JEBAT, 2023, Vol 6, No 1, 44-48
https://doi.org/10.54987/jebat.v6i1.814

HIBISCUS PUBLISHER

JOURNAL OF ENVIRONMENTAL BIOREMEDIATION AND TOXICOLOGY

Website: http://journal.hibiscuspublisher.com/index.php/JEBAT/index

JEBAT VOL 6 NO 1 2023
SEM of *Theobroma cacao*

Phytochemical Screening and Antiproliferative Potential of Some Medicinal Plants in Northeastern Nigeria

Jalil Idi James[1]*, Khalid Ibrahim Madugu[1], Furaira Isa Sulaiman[1], Nabila Yusuf Yarima[1], Abubakar Ahmad[1], Abubakar Usman Abare[1], Abubakar Abdullahi[1] and Salihu Abdussalam[1]

[1]Biochemistry Department, Faculty of Science, Gombe State University, P.M.B 127, Tudun Wada, Gombe, Nigeria.

*Corresponding author:
Jalil Idi James,
Biochemistry Department,
Faculty of Science,
Gombe State University, P.M.B 127,
Tudun Wada,
Gombe,
Nigeria.
Email: jahleel.james@gsu.edu.ng

HISTORY

Received: 8th May 2023
Received in revised form: 23rd June 2023
Accepted: 25th July 2023

KEYWORDS

Antiproliferative
Phytoconstituents
Sorghum bicolor seed
Inhibition
Anticancer

ABSTRACT

The use of medicinal plants for the therapy of different disease conditions has been in practice for decades, this has been attributed to the various phytoconstituents present in plants. This study seeks to investigate the presence of secondary metabolites and assess the growth inhibitory properties of the plant extracts *Curcuma longa*, *Momordica balsamia*, *Prosopis africana*, *Zizipus mauritianai, Boswellia dalziel*, *Guiera senegalensis* and *Diospyros mespiliformis*. The method used to assess the growth inhibitory potential of the extracts involved the incubation of viable *Sorghum bicolor* seed in different concentrations of the extracts and water as a control. The seeds radicle lengths were measured at different time intervals to ascertain the antiproliferative activity of the extracts. The results showed the presence of alkaloids, coumarins, flavonoids, phenolics, steroids, terpenoids, tannins, saponins, quinone, anthraquinone and glycosides. The antiproliferative potential of the plants was evident by the concentration-dependent decrease in the growth of the seeds in the different extracts. This suggests that when explored further; extracts from the different plants might be used as potential antitumor and anticancer agents.

INTRODUCTION

Medicinal plants were the original source of the discovery of a number of primary chemicals that were later included in the production of synthetic and semi-synthetic substances [1]. People have been using the medicinal qualities of plants as a therapy for illness ever since the beginning of human civilisation. The study of plants as a possible resource for improving human health has been conducted by a large number of scientists, and the results of these studies have led to the identification of distinctive characteristics present in each species [2].

As a result of the growing interest among many people in natural treatments and alternative healthcare practices that do not include the use of synthetic chemicals, the consumption of medicinal herbs has experienced a surge in popularity in recent years. It is possible that natural sources were the starting point for 61 percent of all newly discovered small-molecule medicines. Pharmaceuticals generated from plants are widely considered to be safer and more biochemically sound for human use [2], notwithstanding the success of combinatorial chemistry in developing a wide variety of synthetic drugs.

A crop with shallow roots and a vascular plant, turmeric is a member of the family Zingiberaceae and the genus Curcuma. It has thick and fleshy rhizomes and belongs to the genus Curcuma. The curcuma longa variety known as turmeric linn produces the most fruit and has the highest market value. It has been determined that it originated in South and Southeast Asia [4]. In addition to being used as a spice and being the primary component of curry powder, turmeric also has a place in the cosmetics sector and imparts a distinctive aroma. Curry powder is another common application for turmeric. In addition to its other applications, it is utilized in the medical industry for the purpose of disease prevention and treatment of a wide range of conditions. As a dye, it is utilized in the coloring of fabrics.

