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Pharmacological review of *Jatropha Gossypiifolia* and *Senna Alata*

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Abstract
This review provides updated Pharmacological activity of *Jatropha gossypiifollia* and *senna alata*. *Jatropha gossypiifollia* used as analgesics, neuropharmacological agents, anti-diarrheal, anit-cancer, hypotensive, vasorelaxant, coagulant and anti-inflammatory, anti-pyretic, anti-oxidant, anti-microbial, hepatoprotective, and anti-diabetic activity. Latex of *J.Gossypiifollia* used as hemostatic agent. The *J.gossypiifollia* leaves are used to treat multiple boils in the skin, dermatitis, itches, and tongue sore of babies, inflammation of milk secreting glands, stomach ache, and sexually transmitted diseases and also the leaf decoction is used for cleaning the wounds. Seeds are emetic and purgative. *Senna alata* roots, leaf, bark, flower and seed extracts possesses pharmacological activities such as anti-inflammatory, antitumor, antioxidant, analgesic, and antimicrobial, immune boosting activities.

Keywords: anti-oxidant, anti-microbial, anti-tumor. *J. Gossypiifollia, Senna alata*, haemostatic

1. Introduction
Jatropha gossypiifolia L. (Euphorbiaceae), also called as "bellyache bush" is largely used throughout the country for their medicinal purposes. Different preparations and parts of the plants are used for human and veterinary medicinal uses. This review provides traditional uses, as well as pharmacological activity of *J. gossypiifolia l.* and *Senna alata*. Various compounds are isolated from these two plants and their pharmacological studies provide significant action of different extracts and (or) isolated compounds as antimicrobial, anti-inflammatory, anti-diarrheal, anti-hypertensive, and anticancer agents. *Senna alata* leaves extract commonly used to treat ringworm, fungicidal and has an antibacterial, laxative, anti-inflammatory, anti-tumor and diuretic property. Clinical trials are not conducted to till date. Need to screen important folk uses, and to find new bioactive molecules with pharmacological purpose based on the demand.

Fig 1: Plant *Jatropha gossypiifolia*

Scientific Classification
Kingdom: Plantae
Clade: Tracheophytes
Clade: Eudicots
Clade: Rosids
Order: Malpighiales
Family: Euphorbiaceae
Genus: Jatropha
Species: *J. gossypiifolia*

Senna alata also known as Cassia alata (Family: Leguminosae). In Tamil it is known as semaiagathi. Commonly called as Candle bush, Christmas candle, Acapulo, Ringworm bush, Emperor Candle stick, and Calabra bush. *Senna alata* is a shrub with an average height of between 1 and 5 metres and their branches spread horizontally. Leaves are 50 to 60cm long with 8 to 20 pairs of leaflets. Each leaflet is oblong or elliptic oblong and rounded at both ends. Its flowers are dense in auxiliary racemes, about 20 to 50 cm long and 3 to 4 cm broad. The inflorescence looks like a yellow candle. The plant fruits are a thick, flattened with wings and glabrous pods. They grow well in full sun in wide range of soils that retain moisture adequately. The species is easy to grow from the seed.

Fig: Plant *Senna alata*

Kingdom: Plantae
Clade: Tracheophytes
Clade: Angiosperms
Clade: Eudicots
Clade: Rosids
Order: Fabales
Family: Fabaceae
Genus: Senna
Species: S.alata.

