

Physiochemical, Insecticidal and Antidiabetic activities of *Senna occidentalis* Linn Root

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Research Article

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Abstract

The present study aimed to investigate the physicochemical activities of *Senna occidentalis* (Linn) roots, phytochemicals as insecticidal (ethyl acetate and methanol) and antidiabetic (ethanolic extract) activities. Physicochemical properties were carried out by using Association of Official Analytical Chemists methods, thin layer chromatography was carried out according to the Stahl method. Larvicidal activity and LD50 were studied against third instar of *Culex quinquefasciatus* mosquito larvae to detect, which extract is safe or toxic. The ethanolic extracts of the roots were orally tested at the dose 200 mg/kg for hypoglycemic effect on induced hyperglycemia in normal rats, assessed in the ethanol extract were compared with diabetic control and standards Glibenclamide 10mg/kg. Physicochemical parameters showed high parameters in nitrogen free extract (69.6%), curd fiber (14.5%), crude proteins (8.15%), ether extract (3.75%), and both Ash and moisture (2%), high concentrations values were found in potassium (43 mg/l) followed by phosphorous (28.5 mg/l), calcium (15 mg/l), sodium (3.65 mg/l) and magnesium. (0.145 mg/l) in this part beside phytochemical compounds showed high amount of alkaloids, triterpene, flavonoids, tannins, sugars, and few amount of Anthraquinone glycosides. Thin layer chromatography (TLC) studies different colored phytochemical constituted with different Rf values. All the spots are colored under UV light, but some are localized colorless after spaying. Ethyl acetate (EtAc) extract showed eight spots and methanol (MeOH) extract showed thirteen spots. The Larvicidal activity showed that ethyl acetate extract was safe against mosquito larvae with LD50 value 1412.54 ($p < 0.05$) and methanol extract had moderate larvicidal activity against mosquito larvae with LD50 value 257.54 ($p < 0.05$). While the ethanolic extract of *Senna occidentalis* (L.) cause a favorable hypoglycemic activity when compared to control significant reduction by [53.15%, 32.87% and 20.94%] respectively as while as standard Glibenclamide. Based on the various data of the physicochemical parameters, TLC spots and phytochemical compounds of *Senna occidentalis* root, they could be used as references standards for manufacturing units of *Senna occidentalis* root Larvicidal and antidiabetic drugs.

Introduction

Standardization of medicinal plants is essential issue to be considered as therapeutic drug for safety in health care. *Diabetes mellitus* is a disease responsible for many deaths around the world [1,2] *Senna occidentalis* (Linn), or *Cassia senna* or *Cassia occidentalis*, in Sudan known as Soreib (Ar.), which belongs to the family "*Caesalpinioideae*" widely distributed in all over of the Sudan. *Senna occidentalis* roots used traditionally in treating of diabetes and other ailments [3]. Although its adequate validation as therapeutic specifically anti-diabetic and hepatoprotective effects has not been established [4]. *Senna occidentalis* is prescribed for use only for the treatment of a laxative and bowel cleanser for colon and in surgery [5]. The seed of *Senna occidentalis* are toxic for the children [6,7]. The various extracts of the whole plants was subjected to normal and alloxan-induced diabetic rats Gidado and his co-workers [4] and Verma *et al* 2010 [8] studied the effect of *Senna occidentalis* leaves on diabetic rats. In traditional medicine, leaves were externally applied to wounds, sores, itch, cutaneous diseases, bone fracture, fever,

ringworm, skin diseases, and throat infection and to cure sore eyes, hematuria, rheumatism, typhoid fever and tuberculosis [9].

Insects, ticks, and mites are dangerous vectors of deadly pathogens and parasites, which may consider as epidemics in the increasing world population of humans and animals [10-14]. Mosquitoes are the most important single group of insects in terms of public health importance, which transmit Malaria, Filariasis, Dengue, Japanese encephalitis, [15, 16]. Reduction the source of infection is an essential step in the control of mosquito-borne diseases [17]. Although synthetic organic insecticides have been produced and used to eliminate mosquitoes. The treatment of the disease vectors using synthetic insecticides has failed due to their efficiency in attaining physiological resistance and effect on non-target organisms [18]. The phytochemical compound present in *Senna occidentalis* other parts has been isolated and reviewed such compounds as Sennoside, anthraquinone glycosides, fatty oils, flavonoids glycosides, galactomannan, polysaccharides and tannins [8]. The insecticidal activity of the extracts of this plant on vector mosquitoes is not sufficiently reported [19].