The Prosopis genus is comprised of approximately 45 different species of spiny trees and shrubs. It is classified as either a member of the Fabaceae or Leguminosae family. The pods of the Prosopis tree are used not only as a source of food for humans but also as an addition to the diets of smaller ruminants (sheep, goats). It has been shown that Prosopis has a broad-spectrum antibacterial effect, and this has been demonstrated both in vitro

and in human food preservation conditions. A decoction that is prepared from the bark is used as a treatment for headaches, toothaches, period discomfort, and other aches and pains in the Senegalese and Nigerian cultures. Crushed bark is rubbed onto the affected skin in order to treat skin ailments, and it is consumed in order to treat worms. The leaves have been shown to be effective in treating a variety of diseases, including headaches, vertigo, diarrhoea, and rheumatism [5].

Ziziphus mauritiana is a type of tree that belongs to the Rhamnaceae family. It is also frequently referred to as Indian jujube. Medicinally, the fruit has been used for a wide variety of purposes, including as a pain reliever, a sleep aid, a tonic, a cancer fighter, a potent wound healer, and as a treatment for asthma. Some of these uses are listed below. The indigenous Hausa people of northwestern Nigeria give the tree plant known scientifically as *Boswellia dalzielii* (Burseraceae) its local name, Hararrabi. An extract that is prepared from the leaves of the plant can be used to treat diarrhea that occurs in poultry. Using a decoction made from the root of *B. dalzielii* to heal wounds [6]. Consuming fresh bark has been demonstrated to be an efficient method for alleviating giddiness and palpitations, as well as triggering vomiting. It has a long history of traditional usage in the treatment of rheumatism, pain, and inflammation. Its anti-microbial, anti-diabetic, anti-plasmodial, anti-viral, and analgesic activities have been widely noted, and it has also been shown to inhibit the growth of plasmodia.

The African pumpkin, sometimes referred to as *Momordica balsamina*, is a member of the family Cucurbitaceae and is a popular food item in many parts of the world. This is due to the African pumpkin's medicinal and nutritional properties. It is possible for this herb to be either an annual or a perennial, and it grows in the tropical regions of Africa. During the monsoon season in India's many different forest regions, it is a natural occurrence that can be found throughout the country.

Active chemicals can be found throughout the plant, including in the bark, the fruit, the seeds, and the leaves. These compounds have the potential to improve one's health [7] The phrase "Nature's secret gift" is what the title refers to, so keep that in mind when reading it. In order to treat malaria, traditional African medicine takes advantage of the antiplasmodial effect that leaf and fruit preparations of the *Momodica charantia* plant contain [9]. This action may be found in both the leaves and the fruits of the plant. It has been discovered that momordins or balsamin could be able to prevent the proliferation of viruses, including the human immunodeficiency virus (HIV), as well as other viruses [8].

The Combratacea plant family includes the tropical shrub known as *Guiera senegalensis*. It is a shrub that can be either evergreen or semi-evergreen, and its heights typically range from 1 to 3 meters, although there have been isolated reports of it reaching heights of up to 5 meters. This plant is covered in teeny, tiny black glands all over its surface. It is believed that the leaves have medicinal characteristics, and as a result, they are much sought after throughout Africa. They are taken from the wild and offered for sale at the markets in the surrounding towns and cities.

Herders in the area use it as a treatment for trypanosomiasis. Additionally, local livestock farmers, Fulani ranchers, and traditional healers in northern Nigeria continue to use the plant as a treatment for snakebite. These bitter leaves have many different medical effects, including those of an expectorant, a blood purifier, a diuretic, a febrifuge, a galactagogue, a laxative, a pectoral, and a tonic. Some of these properties are listed in the previous sentence. are beneficial in the treatment of a wide number of diseases and conditions, including those that affect the digestive system (colic, dysentery, and diarrhea), the lungs (coughs and fevers), the skin (syphilis, beriberi, and leprosy), and the muscles and joints (impotence and rheumatism) [10]. All of these species are abundant in Nigeria and have been traditionally used as food and as herbal medicines. Several studies have all used the radicles of rapidly growing seeds including *Sorghum bicolor* seed [11-15] as a criterion in the testing of probable anti-cancer drugs. Rapid cell division is a hallmark of cancer cells; under optimal conditions, it is also a feature of meristematic cells of seeds (like *S. bicolor*). Thus, the aim of this study is to carry out phytochemical screening and antiproliferative potential of some medicinal plants in Northeastern Nigeria.

MATERIALS AND METHODS

Reagents

Wagnas reagent**,** anthrone, magnesium acetate, basic lead acetate, magnesium turning**,** dimethyl sulphoxide, ferric chloride and acetic anhydride are of analytical grade. all other reagents used were of standard grade.