Phytochemistry

Chemical constituents of Various Extracts of *J.gossypiifolia & Senna alata.*

Compounds reported in *J.gossypifolia* include fraxetin-7,8 dihydroxy-6- methoxycoumarin (Das and Kashinathan, 1997; Dabur *et al*., 2007,) gadain and jatrophan (Banerji *et al*., 1984), Jatrophone (Calixto and Sant' Ana, 1987), Prasanthaline (Chatterjee *et al*., 1988), aryl naphthalene, 2,2- bis (hydroxyl-methyl)-6,7-(methylenedioxy)-1-3'4'-dimethoxyphenyl) naphthalene (Das & Banerji, 1988), 2α-hydroxy jatrophone, 2β-hydoxy jatrophone and 2β-hydroxyisojatrophone in J.gossypifolia (Kong and Jin, 1993), alkaloids A,B,C (Ahmed *et al*., 1992), (2α, 13α, 14β, 20S)-2, 24, 25-trihydroxylanost7-en-(3-one), (13α, 14β, 20S)-2, 24,25trihydroxy lanost-1-7-diene(3-one) (Tino *et al*., 1992), gossypifan (Das A and Das 1995), Jatrodiene (Das et.al., 1996), cyclogossine A (Horsten *et al*., 1996), tetradecyl (E) ferulate and ferulic acid (Oxkuyama *et al*., 1996), cyclogossine B (Auvin-Guette *et al*., 1997), gossypilline (Das *et al*., 1998), gossypidien (Das and Anjani,1999, propacin (Das and Venkataiah 2001), flavonoids namely vitexin, isovitexin, and apigenin (Sankara *et al*., 1971), cleomiscosinA, jatrorins A, B, jatrocins A,B(Das *et al*.,2003), and jatrophenone (Ravindranath *et al*., 2003 b).

The secondary metabolites reported in cassia alata are flavonoids including Kaempferol and its glycosides(Kaempferol 3-O-genitobioside and Kaempferol 3-O-B-d- glucopyranoside), anthraquinone derivatives (e.g. alatonal, alatinone, chrysaphanol, emodin, rhein, aloe-emodin), essential oils, fatty acids and terpenoids (Palmitic acid, Oleic, Linoleic acids, terpenoids (β-sitosterol, stigmasterol, campsterol) and other metabolites for instance, ellagitannins and p-hydroxybenzoic acid.

Pharmacological activities of *Jatropha gossypiifollia*

Analgesic activity

The analgesic activity of the extract was evaluated using acetic acid induced writhing method in mice. In this method, four groups of mice were taken each consisting of five animals. Control received 1% (v/v) Tween 80 in normal saline at a dose 0.5 ml/mice, positive control (Diclofenac sodium) at a dose of 10 mg/kg of body weight and test samples 200 mg/kg and 400 mg/kg body weight. After 30 minutes of oral administration of control and test groups, 0.7% v/v acetic acid solution was administered intra peritoneally to each mouse at a dose of 0.1ml/10 g. The positive control was administered orally 15 min prior to acetic acid injection. 5 min after the administration of acetic acid, the number of writhing by each mouse was counted individually for a period of 20 min. The percent inhibitions of the writhing response at the doses 200 mg/kg and 400 mg/kg were 77.86% and 71.25% respectively [2]. The methanolic extract of aerial and bark parts of *J.gossypiifolia* demonstrated significant analgesic activity in Eddy's hot plate [6].

Analgesic activity of *J.gossypiifolia* was determined by tail flick method and by eddy's hot plate method. The albino mice were divided into six groups of six animals each. Group I received 0.2ml of 2% w/v carboxy methyl cellulose suspension orally for 7 days as a control group. Group II received 100 mg/kg body weight of methanolic extract of *jatropha gossypiifolia* orally for 7 days. Group III received 200 mg/kg body weight of methanolic extract of *Jatropha gossypiifolia* orally for 7 days, Group IV received 100 mg/kg body weight of petroleum ether extract of *Jatropha gossypiifolia* orally for 7 days, Group V received 200 mg/kg body weight of petroleum ether extract of *Jatropha gossypiifolia* orally for 7 days and Group VI received 1 mg/kg of body weight of diclofenac sodium intraperitoneally for 7 days as a standard drug. The reaction time was recorded using tail flick analgesiometer at 0, 30 60,120 and 180 minutes time interval after the drug administration. The temperature was maintained at 50-55°C. By eddy's hot plate method the animals were divided into six groups of six animals each and drug treatments were given as per tail-flick method. Animals were placed on the eddy's hot plate maintained at 55±1°C. The reaction time in control and treated animals was recorded at 0, 30, 60,120 and 180 minutes after the treatment [7]. The methanolic extract of *Jatropha gossypiifolia* showed significant analgesic activity when compared with control as well as standard drug but in case of petroleum ether extracts of *Jatropha gossypiifolia* don't exhibit significant analgesic activity when compared with control and Diclofenac treated animals. Thus methanolic extract exhibited marked central analgesic effect as evidenced by significant increase in reaction time when compared to the control.