The objective of the present work was to determine and investigate the efficiency of the crude extract of root of *Senna occidentalis* for larvicidal activity against the *Culex quinquefasciatus* mosquito larvae as well as antidiabetic with reference to physiochemical activities.

Materials And Methods

Plant material collection and Identification

Senna occidentalis roots were collected in September 2015 from Al-Debabat city, locality of algoz, South Kordofan state, Sudan [20]. Samples were identified in herbarium at department of phytochemical and natural resource where herbarium no.k.14/96 was deposited at herbarium, National center for research medicinal and aromatic plants institutes Khartoum, Sudan.

Preparation of plant material

The roots part were air dried in shadow, then were powdered by using locally made in a hammer mill, then the plant were weighted with electric balance and stored for further analysis.

Preparations of Crude Extracts

Amount of 196g of the dried plant was weighted and then extracted successively with n- hexane (for four hours), ethyl acetate and methanol extracts (eighteen hours) and single ethanolic extract was also extracted by using shaker apparatus at room temperature. All extracts were air dried and kept separately in universal bottles till used for subsequent experiments. Their physical appearance and percentage yields properties were tabulated in results. Percentage yields were calculated as follows,

$$\text{Yield (\%)} = \frac{\text{Weight of extract}}{\text{Weight of plant}} \times 100$$

Weight of sample

Phytochemical screening

The general phytochemical screenings were carried out according to the methods described by Harborne, and Sofowora,[21-23]

Thin layer chromatography

The results of the Thin Layer Chromatography (TLC) were carried out by using the standard method described by Galib *et al.* and Stalh [24, 25]

Physicochemical analysis

Physicochemical properties such as the proximate composition (moisture, crude protein, crude fibre, crude lipid and nitrogen free extract %) of the roots were investigated using the standard methods of the Association of Analytic Chemist, (AOAC, 1990-2005) methods[26-29]. The mineral compositions of the root sodium and potassium Contents were determined by using Flame Photometer while Calcium and magnesium contents were determined by Atomic Absorption spectrophotometer (1100 B Perkin-Elmer, Germany) and phosphorus was determined by vandomolybdate standard colorimetric method [26].

Cytotoxicity Bioassays

Preparation and Hatching of *Culex quinefasciatus*

Culex quinefasciatus egg rafts were collected from stagnant water in Al kadarow area. The egg rafts were kept in aluminum dish 10.6 inches wide and 1.6 inches deep containing distilled water till hatching, the Larvae were fed with fine powdered bread. Dead larvae were continuously removed to a void contamination of cultures with pathogens. The third instars larvae for experiments were used.

Experiment Toxicity Tests of *Culex quinefasciatus*

The Larvicidal activity of *Senna occidentalis* root was carried out to investigate lethality bioassay against *Culex quinefasciatus* mosquito third instar larvae of *Senna occidentalis* roots. The cytotoxicity bioassay experiment was performed according to modification procedure described by Nguta *et al.*, [30]. Thirty larvae were selected and transferred into three test tubes by means of a 23 cm disposable Pasteur pipette from aluminum dish, each containing 5ml of distilled water. The Samples for the experiment were prepared by dissolving 20 mg of each different extracts in each 5mL of dimethyle sulphoxide (DMSO). Appropriate amounts of this DMSO solution (5 μ L, 50 μ L and 500 μ L) to give three different concentrations of ethyl acetate and methanol extracts (10ppm, 100ppm and 1000ppm ppm or (mg/L) respectively) were transferred into 100 ml test tubes (3 test tubes for each dose and 1 for control). Three replicates were prepared for each dose level then dried further in vacuum for 1 h to remove DMSO completely. Control was prepared using only DMSO then the thirty larvae were placed in each test tube. The surviving larvae were counted with the aid of a 3x magnifying glass, after 24 hours. The second count after 72hrs, and

larvae were considered after dead when they fail to rise to the surface or settle motion less in the bottom of the test tube.

LD₅₀ Determination

The lethal Death fifty (LD₅₀), of plant extracts resulting in 50% mortality of the larvae of *Culex quinefasciatus* LD₅₀ and 95% confidence intervals were determined from the 72 hours counts and the dose response data were transferred into LD₅₀ analyzed by Finney [31] Probit Analysis computer program to determine lethal death fifty (LD₅₀) values. Potassium dichromate (K₂Cr₂O₇) was used as a positive control with LD50 value (1.7 µg/ml) toxic and DEMSO (1000µg/ml) as negative control in the bioassay experiments LD50 (726129X10¹¹ µg/ml) according to modification by Meyer *et al* (1982). LD₅₀ values below 250µg/ml were considered as highly toxic, 250–499 µg/ml as moderately toxic and 500–1000 µg/ml as (low toxic). Values above 1000 µg/ml were regarded as safe or non-toxic according to McLaughlin and co-workers [32]