Collection and Identification of Plants

Curcuma longa, *Momordica balsamia*, *Prosopis africana*, *Zizipus mauritianai, Boswellia dalziel*, *Guiera senegalensis* and *Diospyros mespiliformis* were collected from different northeastern states, Identification of plant specimen was done by plant taxonomists in Gombe state university by using standard herbarium technique. Voucher numbers were given to all the identified samples.

Extract Preparation

The various plant parts collected and identified were sprayed under shade in order to air dry for few days. The dried samples were grinded using a laboratory mortar and pestle and were sieved to obtain the powder. The sieved powdered portion was stored tightly in a polyethylene bag for further use. Ethanol was used as a solvent for extraction, Fifty (50 g) of each sample was weighed and poured into a 500 mL conical flask containing 250 mL of 50% ethanol which was then placed on an orbital shaker to thoroughly shake at 200 rpm for two hours. The mixture in each case was also filtered and the excess solvent from the filtrate evaporated using a rotary evaporator; the crude extract was transferred into a 250 mL beaker and preserved in a refrigerator for subsequent use in each case.

Phytochemical Analysis

The plant extracts were subjected to phytochemical screening to find out the presence of secondary metabolites such as alkaloids and tannins, glycosides, saponins, flavonoids, sugars and terpenoids. The different methods used were as described by [16] with slight modification.

Determination of growth inhibitory effect of plant extracts on guinea corn (*sorghum bicolor*) seeds radicles length

Sorghum bicolor (guinea corn) viable seeds were obtained from Gombe main market, cleaned with alcohol and dried.

10 mL of 5% dimethyl sulphoxide was used to dissolve the different plant extracts. Three different concentrations (10 mg/mL, 20 mg/mL and 30 mg/mL) of each of the extracts were prepared and poured into a 9 cm wide petri dishes laid with cotton wool and filter paper (Whatman No. 1). Ten (10) viable seeds were spread on each of the Petri dishes and were incubated. The lengths (mm) of *Sorghum bicolor* radicles emerging from the seeds were measured after 24, 48, 72 and 96 hours. The control seeds were treated with distilled water without extracts.

Statistical Analysis

Data obtained were expressed as the mean of three replicates ± standard error of the mean (SEM). The data were then subjected to analysis of variance (ANOVA) and Tukey's multiple range tests using the GraphPad Prism version 6.0 (GraphPad software, San Diego C.A USA) differences were considered significant at $p<0.05$.

RESULTS AND DISCUSSION

The qualitative phytochemical content (**Table 1**) revealed that all the plants contain alkaloids, saponins, tannins, flavonoids and glycosides. Phenols were found to be absent in *P. africana*, *Z. mauritiana*, *G. senegalensis*, *D. mespiliformis.* Amongst all the plants, only *C. longa* and *D. mespiliformis* contains anthraquinones while *M. balsamia*, and *B. dalzieli* revealed the presence of quinones. **Figs. 1** to **7** show the antiproliferative effects of the different plant extracts on sorghum bicolor seeds radicle length. All the plant extracts showed a concentration-dependent reduction in the growth of seed radicles with an increase in the number of days.

Table 1. Qualitative phytochemical content of some medicinal plants.

Phytochemicals	Plant samples						
	C. longa	*M. balsamia*	*P. africana*	*Z. mauritiana*	*B. dalzieli*	*G. senegalensis*	*D. mespiliformis*
Alkaloids	+	+	+	+	+	+	+
Anthraquinone	+	-	-	-	-	-	+
Coumarin	+	+	-	-	-	-	-
Flavonoids	+	+	+	+	+	+	+
Phenols	+	+	-	-	+	-	-
Terpenoids	+	-	-	-	-	-	+
Saponin	+	+	+	+	+	+	+
Tannins	+	+	+	+	+	+	+
Sugars	-	-	-	+	+	+	+
Glycoside	+	+	+	+	+	+	+
Quinone	-	+	-	-	+	-	-

Keys: + = Presence of phytochemical, - = Absence of phytochemical

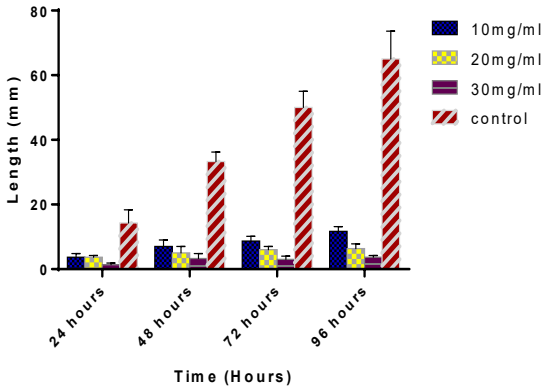

Fig. 1. Antiproliferative effects of *Curcuma longa* on sorghum bicolor seeds radicle length.

