl of the clinical isolate (test organism) and negative controls were also run parallel in the same plate. The plates were incubated at 37°C for 18 hours for bacterial activity and 25°C for 48hours for fungal activity. The antibacterial and antifungal activities were assessed by measuring the diameter of the zone of inhibition and antimicrobial potential of the different extracts was evaluated by comparing their zones of inhibition.

Determination of Minimum Inhibitory Concentration (MIC)

The plant extracts that were found effective at minimum concentration, as antimicrobial agent, were later tested to determine the MIC values for each strain .The minimum inhibitory concentration for bacterial isolates was carried out using tube dilution technique as described by Akinyemi *et al*. 2005(17). MIC was determined using broth dilution method. The extracts were diluted to give the final concentrations and the tubes were incubated aerobically at 37 °C for 24-48 h. Three control tubes were maintained for each strain (media control, organism control and extract control). The lowest concentration (highest dilution) of the extract that produced no visible growth (no turbidity) in the first 24 h when compared with the control tubes was considered as initial MIC. The dilutions that showed no turbidity were incubated further for 24 h at 37 °C. The lowest concentration that produced no visible turbidity after a total incubation period of 48 h was regarded as final MIC.

RESULTS AND DISCUSSION

DISCUSSION

The present study reveal that *Moringa oleifera* leaves shows the presence of various phytochemical constituents such as phenols, alkaloids, saponins, ascorbic acid, tannins, terpenoids, flavanoids, steroids and cardiac glycosides in different solvent extract shown in table 3.2, alkaloids were observed in hydroethanolic (HE) and hydromethanolic (HM) leaf extract and were found absent in the aqueous leaf extract. Also phenol and saponin were found to have high concentration in aqueous leaf extract and a low concentration in both methanolic and ethanolic leaf extract. terpenoid, tannins , steroids, ascorbic acid, flavanoids, cardiac glycoside, protein and carbohydrate were all found in both solvent extract (AQ, HE and HM leaf extract). Alkaloids are naturally occurring chemical compounds containing basic nitrogen atoms. They often have pharmacological effects and are used as medications and recreational drugs (Patel *et.al* 2014). Flavonoids enhance the effects of Vitamin C and function as antioxidants. They are also known to be biologically active against liver toxins, tumors, viruses and other microbes (Patel *et.al* 2014)).Plant terpenoids are used extensively for their aromatic qualities. They play role traditional herbal medicines and are under investigation for Antibacterial, Antineoplastic and other Pharmaceutical fun Tannins have shown potential Antiviral, Antibacterial and Antiparasitic effects. Saponins cause hemolysis of red blood Cells (Patel *et.al* 2014). The antifungal activity was screened because of their great medicinal properties towards the pathogenic organisms. Also In the present investigation of antimicrobial and antifungal activity of the leaf extract of *MO* was assayed against four potentially pathogenic microorganisms *Staphylococcus aureus, Escherichia coli, and Klebsiella species* while antifungal activity against one pathogenic fungi *Candida albican* at different concentrations of the extract to understand the most effective activity. The leaf of MO extract shows a broad spectrum antibacterial activity shown in table 3.3, 3.4, 3.5 and 3.6 with the zone of inhibition ranging from 07.60 ± 0.54 - 13.30 ± 0.57 (mm) and antifungal activity 08.60 ± 0.72-09.00 ± 0.27 (mm).

For hydromethanolic extract the maximum zone of inhibition was found to be 12.30 ± 01.20 in *Escherichia coli* at concentration of 1000 µg/disc and minimum concentration of 07.60 ± 0.54 in *Staphylococcus species* at concentration of 500 µg/disc. for hydroethanolic extract the maximum zone of inhibition was found to be 13.30 ± 0.57 in *Escherichia coli* at a concentration of 1000 µg/disc and minimum zone of inhibition of 07.60 ± 0.27 at concentration of 750 µg/disc in *Staphylococcus species,* while in aqueous extract 09.60 ± 0.27 was found to be the maximum zone of inhibition at concentration of 500 µg/disc and 1000 µg/disc, while the minimum zone of inhibition was found to be 08.60 ± 0.72 at concentration of 250 µg/disc in *Candida species*. All tested microorganism exhibited good sensitivity against all extract concentration with the exception of *Candida albican* in HE and HM extract which shows no activity. The MIC was found to be at concentration of 250 µg/disc.

DPPH is one of the most widely method used for scavenging antioxidant activity of plant. It is stable nitrogen centered free radicals which produce violet color in ethanol. The effect of DPPH on antioxidant is thought to be on hydrogen donating ability which involves the reaction of specific antioxidant with stable free radical 2, 2-diphynyl-picrohydrazyl DPPH as a result there is reduction of DPPH concentration by antioxidant. Table 3.7 show that there is significant decrease in DPPH concentration due to scavenging activity of MO extract The scavenging effect of MO extracts on DPPH was found to be 63.12% at 1000 µl compare with the standard BHA 86.9%, thus the extract shows scavenging activity of free radical which transformed Fe^3 to $Fe^{2.}$ Highest scavenging DPPH activity was found in HE with 63%, then HM with 60% and AQ with 52% compared with standard 86%. This correspond with the work of (Kumar et.al 2007) Also the reducing capacity of a compound may serve as a significant indicators for its potential activities and the highest reductive capacity of MO extract where found to be 0.48 ± SD compared with the standard 0.79 ± SD and AQ has the highest value of 0.48 followed by HE 0.38 and HM 0.31 when compared with standard 0.79 ± SD thus, it shows that there is reducing power capacity with increase in concentration and absorbance. Hydrogen peroxide is sometime not very reactive but could be toxic to the cell because it may give rise to hydroxyl radical in the cell thus removing

hydrogen peroxide is important for food system protection. The highest % inhibition of MO was found to be 74% compared with standard BHA 91% thus this shows that MO leaf extract have hydrogen scavenging activity. Among the three extract HM was found to have high % scavenging hydrogen peroxide of 74% followed by AQ with 64% and HM 60% compared with the standard BHA 91%.