Diabetics Assay

Study of hypoglycemic effect of on induced hyperglycemia in rats

Experimental Animals

Twenty four Healthy adult Wistar albino rats strain of male sexes weighing (150-250g) age between 6-12 months were purchased from the Department of animal house laboratory, Faculty of Veterinary Medicine, Khartoum, Sudan. The rats were kept in well aeration laboratory, were divided into four groups with six rats each in cages. The animals were fed freely on standard animal feeds with balanced diet and drinking water *ad libitum* during the experimentation period. The animals were exposed to 12 h light-dark cycle.

Experimental Design of Glucose loading Induction Model

They were fasted from food for eighteen hours prior to experimentation and had water *adlibitum*, Four groups starting with first group (I) was administered with 10 ml/kg body weight of distilled water and considered as normal control group (I). The second group (II) was administered with 2g / kg body weight of glucose loading and considered as positive control. The third group (III) was administered with 10 mg/kg body weight of the hypoglycemic drug-Glibenclamide and considered as the standard group. The last groups (IV) were treated with 200 mg/kg body weight the ethanolic extract of *Senna occidentalis* roots. All four groups of rats were then loaded with 50 % glucose solution at a dose of 2g/kg. The blood glucose level of all groups was monitored after 1, 2 and 4 hours after the glucose load according to Konuklugil *et al* [33].

Determination of Blood glucose Level

The fasting blood glucose levels were first conducted at '0' minutes initial fasting blood samples were collecting from the overnight fasted rats, by drawing out about 1ml of the blood samples from eye side

(retro-orbital plexus) cervical dislocation by using heparinized- capillary tubes under mild diethyl ether inhalation anaesthesia on a four hours interval (starting with the fasting plasma glucose levels of the four groups of rats were determined (0 time), then 1, 2 and 4 hours) for a period of one day. A manual digital spectrophotometer was used to analyze blood glucose levels throughout the experiment according to method described by Trinder, [34].

Statistical Analysis of Blood glucose Level

Results of Blood glucose Level were expressed as mean \pm standard error of mean. The data was statistically analyzed using analysis of variance (ANOVA) with Duncan Multiple Range Test comparisons versus control groups. The values of $p < 0.05$ were considered as significant according to Duncan *et al.* [35].

Results And Discussion

The physical properties and yields of *Senna occidentalis* root

The results of physical properties such as consistency, color and extractive value percentage yields of successively extracted in an order of non-polar to polar solvent based on increasing degree of polarity were reported in Table 1. High values were found in polar solvent methanol (MeOH) followed by intermediate polarity ethyl acetate (EtAc) and non-polar n-hexane (n-hex) respectively. n- hexane less extractive value signifies the presences of amounts of fats, lipids and some steroids in the plant materials, may be indicates addition of exhausted material, adulteration or incorrect processing during drying, or storage or formulating [1].

Table 1. The physical properties of *Senna occidentalis* root

Solvents of extraction	Consistency	Color	Yields %
n. hexane	Semi-solid	Yellow	0.046%
Ethyl acetate	Semi solid	Brown	0.15%
Methanol	Solid powder	Dark brown	1.13%

Thin layer Chromatography

The results of the Thin Layer Chromatography (TLC) separated the various some phytochemical components in ethyl acetate and methanol extracts of *Senna occidentalis* root, by using solvent system Toluene: Ethyl acetate in the ratio (70:30) as described by Fried and Sherma [36] and Wagner *et al* [37]. Plate 1 (A) before spray: under UV (254nm) light, showed several spots with the R_f values colors at Sample A1 Left represent the Et.Ac extract of root was gave eight spots (S) with numbers from upper to the lower: S1= 0.93 (pale blue fluorescent), S2= 0.85 (green fluorescent), S3= 0.67 (green fluorescent), S4= 0.46 (sky blue fluorescent), S5= 0.37 (green fluorescent), S6= 0.28 (green fluorescent), S7= 0.21 (light sky blue fluorescent) and S8= 0.16 (light sky blue fluorescent) color. Sample A2 Right represent the