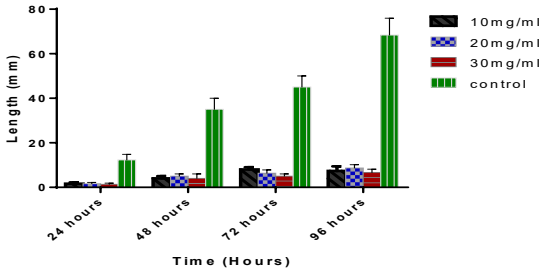

Fig. 2. Antiproliferative effects of *Momordica balsamia* on sorghum bicolor seeds radicle length.

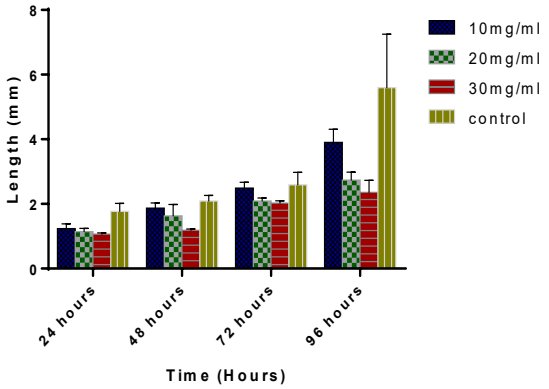

Fig. 3. Antiproliferative effects of *Prosopis africana* on sorghum bicolor seeds radicle length.

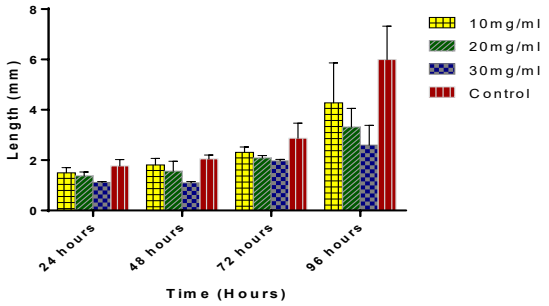

Fig. 4. Antiproliferative effects of *Zizipus mauritiana* on sorghum bicolor seeds radicle length.

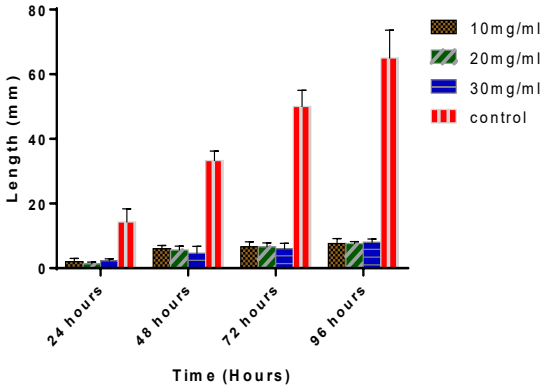

Fig. 5. Antiproliferative effects of *Boswellia dalzieli* on sorghum bicolor seeds radicle length.

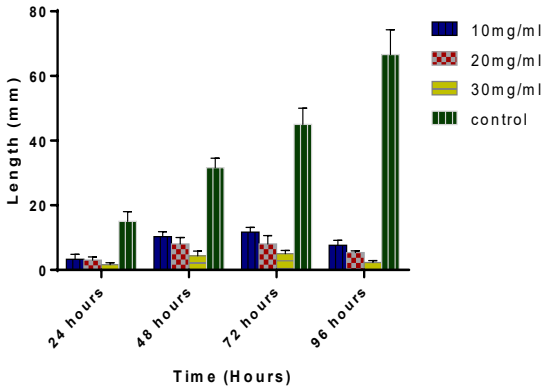

Fig. 6. Antiproliferative effects of *Guiera senegalensis* on sorghum bicolor seeds radicle length.