Neuropharmacological activity

The methanolic extract of *Jatropha gossypiifolia* fruit was evaluated for its neuropharmacological activities by using hole cross test, hole-board test, and elevated plus maze test. Mice were divided into four groups each of containing 5 mice. Group I Control received 1% v/v tween 80 in normal saline at a dose of 0.5 ml/ mice. Group II Positive control receive diazepam 1 mg/kg body weight .Group III receive Test sample I (methanol extract at dose of 200 mg/kg body weight. Group IV receive Test sample II (methanol extract at the dose of 400 mg/kg body weight [2].

In hole cross test the spontaneous movement of the mice from one chamber to other through the hole was observed for 3 min. The observation was conducted at 0, 30, 60, 90 and 120 min. Group III receive Test sample I (methanol extract at dose of 200 mg/kg body weight showed increase in locomotion activity in the test animals at the 2nd observation period (30 min). At the same dose movement of mice decreased with time and extract at dose 400 mg/kg showed an increase in locomotion activity at the second observation period [2]. Hole-board test was adopted for testing the central nervous system activity of methanol fruits extract of gossypiifolia. The study was conducted using a wooden hole-board apparatus measuring 20 cm by 40 cm with 16 evenly spaced holes (each diameter of 3 cm). Thirty minutes after treatment, mice were placed singly on the centre of the board and the number head dipping and the latency until the first entry was counted using a tally counter during a 5 min trial period. The extract at dose 200 mg/kg

body weight showed an increase number in head dipping(55.0 ± 2.05) and latency until the first head dipping (17.4±1.77) behaviour compared to the control group, which were statistically highly significant($p<0.001$). However, the extract at dose 400 mg/kg showed highly significant ($p<0.001$) decrease in latency until the first head dipping (4.2±0.37) behaviour compared with the control group [2].

Anxiolytic activity

The anxiolytic activity of methanol extract of *J.gossypiifolia* fruits was evaluated using the EPM test. The test was initiated by placing the mouse on the central platform of the maze, facing one of the open arms after 30 min of the treatment. The activities of each mouse were recorded for a period of 5 min by using a digital video camera. The parameters were collected; a) Time spent and number of entries in open arm and closed arm (b) number of stretch attend postures (c) number of grooming and (d) number of rearing. The extract at dose 400 mg/kg body weight showed significant ($p<0.05$) increase in the time spent in the open arm to control [2].

Anti-diarrhoeal activity

In Castrol- induced diarrhea inhibition test, the mice were randomly chosen and divided into four groups having 5 mice in each. The mice were fasted overnight before the experiment. Control group receive 1% v/v tween 80 in normal saline, 0.5 ml/mice, Positive control (loperamide) 2mg/kg body weight and test samples (200 mg and 400 mg/kg of body weight). Diarrhoea was induced by oral administration of 0.2 ml castor oil to each mouse, 30 min after the treatment and then each mouse was placed in a separate beaker lined with filter paper for observation. During an observation period of 2 h a numbers of parameters were recorded; (a) onset of dry stool (b) onset of wet stool (c) number of wet stool (d) weight of wet stool and (e) total weight of faecal output. The dose at 200 mg/kg body weight showed decrease in mean latent period for diarrhea episode (32.2 ±0.86 min), whereas at the dose 400 mg/kg showed an increase in mean latent period for diarrhea episode (60. 8± 1.68 min) compare to control. Both the data were statistically highly significant ($p<0.001$) [2].

Anti-cancer activity

Mawardi *et al*., (1990) isolated an anticancer agent, lathyrane diterpene, jatrophatrione from *jatropha gossypiifolia*. Das and venkataiah (1999) present 5-9-5 tricyclic diterpenoid citalitrione as first report from *J.gossypifolia* and its anticancer potential [3].