MeOH extract of root were gave twelfth spots with R_f values S1= 0.98 (pale red fluorescent), S2= 0.93 (pale blue), S3= overlapping between 0.87 to 0.85 (Orange to green fluorescent), S4= 0.75 (pale red fluorescent), S5= 0.67 (blue bright sky fluorescent), S6= 0.46 (blue fluorescent), S7= 0.42 (light sky blue fluorescent), S8= 0.38 (light sky blue fluorescent), S9= 0.28 (light sky blue fluorescent), S10= 0.21 (light green fluorescent) and S11= 0.16 (arc light green fluorescent) and S12= 0.08 (arc green fluorescent). These colors indicated the presence of constituents may be with R_f values 0.38 (white sky blue to white green fluorescent), 0.44 (red), 0.88 (violet) alkaloids (white blue fluorescent), phenolic compounds (blue to white green fluorescent), negligible amount of alkaloids (very weak intensity) or saponins with glycosides in the roots with R_f (0.18, 0.32 (both orange); a blue fluorescent spot R_f (0.16, 0.32, 0.72 and 0.97) respectively, these could not be isolated but on spraying with anisaldehyde sulphuric acid reagent and heating plate (B) for ten minutes at 110°C and spots of purple colour appear at grey dark violet colors were detected with two R_f values between (0.50 and 0.21) constituents may be tannins or Triterpene and phytosterol Wagner *et al*[37]. These colorless in the same plate constituents may be oils [Volatile oil, fixed oils] or protein and (dark brown) cardiac glycosides with the R_f (0.88, 0.60, 0.38, 0.32, 0.23 and 0.18). Generally MeOH and EtAc were observed they have a good manner colored spots under UV light but showed less color toward Anisaldehyde Sulphate reagent. Constituents may be Stilbenes or pigments (0.96 with red or pink color). Constituents may be Alkaloids with R_f 0.74 (no color) and 0.70 (no color).

Constituents may be may be terpenoids and Saponins with R_f 0.62 (dark blue), 0.61 (dark violet blue), 0.48 (dark blue), 0.42 (dark blue violet). May be flavonoids with R_f 0.32 (orange), 0.21 (orange) and 0.11 (dark blue orange). Chromatogram revealed a mixture of compounds which exhibited different colored reactions with R_f values. Terpenoids (purple or blue violet), flavonoids (yellow, pinkish or orange), stilbenes (bright red to dark pink color) and proanthocyanidins (pink color). These results agreed with the chemical constituents reported by (Wagner *et al* [37]. (Tsakala *et al.*, [38]

Results of phytochemical screening of *Senna occidentalis* Root

The general results of phytochemical screening were shown in Table. 2. Tests gave these colors with few modification according to the colors of extracts indicate the presence of the high concentrations of the various active phyto-constituents metabolites, as follow alkaloids ([Dragendorff's Orange brown]; [Mayer's Yellow to creamshies]; [Hager's Yellow] and [Wagner's reddish brown] with precipitations), Triterpenes ([Liebermann-Burchard deep purple/violet] and [Salkowski deep red to brown] color ring at the junction of the two layers), tannins ([Ferric chloride blackish blue to violet] and [salt gelatin white with precipitations]), saponins ([white foam at upper layer persists for 10 minutes]), flavonoids ([Sodium Hydroxide yellow]; [Ammonium Hydroxide deep yellow]; [Aluminum Chloride yellow-creamshies] and [Magnesium turnate piece - sulfuric acid reddish]) and sugars ([Molisch's violets to green ring at the junction of the two layers]; [Benedict's few reducing monosaccharides] and [Barfoed's high reducing disaccharides]) followed by a moderate amount of proteins [Biuret violet] and Coumarins [blue fluorescence under UV light with KOH alcoholic], but low amount of amino acids [Ninhydrin purple color] and [Xanthopreotic yellow-orange moderate amount of aromatic amino acids may be produces from

degradation of proteins] and Glycosides both of (Anthraquinone pink-red) and (Cardiac A brown ring) respectively in this part. Similarly to the previous studies on other parts of this plant by Lawal *et al* [39], on *S. occidentalis* leaves, the results found show that the leaves extracts contain glycosides (anthraquinones and cardiac), phenolic compounds such as terpene (has antiviral properties), flavonoids (have antiinflammation and antioxidant), tannins (for wound healing), coumarins and saponins and absent of Alkaloids (have bloods pressure decrease and nervous system balancing). Also similar findings were reported by [8] in the other species of the same family. According to TLC results in Plate 1 (A) Ethyl acetate and methanol extracts of this plant: under 254nm UV light, showed the presence of eight and twelfth spots respectively with different R_f values in colors may be flavanoids (orange to red yellow fluorescent), alkaloids (white blue fluorescent) and phenolic compounds (blue to white green fluorescent) and after spraying with 1% Anisaldehyde Sulphate reagent showed few colored spots in (Et Ac) extract and colorless in MeOH extract with R_f values and Plate 1 (B), which suggests that the presence of many compounds in the extracts. The Et Ac and MeOH extracts were subjected to the phytochemical screening for the detection of various plants constituents. It was found that terpenoids, flavanoids and phenolic compounds were present as major active principle [36, 37]. The active principles of many drugs found in plants are secondary metabolites, are widely used in traditional medicine to treat various ailments. Galib *et al*. [24] mentioned that, *Senna occidentalis* root could be used as Larvicidal and antidiabetic.