Conclusion

These findings suggest a new pathway in elucidating a potent antimicrobial agent from *Moringa oleifera* leaf. This Present study indicates that MO contains antimicrobial compound that can be further developed as phytomedicine for the therapy of infection. The extracts were found to inhibit the growth of Gram-positive bacteria as well as the Gram-negative bacteria and the fungal species. Thus MO can be used to treat common medical conditions. Also MO has significant antioxidant activity may be due to certain compound found in it such as phenols thus the plant is suggested for the treatment of various human alignment such as liver disorders, diabetes, cancers since they have the ability to reduce Fe^3 to Fe^2.

Acknowledgement

With honor and gratitude my sincere appreciation goes to my parents Alh. Sani Shawai and Bilkisu Rabiu and Kano State government who devotes much of their time and support me with Money and other necessary contribution that helps me towards achieving this goal. My sincere appreciation goes to my Supervisor Dr.Rita Singh who assists and contributes a lot during the Research. I will also like to show my gratitude to my lecturers Dr. Ritu Paliwal and Mrs. Monica Shukla who contribute toward achieving this goal.

REFERENCES

Ababutain, I. M. 2011. Antimicrobial activity of ethanolic extracts from some medicinal plant. *Aust J Basic & Appl Sci*, *5*, 678-683.

Akinyemi, K. O., Mendie, U. E., Smith, S. T., Oyefolu, A. O., and Coker, A. O. 2005. Screening of some medicinal plants used in south-west Nigerian traditional medicine for anti-salmonella typhi activity. *Journal of herbal pharmacotherapy*, *5*(1), 45-60.

Edeoga, H. O., Okwu, D. E. and Mbaebie, B. O. 2005. Phytochemical constituents of some Nigerian medicinal plants. *African journal of biotechnology*, *4*(7), 685-688.

Furo, N. A. and Ambali, A. G. 2013. An investigation into the phytochemical constituents of Moringa oleifera aqueous root extracts. *Centrepoint Journal (Science Edition)*, *18*(1).

Geetha, T. S. and Geetha, N. 2014. Phytochemical Screening, Quantitative Analysis of Primary and Secondary Metabolites of Cymbopogan citratus (DC) stapf. leaves from Kodaikanal hills, Tamilnadu

Harborne, J.B. 1973. *Phytochemical methods*, London. Chapman and Hall, Ltd. pp. 49-188.

Ijeh Ifeoma I. and Chukwunonso E. Ejike 2011. Current perspectives on the Medicinal potential o*f Vernonia amygdalina. Journal of medicinal Plants and research vol 5(7) pp 1051-1061*

Kumar, S. Kumar, D., Singh, N. and Vasisht, B. D. 2007. In vitro, free radicals scavenging and antioxidant activity of Moringa Oleifera pods. *Journal of Herb Med Toxicol*, *1*(2), 17-22.

Masurekar, T. S., Kadam, V. and Jadhav, V. 2014. Roles of Moringa oleifera in Medicine-a Review Morton JF. The horseradish tree, *Moringa pterygosperma* (Moringaceae), A boon to arid lands. Econ Bo 1991; 45:318–333.

Patel, P., Patel, N., Patel, D., Desai, S. and Meshram, D. 2014. Phytochemical Analysis and Antifungal Activity of Moringa oleifera. *International Journal of Pharmacy & Pharmaceutical Sciences*, *6*(5).

Roloff, A., Weisgerber, H., Lang, U. and Stimm, B. 2009. Moringa oleifera LAM., 1785. *Sea*, *10*, 10.

Snehadri Sinha, Aishwarye Sharma; Hemalatha Reddy; Brijesh Rathi; NVSRK Prasad and Amit Vashishtha 2013. Evaluation of Phytochemicals and pharmacological aspect of *Holarrhena antidysenterica* (wall) A comparative review. *Journal of pharmacy research, 488-492*.

Sofowara A (1993). Medicinal plants and Traditional medicine in Africa. Spectrum Books Ltd, Ibadan, Nigeria. p. 289.

Tamanna Telreje 2011. Biochemical estimation of three primary metabolite from medicinally important plant *Moringa oleifera International journal of pharmacy and science review and research Vol 71-033*

Trapti Rastogi. Comparative Studies on Anthelmintic Activty of Moringa Oleifera and Vitex Negundo. *Asian J. Research Chem. 2009; vol. 2(2).*

Trease, G.E. and Evans, W.C. 1989. Pharmacognosy.11th edition. Brailliar Tiridel Can. Macmillian publishers.

****