Hepatoprotective activity

Panda *et al*., (2007) screened extracts of aerial part of *J.gossypiifolia* for its hepatoprotective activity in carbon tetrachloride induced liver damage in Wistar albino rats and recorded maximum protection to petroleum ether extract and minimum to methanol extract [3]. And also investigated the anti-inflammatory and analgesic effects of methanol and petroleum ether extracts of *J.gossypiifolia* which showed maximum effect.

Hypotensive and Vasorelaxant effect

The hypotensive and vasorelaxant effects of ethanol extract from *J.gossypiifolia* were reported in rats by Shah et. al., (2004) [3]. The ethanolic extracts of roots and aerial parts of *jatropha gossypiifolia* of about 125 and 250 mg/kg, over 4 weeks, by oral route in rat produced a reduction of systolic blood pressure [6].

Anti-microbial activity

Ogundare (2007) investigated chloroform and methanol extracts of the leaves in *Tithonia diversifolia* and *jatropha gossypiifolia* against 10 human pathogens namely Staphylococcus aureus, Escherichia coli, Proteus mirabilis, Salmonella typhi, Bacillus subtilis, Shigella dysenteriae, Cornyebacterium diptheriae, Pseudomonas aeruginosa, Streptococcus pneumonia and Candida albicans are reported their antimicrobial effect [3].

The alcoholic leaf extract of *J.gossypiifolia* exhibit significant antibacterial activity by using agar disc diffusion method. It was reported that diterpene jatrophenone is isolated and exhibits *in vitro* antibacterial activity. The methanolic extracts of the leaf, seed, and stem bark have been shown to have anti-bacterial, anti-fungal, anti-viral and anti-parasitic activities. E.coli, S.aureus, B.subtilis have been reported to be sensitive the different extracts of the plant [6].

Haemostatic agent

The normal haemostatic mechanism involves normal functions of blood vessels, platelets and the blood coagulation. Vessels with muscular coats contract following injury thus helping to arrest blood loss. The contraction is aided by the release of vasoconstrictors such as angiotensin.

Mechanism of action of *Jatropha gossypiifolia* was investigated by adding 0.1 ml of the neat latex (undiluted) to 1 ml of 30 % bovine albumin. Serial dilutions of latex were then made with distilled water. ½, ¼, 1/8, 1/16, 1/32, 1/64, 1/128, and 1/512, 0.1ml of each dilution was added to 1 ml of 30% bovine albumin.

The clotting time without adding stem latex was 6 minute 25 second while it was 5 seconds when stem latex was added. The difference was statistically significant ($p<0.05$). The reference range for whole blood clotting time is 6-9 minutes at 37°C. The bleeding time without adding stem latex was 2 minutes 20 second while it was 2 seconds on addition of stem latex. The difference was statistically significant ($p<0.05$). The reference range for bleeding time is 2-5 minutes. *J.gossypiifolia* latex and fresh juice used as haemostatic agent for preventing bleeding disorders. The methanol, petroleum ether and water extracts from the aerial parts of *J.gossypiifolia* restored the serum levels of serum glutamate oxaloacetate transaminase, serum glutamate pyruvate transaminase, serum alkaline phosphatase, total bilirubin, superoxide dismutase, catalase [6].

Ouduola *et al*. (2005) investigated the coagulant activity of the stem latex in *J.gossypiifolia* and reported its mechanism of action was found to be the highest at a concentration of 0.1 ml per ml of blood. Stem latex of *J.gossypiifolia* is used by local and urban dwellers in southern Nigeria to stop bleeding from nose, gum and injured skin. Oduola *et al*. (2007) investigated safety of its use in different groups of wistar albino rats at different doses of latex [3].

Mechanism of action of *Jatropha gossypiifolia* was investigated by adding 0.1 ml of the neat latex (undiluted) to 1 ml of 30 % bovine albumin. Serial dilutions of latex were then made with distilled water. ½, ¼, 1/8, 1/16, 1/32, 1/64, 1/128, and 1/512, 0.1ml of each dilution was added to 1 ml of 30% bovine albumin [3].