Table 2. Results of Phytochemical screening of *Senna occidentalis* Root

Metabolizes	Tests	Methanol
Alkaloids	Dragendorff's	++++
	Mayer's	++++
	Hager's	++++
	Wagner's	++++
Coumarins	KOH/U.V.	++
Flavonoids	NaOH /KOH	+++
	NH ₃ OH con.	+++
	ALCL ₃ (flavones or and chalcone).	+++
	Mg/ HCL (flavones / flavanol glycosides)	-
Glycosides	Anthraquinane	+
	Cardiac	+
Saponins	Foam	+++
Sterols/ Triterpene	Liebermann-Burchard	-/+++++
	Salkowski	-/+++++
	Ferric chloride	+++

Tannins	Salts gelatin	++
Sugar	Molisch's	+++
	Fehling's / Benedict's	+
	Barfoed's	+++
Amino acids	Ninhydrin	+
	Xanthopreotic	++
Proteins	Biuret	++
Lipids	Sudan III	-
Where: ++++ = very high amount, +++≡high amount, ++ ≡moderate amount, +≡low amount, ± ≡ trace amount or absent and - =absent		

Physiochemical analysis

The Nutrition composition percentage of plant powder of *S.occidentalis* root Table 3, were determined with the high percentage of physiochemical which found to be in dry matter (98%) followed by nitrogen free extract (69.6%), curd fiber (14.5%), curd proteins (8.15%), ether extract (3.75%), both Ash and moisture (2%). many plant proteins are low in one of the essential amino acids but a combination of plant proteins such as grains with pulse or seeds may give a high quality protein which is just as good as protein from animal foods.

Table 3. Physiochemical (Proximate analysis) of *Senna occidentalis* Root

Proximate analysis	Values %	Proximate analysis	Values %
Dry matter	98	Crude fibers	14.5
Moisture	2	Nitrogen free extracts	69.6
Ash	2	Reducing sugar	6.5
Ether extracts	3.75	Total sugar	26
Crude protein	8.15	Total tannin	25

The results of the minerals composition

Table (4), showed the mineral composition *Senna occidentalis* Root, high concentrations values were found in potassium (43 mg/l or ppm) followed by phosphorous (28.5 mg/l), calcium (15 mg/l), sodium (6.5 mg/l), iron (4.15 mg/l), copper (1.5 mg/l), zinc (1.5 mg/l), manganese (1.5 mg/l), and magnesium (1.5 mg/l).

(3.65 mg/l) and magnesium (0.145mg/l). Similar findings were reported by Agbugui,, *et al.* [40]. In the other species of the same family. He showed these elements form part of the rigid body structure, soft tissue and body fluids of most vertebrates and Anhwange *et al.*, (2005) reported that the general, minerals work in combination with each other and other nutrients, therefore deficiency of any mineral may cause health problems. Sodium and potassium maintains water balance in cells, they are important for nerve impulse transmissions and stimulation of normal movement of the intestinal tract. Glew *et al.* [42] reported that magnesium is essential because it maintains, repairs cells and provides energy, and its deficiency may result in vertigo, convulsions, nervousness and heat palpitation. It also assists the muscles to keep reservoir of oxygen and increases the body's resistance to infection. Its deficiency results in anemia, tiredness, insomnia and palpitations.

Table 4. Mineral composition values of crude powder of *Senna occidentalis* roots

Potassium	Phosphorus	Calcium	Sodium	Magnesium
43 mg/l	28.5 mg/l	15 mg/l	3.65 mg/l	0.145 mg/l
0.043 g/l	0.0285g/l	0.015g/l	0.00365g/l	0.000145g/l

Keys: = Means of duplicates values

Cytotoxicity bioassays (Larvicidal activity) of *Senna occidentalis* root

The results of cytotoxicity bioassays with n-hexane, ethyl acetate and methanol from the root extracts showed good larvicidal activities for all extracts high mortality was observed with high concentration (1g/L) representing 1000ppm dose of methanol extracts, and low mortality was observed in low to moderate concentrations (0.01 and 0.1g/L) representing 10ppm and 100ppm. 100% mortality was not obtained at all concentrations. In general, n-hexane and ethyl acetate were showed safe effects and methanol showed moderate effect Table (5). Kumar, *et al* [43] showed the significant effect at other doses than that reported in this studies 100% mortality effect of petroleum ether and butanol of Larvicidal activity of *C. occidentalis* against mosquito *Culex quinquefasciatus* at (0.2 and 0.3g/L) representing 200ppm and 300ppm respectively.