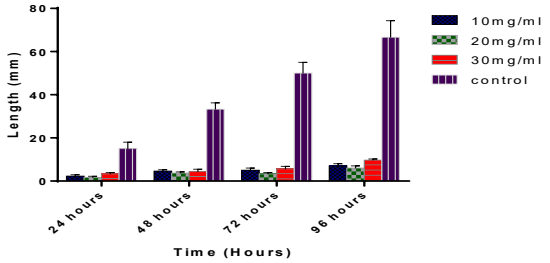

Fig. 7. Antiproliferative effects of *Diospyros mespiliformis* on sorghum bicolor seeds radicle length.

DISCUSSION

Plants and plant products have been used by humans for a wide variety of purposes throughout recorded history. As a form of defence against disease and infection, several of these substances are produced as secondary metabolites in higher plants. The result of the preliminary phytochemical screenings provides an empirical basis for the use of medicinal plants in traditional therapy, this is so due to the presence of constituents which are responsible for the biological and pharmacological actions of these plants. Qualitative screening for primarily phytochemicals indicated the presence of alkaloid, flavonoid, saponin, tannins and glycosides, nevertheless sugars and other constituents are not detected in some of the plants used in this research. Alkaloid as one of the secondary metabolites has antibacterial activity and also functions as antiproliferative and anti-metastatic against different types of tumor in both in-vitro and in-vivo. Camptothecin and vinblastine, two alkaloids used to treat cancer, are already on the market. As anaesthetics and CNS stimulants, alkaloids are useful in the pharmaceutical industry [17].

It has been suggested that saponins may serve as a crucial precursor for steroidal compounds due to their purported antibacterial characteristics. There is a great diversity in the pharmacological effects of these steroidal compounds [18]. Curcumin's terpenoids and sesquiterpenes have anti-inflammatory and antibacterial properties, too. Flavonoids are a class of polyphenols that can be found in a wide variety of plants. Many studies highlight their value as free radical scavengers or antioxidants [19]. Flavans serve as a source for flavonoids. There are more than 4,000 different flavonoids, and many of them serve as pigments in higher plants. The phenolic group found in tannins gives them their antiseptic properties.

Ethanol extracts of different medicinal plants in varying concentrations were tested for the inhibitory effect on the seed's radicles of guinea corn (*Sorghum bicolor*). It evaluates many therapeutic plants that were claimed to treat tumor-related diseases. Thus, at 24 hours of the incubation period, the seeds treated with 10, 20, and 30 mg/mL of the tested plants has radicle lengths ranging from 3.66±0.67 mm to 1.00±0.00 mm respectively while the controls had a maximum length of 15.00±2.33, this indicated the gradual decrease in seed germination on the first day. Ultimately after 96 hours of incubation, the radicles length for the control seeds (66.00±5.00 mm) while those treated with 10, 20, and 30 mg/mL were observed to be 11.66±0.88 mm, 6.33±0.88 mm and 3.66±0.33 respectively and therefore in all the three concentrations, the lengths of seed radicles were significantly different ($p<0.05$) from the control (**Figs. 1** to **7**). This decline in the growth between 10-30 mg/mL of these plant extracts has shown their ability to inhibit cell multiplication as such they have antiproliferative activity and can be further explored for antitumor potential.

CONCLUSION

The bioactive compounds from the plants *Curcuma longa*, *Momordica balsamia*, *Prosopis Africana*, *Zizipus mauritianai, Boswellia Dalziel*, *Guiera senegalensis* and *Diospyros mespiliformis* were evaluated for their potential antiproliferative effect using *Sorghum bicolor I* seed's radicle test. The extracts were found to exhibit varying antiproliferative activity against the seed radicle length of the plant *Sorghum bicolor*. The results from this study suggest that these plants have the potential of antitumor activity but further in vitro studies using cancer cell lines need to be undertaken.