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Anti-diabetic activity

The extracts from *J.gossypiifolia* inhibit glucosidase and prevent the liberation of D glucose from dietary carbohydrates and delay the absorption of glucose which in turn reduce plasma glucose level and decrease hyperglycaemia. Thus *J.gossypiifolia* possesses significant anti-diabetic activity [6].

Anti-inflammatory activity

The methanolic extract of *jatropha gossypiifolia* leaves at 500 and 1000 mg/kg oral doses, inhibited the acute carrageenan paw edema in rats and at 50 and 100mg/kg oral doses, inhibited the chronic cotton pellet induced granuloma formation in rats. The leaf paste at 0.5 and 1mg/ear showed significant reduction in TPA-induced local inflammatory changes in mouse ear oedema model. The ethanol and water extracts of *J.gossypiifolia* leaves have anti-inflammatory, using the *in vitro* human red blood cell membrane stabilization method. The human red blood cell membranes are similar to the lysosomal membrane components, the prevention of hypo tonicity-induced membrane lysis of these cells could be taken as a measure in estimating the anti-inflammatory property of compounds [6].

The albino rats were divided six groups of six animals each. Group I received 0.2ml of 2% w/v carboxy methyl cellulose suspension orally for 7 days as a control group, Group II received 100 mg/kg body weight of methanolic extract of *Jatropha gossypiifolia* orally for 7 days. Group III received 200 mg/kg body weight of methanolic extract of *Jatropha gossypiifolia* orally for 7 days; Group IV received 100 mg/kg body weight of petroleum ether extract of *jatropha gossypiifolia* orally for 7 days. Group V received 200 mg/kg body weight of petroleum ether extract of *jatropha gossypiifolia* orally for 7 days and group VI received 10 mg/kg of body weight of indomethacin intraperitoneally for 7 days as a standard drug. Acute inflammation was induced in all groups by injecting 0.1 ml of 1% w/v carrageenan into the sub-plantar region of the right hind paw of rats. On 7th day, paw volume was measured 1h prior to carrageenan injection using plethysmometer and at 0 and 3 hr after the carrageenan injection [7].

The methanolic extract of *J.gossypiifolia* at 100 mg/kg reduced the paw volume by 50.99% whereas 200 mg/kg shows 64.24%. It shows inhibitory carrageenan induced paw edema thus exhibiting anti-inflammatory effect against acute inflammation. Petroleum ether extract of *Jatropha gossypiifolia* at 100 mg/kg reduce the paw volume 04.63% and at 200 mg/kg exhibited 07.28% reduction in paw volume. So petroleum ether extract of *Jatropha gossypiifolia* don't possess significant anti-inflammatory activity when compared with control and Indomethacin treated animals. It may be due to absence of flavonoids in the petroleum ether extract.

Pharmacological activity of *Senna alata*

Antioxidant activity

Total phenolics and flavonoids were higher in the ethanol extract (78.21 mg GAE/g and 39.29 mgQE/g respectively) than aqueous and acetone extracts. *Senna alata* extracts at 10µg/ml, the acetone, ethanol and aqueous extracts scavenged 23.1%, 45.2% and 35.1% of the DPPH radical respectively, while at 150 µg/ml, 69.1%, 89.6% and 78.5% of the stable radical was scavenged. Overall the ethanol extract exhibited higher scavenging ability(IC= 45.18 µg/ml) than the other extracts [8]. Similar results were obtained for the ABTS radical cation scavenging activity, with a range from 28.5% to 93.2%. The ethanol extract exhibited the highest ABTS radical cation scavenging ability amongst all the extract and its activity at 150 µg/ml, was close to BHA (96.1%). The ethanol extract of *senna alata* possess high level of total phenolics and flavonoids with values of 78.21mgGAE/g and 39.29 mgQE/g and exhibited the simplest antioxidant activity within the DPPH and ABTS assays (IC50=45.18 and 39.14µg/ml respectively) [9].