This studies of Larvicidal activity of *Senna occidentalis* root n-hexane, ethyl acetate and methanol extracts had LD50 values 1564721 ppm, 1412.54 ppm and 1412.54 ppm respectively, were carried out against 3rd instar of *Culex quinquefasciatus* mosquito larvae (Malaria vector) (Table 5), which revealed that the results of the lethal doses were determined in both n-hexane and ethyl acetate extracts were Larvicidal significant (p< 0.05) high effective safe for mosquito larvae with increase LD50 values 1564721 and 1412.54 respectively, this indicate that non polar (n-hexane) and intermediate polar ethyl acetate, they have more potent activity to larvae. The methanol extract showed least effective Larvicidal significant (p< 0.05) moderate effect for mosquito larvae with LD50 value 257.54 ppm.

Based on the previous literature on the mosquitocidal activity of different species of the genus *Senna* (*Cassia*).

in Table 5 the aquatic immature larvae stage is recognized as the most vulnerable and best control strategy to effectively reduce mosquito population densities during infestations. *Senna occidentalis* root displayed good larvicidal effective considered to larvae Safe (nontoxic) control by the solvents DMSO with LD50 (726129X10¹¹) at all concentrations according to modification of Meyer *et al* [44] and McLaughlin *et al* [45].

Yadav *et al* [19] and Duke *et al* [45] previously reported that the phytochemicals screening possess insecticidal activity are present in plants of this genus, which it could be responsible to the Larvicidal activity of *Senna occidentalis* root in n-hexane, ethyl acetate and methanol extracts or it may be due to contain such phytochemicals and related compounds that display a role in plant defense against pests insect, and might have been responsible for larval deaths at high concentrations.

Table 5. The effects of different concentrations of n-hexane, ethyl acetate and methanol extracts on *Culex quinquefasciatus* mosquito larvae mortality rate

Extract	Con. (ppm)	Total	*Death	*Survive	LD50	Remark
n- hexane	10	30	1	29	1564721	Safe
	100	30	3	27		
	1000	30	4	26		
Ethyl acetate	10	30	3	27	1412.50	Safe
	100	30	3	27		
	1000	30	14	16		
Methanol	10	30	2	28	257.54	Moderate
	100	30	4	26		
	1000	30	27	3		

Keys: *≡ Means of triplicates values; conc. ≡ concentrations; (ppm)≡ part per million (mg/l)

Effect of the Roots Supplement on Blood Sugar Level (BSL)

In the present study, the effect of ethanolic extract of *Senna occidentalis* (L.) roots was determined on to Blood glucose levels of all animals treated with the supplement were seen to reduce significantly ($p < 0.05$) by about 58.25%, 48.59% and 41.93% respectively when compared with that of the untreated diabetic control group Table 6 and cause a favorable hypoglycemic activity when compared to fasting glucose levels within groups (Figure 1) significant reduction by 53.15%, 20.94% and 32.87% respectively; but with standard Glibenclamide 10 mg/kg significant reduction only between one hours with the value 37.10% and a significant increasing for the other 29.56% and 18.96% respectively Figure (2). This study proved the use of *Senna occidentalis* roots in traditional medicine for the treatment of diabetes and showed that *Senna occidentalis* roots supplement has goods potent hypoglycemic effect may be due to its high

Senna occidentalis roots supplement has good potent hypoglycemic effect may be due to its high contents of active phytochemical constituents such as flavonoids that was reported in most medicinal plants with hypoglycemic and antidiabetic properties. This finding agrees to Gidado, *et al* [4] and Verma *et al* [8].