REFERENCE

1. Jamal Elmezughi, Hafsat Shiru, Carol Clement, Ru angelic Edrada-Ebel, Veronique seidel and Alexander Gray. Bioactive natural compound from *Prosopis africana* and *Abies nobili*. J Appl Pharm Sci. 2013;3(03):040-043.
2. Javad Sharifi-Rad, Farzad Kobarfard, Athar Ata, Seyed Abdulmajid Ayatollahi, Nafiseh Khosravi Dehaghi, Arun Kumar Jugran. Prosopis plant chemical composition and pharmacological attributes: Targeting clinical studies from preclinical evidence. Biomolecules. 2019;9(777); doi:10.3390/biom9120777.
3. Ibrahim, M. Mohammad, AA, Faisal, H. Musa. Biochemical and antimicrobial activity of *Prosopis africana*. Int J Environ Prob. 2018;4(1):19-23.
4. Sahdeo P. and Bharat B. A. Tumeric, the Golden Spice. Herbal Medicine: Biomolecular and Clinical Aspects, 2011; 2nd edition.
5. Lydia O. Ayanwuyi, Abdullahi H. Yaro & Olajumoke M. Abodunde . Analgesic and anti-inflammatory effects of the methanol stem bark extract of *Prosopis africana*, Pharm Biol. 2010;48(3):296-299, DOI: 10.3109/13880200903121006.
6. Ratnam KV, Bhakshu LM. Traditional Uses and Pharmacology of Boswellia Species. Frankincense-Gum Olibanum: Botany, oleoresin, chemistry, etraction, utilization, propagation, biotechnology, and conversation. 2023 Jul 17, Apple Academic Press. New York.
7. Thakur GS, Bag M, Sanodiya BS, Bhadouriya P, Debnath M, Prasad GB, Bisen PS. *Momordica balsamina*: a medicinal and neutraceutical plant for health care management. Curr Pharm Biotechnol. 2009;10(7):667-682.
8. Kaur I, Puri M, Ahmed Z, Blanchet FP, Mangeat B, Piguet V. Inhibition of HIV-1 replication by balsimin, a ribosome inactivating protein of *Mormodica balsamina*. PLos one. 2013;8(9):e73780.
9. Mshelia SH, Kurami Y. Anti-ulcerogenic effect of extracts of *Momordica balsamina* Linn against experimentally induced gastric ulceration in rats. Int J Med Plants Res. 2017;6(4):332-6.
10. Sule MS, Mohammed SY. Toxicological studies on the leaves of Guiera senegalensis and Psidium guajava in rats. Biol Environ Sci J Trop. 2006;3:81-3.

11. Ayinde BA, Agbakwuru U. Cytotoxic and growth inhibitory effects of the methanol extract *Struchium sparganophora* Ktze (Asteraceae) leaves. Pharmacogn Mag. 2010;6:293–7.
12. McLaughlin JL, Chang C, Smith DI. Bench-top bioassays for the discovery of bioactive natural products: An update. In: Atta-ur-Rahman, editor. Studies in Natural Products Chemistry. Vol 9. Amsterdam: Elsevier Science Publishers; 1991. pp. 383–409.
13. Sogbaike DA, Ogundaini AO, Adesanya SA. The effects of some synthesized stilbene analogues on *Artemia salina* naupalii and germination of *Sorghum bicolor* seeds. Niger J Nat Prod Med. 2002;6:19–25
14. Obuotor EM, Onajobi FD. Preliminary evaluation of cytotoxic properties of *Raphia hookeri* fruit mesocarp. Fitoterapia. 2000;71:190–2.
15. Ayinde BA, Omogbai EK, Ikpefan EO. Comparative cytotoxic and antiproliferative effects of *Persea americana* mill (lauraceae) leaf, stem and root barks. Niger J Pharm Sci. 2011;10:16–26.
16. Ajuru MG, Williams LF, Ajuru G. Qualitative and quantitative phytochemical screening of some plants used in ethnomedicine in the Niger Delta region of Nigeria. J Food Nutr Sci. 2017;5(5):198-205.
17. Madziga HA, Sanni S, Sandabe UK. Phytochemical and elemental analysis of *Acalypha wilkesiana* leaf. J Am Sci. 2010;6(11):510-4.
18. Otukesh H, Ghazanfari B, Fereshtehnejad SM, Bakhshayesh M, Hashemi M, Hoseini R, Chalian M, Salami A, Mehdipor L, Rahiminia A. NPHS2 mutations in children with steroid-resistant nephrotic syndrome. Iran J Kidney Dis. 2009;3(2):99-102.
19. Panda S, Kar A. Antidiabetic and antioxidative effects of *Annona squamosa* leaves are possibly mediated through quercetin-3-O-glucoside. Biofactors. 2007