Anti-inflammatory activity

The hexane extract of *Cassia alata* 500 mg/kg was administered to CFA arthritis, as a chronic model of inflammation. Changes in knee joint swelling, cartilage integrity and synovial fluid leukocyte count were assessed. *Cassia alata* considerably reduced knee joint swelling and provided protection against cartilage degradation. Leukocyte count and cavity secretion was reduced. These results suggest anti-inflammatory activity of *Cassia alata* [9].

Antibacterial activity

The antibacterial activity of chloroform extract of the seed oil of *Cassia alata* and disc diffusion technique against pathogenic gram positive and gram negative bacterial strain. The extracts showed anti-bacterial activity at 0.1 ml/disc concentration against gram (-) bacteria and gram (+) bacteria. Additionally the extract showed 8mm, 9 mm, and 13 mm inhibition zone against staphylococcus aureus, Bacillus subtilis and 9 mm, 11 mm, 9mm, 10mm and 12mm zone of inhibition was shown against Gram (-) bacteria Shigella typhi, E.coli, Vibrio cholera (9). Antimicrobial activity of the aqueous and organic extracts of the plant sample was evaluated by the cup plate agar diffusion method. In antimicrobial susceptibility testing, all the extracts demonstrated significant activity against gram positive bacteria and fungi. The highest activity was demonstrated by methanol extracts of both the roots and the leaves. Of the bacteria tested Str.pyrogens and S.aureus were the most susceptible to all the extracts followed by Salmonella typhi and Escherichia coli. Of the fungal species tested, the most susceptible were Cryptococcus neoformans and C.albicans while the least susceptible was A.flavus. The results of MIC and MMC determination showed that the MIC and MMC of the extracts ranged between 6-20mg/ml and 25-100 mg/ml for the bacteria and fungi respectively while those for the antimicrobial agents ranged between 3-20 mg/ml and 12-100 mg/ml for the bacteria and fungi respectively. Low MIC is an indication of high efficacy of the plant extract while high MIC indicate low efficacy or possible Development of resistance by the microorganisms To the antimicorbials.The antimicrobial activity of S.alata

Provides scientific basis for its use in the treatment of gastrointestinal, urinary tract and wound infections as well as mycotic infections [10]. The antimicrobial assay was carried out using disc diffusion method. Streptomycin and tetracycline (50µg/ml each) are used as reference drugs and the corresponding solvents (ethanol, methanol, chloroform, acetone, benzene, petroleum ether and aqueous) are used as positive controls. About 20 ml of nutrient agar medium for bacteria was poured in the sterilized Petri dishes and allowed to solidify. The agar medium was spread with 24hrs cultured 10^8 CFU/ml of microbial strains by a sterilized rod. Discs of 6 mm in diameter were made in the culture medium using sterile cork borers. About 50µl, 75 µl, and 100 µl of the plant extracts (1mg/ml) were added to the discs. Different volume impregnated disc were placed on the bacterial swapped plates. Plates were incubated at 37°C for 24 hrs. Antimicrobial activity was evaluated by measuring the inhibition zone diameters in mm formed around the disc. The assay was carried out in triplicates. S.typhi, B.subtilis was found to be more susceptible toward the aqueous and chloroform extract of leaves with a maximum inhibitory zone (28mm). Among all the extract of *S.alata* had the wider spectrum of inhibitory activity on streptomycin-resistant E.coli when compared to all the other organisms. It was slightly sensitive to Alcaligenes sp. And P.fluorescen. *S.alata* aqueous extract had inhibitory activity ranging from 27-28 mm. aqueous extract showed very significant antimicrobial activity against the tested organism. The order of antimicrobial efficacy is aqueous-chloroform-ethanol-petroleum ether-benzene-methanol-acetone. Increase the concentration of extract increase zone of inhibition. The results revealed that the flavonoids, terpenoids and anthraquinones which were abundantly found in distilled water, chloroform extracts of *S.alata* leaves [11].