Table 6. Effect of *Senna occidentalis* (L.) Roots of 80% ethanolic extracts on glucose-loaded rats

Treatments	Bloods glucose levels mg/dl mean± S.D.			
	Time			
	0 h	1 hours	2 hours	4 hours
Group I " normal Vehicle 2% water"	68.33 ^{ab} ±8.50	63.67 ^{*c} ±2.52	69.33 ^{*c} ±11.68	57.67 ^{*c} ±3.21
Group II glucose loading 2g/kg body wt "Positive control".	89.00 ^a ±11.27	114.00 ^a ±13.11	138.33 ^a ±13.32	132.67 ^a ±30.75
Group III glucose loading 2g/kg + Standard Glibenclamide 10 mg/kg.	93.67 ^a ±11.6	75.67 ^{*b,c} ±14.15 (-33.62%)	62.00 ^{*b,c} ±7.81 (-55.18%)	57.33 ^{*b,c} ±3.79 (-56.79%)
Group VI glucose loading 2g/kg + EtOH of <i>S.o</i> Roots 200 mg/kg .	101.6 ^a ±18.4 (14.15 %)	47.6 ^{*b,c} ±15.6 (-58.25%)	80.33 ^{*c} ±4.5 (-41.93%)	68.2 ^{*b,c} ±6.9 (-48.59%)

Where: n=6, *a=<0.05 indicates a significant difference compared with diabetic control;*b= (p<0.05) indicates significant difference compared with diabetic control; *c= (p<0.05) indicates significant difference compared with standard drug (glibenclamide), %=level₂-level₁/level₁X100 compared with diabetic control. *S.o*= *Senna occidentalis*.

The phytochemical profiling of *Senna occidentalis* root extracts presented in this study revealed a diverse range of bioactive phenolics compound. Some of the identified bioactive phenolics were reported by several authors for antidiabetic activities. Beside the Larvicidal activity was carried out against *Culex quinquefasciatus* mosquito larvae, showed that the methanol extract moderate effects, n-hexane and ethyl acetate extracts showed safe effects. The larvicidal activities clearly showed safe in this part at high dose required for insecticidal action (1000ppm)but methanol extract is lower than doses used in animal study (200 ppm) for diabetic action.

This was an attempt to identify the potent antidiabetic and pesticides compounds from *Senna occidentalis* root. This plant is widely distributed and it can be predicted that the potent antidiabetic and Larvicidal activity of *Senna occidentalis* root is due to presence of compounds that have potential to be used in local communities for antidiabetic activity and also used as mosquito control during infestation seasons, thus promoting the use of natural antidiabetic and pesticides. It is concluded that *Senna occidentalis* (L.) in parts showed higher potent hypoglycemic activity in glucose-loaded diabetic rats than

other plants. However, further effects can be investigated by the increase in the treating dose of the extract and other pharmacological studies should be done, specifically on dose 200mg/kg, which was presented antidiabetic activity. Isolation and identification of more bioactive compounds highly recommended. *In vivo* studies are needed to be conducted on these active ingredients to study the mechanism of action by which these compounds exert their effect as anti-diabetics activity. I recommended studying anti-diabetic activity using Alloxan-inducing diabetic type 2 in same dose 200mg/kg and histopathological in animal by his the same manner Gidado, *et al* [4] and Verma *et al* [8] they reported in their previous studied on *Senna occidentalis* leaf part and whole parts showed β -cell regenerating potential as depicted by the histopathological studies of the pancreatic tissue, even though, some cytotoxic agents like the cytotoxic saponins may be present in the supplement which is capable of causing damage to both pancreas and liver and induced (hepatotoxicity).

Declarations

Ethics approval

Some applicable in animal ethic clearance according to standard protocol with the rules of the Institutional Ethical governing Committee of the Faculty of Medicine and the Sudanese Government National Council for Science and Technology and other present study is purely based on chemical analysis in lab, not in human were carried out.

Consent for publication

Not applicable

Availability of data and materials

We have already included all data in the manuscript, the lab and data, phytochemical screening, cytotoxicity-Larvicidal activity, Antidiabetic activity, Nutrients and Minerals.

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

T. O. I. was carried out the phytochemical, physiochemical and antidiabetic experiments. and supervised A. I. M. was carried out the Insecticidal and Thin layer chromatography experiments and Y. S. M. were collected the raw materials and identification of the plant. A. M. M. had provided technical and financial

support and helped in the rewrite-up and revision and T. O. K. wrote the draft manuscript, designed the study and supervised the project. All authors read and approved the final manuscript.