Hypolipidaemic activity

Methanol extract of *Senna alata* was evaluated for its hypolipidemic activity in diet-induced lipedemia in mice. *Senna alata* extracts considerably lowered body weight of mice. *Cassia alata* leaf extract restores insulin sensitivity in high-fat-diet-induced obese mice and reduced epididymal fat weight and adipocyte size (Naowaboot & Piyabhan 2017) [9].

Hepatoprotective activity

Hepatoprotective activity of the alcoholic extract of the dried leaves of ringworm *Cassia alata* was studied against Paracetamol induced hepatic injury in albino rats. Pre-treatment of the ECA reduced the biochemical markers of hepatic injury like serum glutamate pyruvate transaminase (SGPT), Serum oxaloacetate transaminase (SGOT), alkaline phosphatase (ALP), total bilirubin and gamma glutamate transpeptidase (GGTP). The results indicate that the leaves of *Cassia alata* possess hepatoprotective activity. This heapatoprotective property is attributed to the active principles of the plant particularly, flavonoids, tannins, and alternative polyphenolic compounds (Ramasamy et.al 2009) [9].

Anti-diabetic activity

The therapeutic effect of *Cassia alata* leaf aqueous extract on oxidative. stress in aorta as well as heart of streptozotocin in hyperglcemic rats (Ishak *et al*., 2015). *Cassia alata* has significantly reduced Malondialdehyde (MDA) levels and also it has increased antioxidant activity and also it helps in lowering the blood glucose level. Therefore, *Cassia alata* could also be effective therapeutic treatment against oxidative stress induced cardiac dysfunction in hyperglycemia and anti-diabetic functions [9]. Antidiabetic effect of *Cassia alata* was studied by Abo *et al*. 2008, Giron *et al*. 1991, Khan & Yadava 2010. Through the previous studies done by the researchers, some preliminary *in vivo* studies have been conducted to confirmed the antidiabetic potential of 85% of ethanol leaves extract as a reducer of the blood sugar level in the streptozotocin-induced hyperglycaemic animals (Palanichamy *et al*. 1988), Kazeem *et al*. 2015 studied the effect of *Cassia alata* leaf extracts by oral administration into the sucrose-induced hyperglycaemic male wistar rats. The results showed significant reduction in the postprandial blood glucose level. Kazeem *et al*. 2015 found that both hexane and acetone extracts inhibited α-glucosidase and α-amylase *in vitro* in a competitive and uncompetitive manner respectively.Verghese *et al* .(2013) α-glucosidase, revealed that cassia alata showed an anti-diabetic activity [9].

Cytotoxicity effect

The cytotoxicity effect of chloroform fraction of leaves was assessed by MTT assay against three human cancer cell lines MDA-MB-231, HepG2 and Caco2. A remarkable cytotoxicity was observed against HepG2 IC50= 37.4µg/ml at treatment time 4 h, whereas weak toxicity effect on MDA-MB-231 and Caco2 cells with IC50 values > 100 µg/ml. The anticancer activity against HepG2 cell was attributed to anthraquinone content (Mohammed *et al*., 2017) [9]. The cytotoxicity effects of hexane extract of the plant leaves in A549 lung cancer cells. The MTT assay was used and the IC50 values were 143 µg/ml. The toxicity effect was mediated by caspase 8 activation which may attributable to kaempferol. The hydromethanolic leaf extract of *Cassia alata* was evaluated by the WST-1 assay by using K562 leukaemia cell line (Adebesin *et al*. 2013) [9].

Conclusion

Based on this review *J.gossypiifolia* presents an important potential for drug development based on popular uses and biological studies. However further studies are necessary to verify important folkoric uses of the various parts of the plant. Further research into bioactivity guided fractionation of extracts and isolation of compounds responsible for various pharmacological activities such analgesic, anticholinesterase, anti-diabetic, anti-hypertensive, antisickling and neuropharmacological activities, *Senna alata* Roots, leaf, bark, flower and seed extracts possesses biological activities such as antimicrobial, anti-inflammatory, analgesic, antitumor, antioxidant and immune stimulating activities. This is imperative for further formulation studies and drug development.

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