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Figures

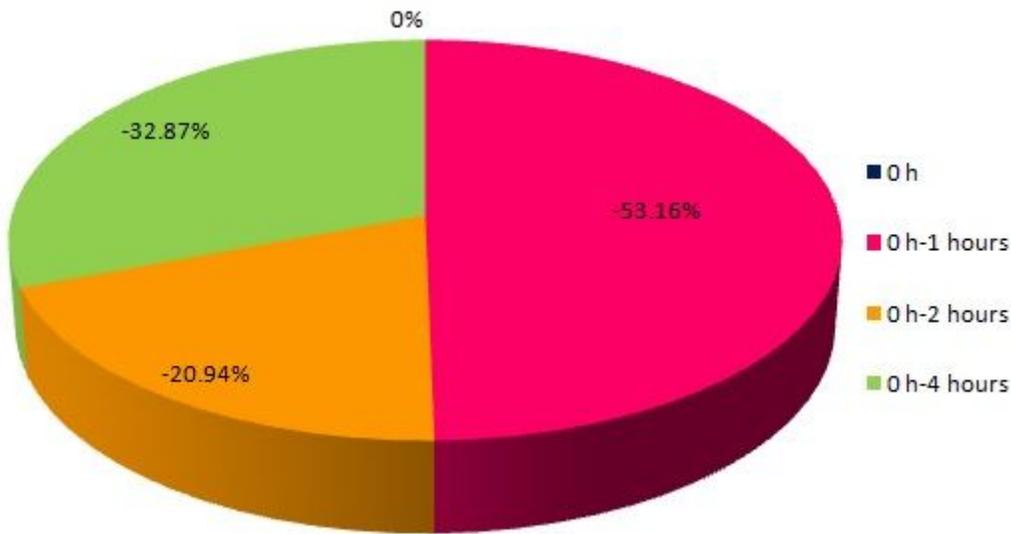


Figure 1

Effect of ethanolic extract of *Senna occidentalis* (L.) roots part on glucose-loaded induced hyperglycemia in rats when compared within groups to fasting

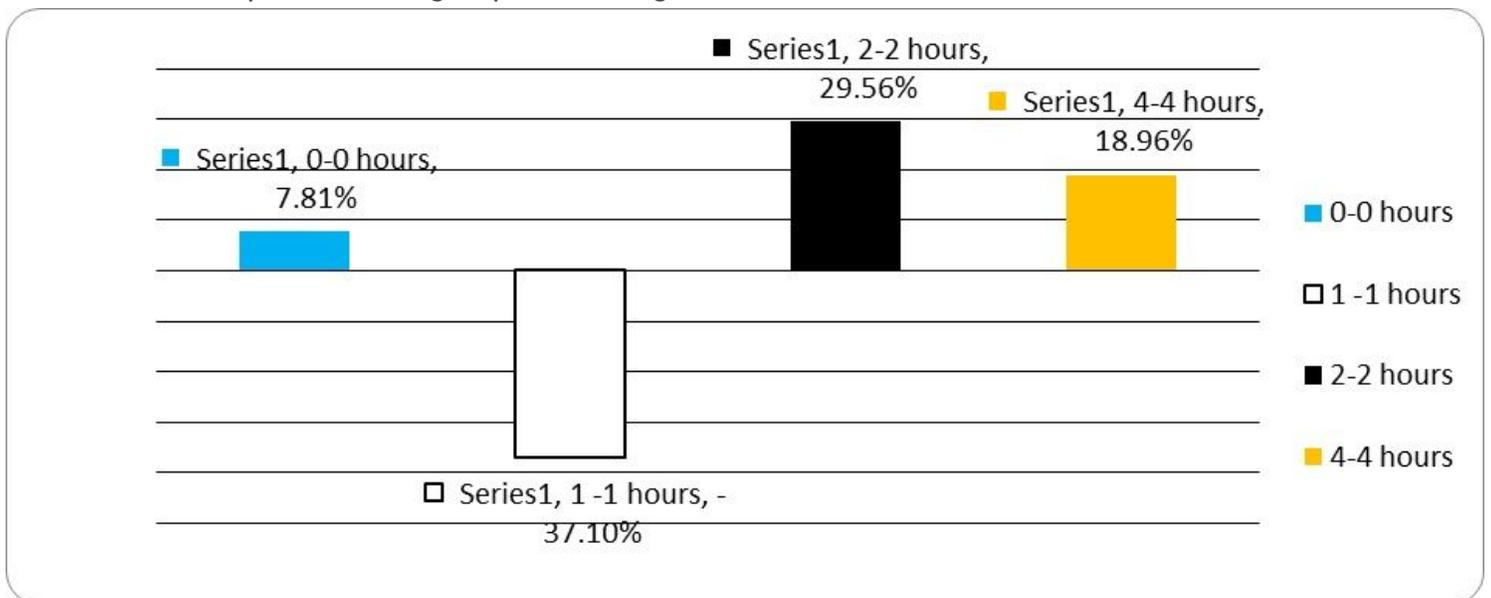


Figure 2

Effect of ethanolic extract of *Senna occidentalis* (L.) roots part on glucose-loaded induced hyperglycemia in rats when compared within groups to standard Glibenclamide 10 mg/kg

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