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# PHARMACOLOGICAL EFFECTS AND THERAPEUTIC PROPERTIES OF *HIBISCUS CANNABINUS* - A REVIEW

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**Abstract:**
*The phytochemical analysis of Hibiscus cannabinus showed the presence of phytosterols, flavonoids, polyphenols, tannins, steroids, alkaloids, saponins, lignans, essential oils, glucosides such as cannabiscitrin, cannabiscetin and anthocyanin glycoside. The pharmacological studies revealed that Hibiscus cannabinus possessed cytotoxic, anthelmintic, antibacterial, antiulcer, antidiabetic, hypolipidemic, antioxidant, immunological, haematinic and hepatoprotective effects. This review will highlight the chemical constituents, pharmacological and therapeutic properties of Hibiscus cannabinus.*

**Keywords:** *chemical constituents, pharmacology, Hibiscus cannabinus*

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## INTRODUCTION:

As a result of accumulated experience from the past generations, today, all the world's cultures have an extensive knowledge of herbal medicine. 75% of the world's population used plants for therapy and prevention. Plants are a valuable source of a wide range of secondary metabolites, which are used as pharmaceuticals, agrochemicals, flavours, fragrances, colours, biopesticides and food additives[1-10]. The phytochemical analysis of *Hibiscus cannabinus* showed the presence of phytosterols, flavonoids, polyphenols, tannins, steroids, alkaloids, saponins, lignans, essential oils, glucosides such as cannabiscitrin, cannabiscetin and anthocyanin glycoside. The pharmacological studies revealed that *Hibiscus cannabinus* possessed cytotoxic, anthelmintic, antibacterial, antiulcer, antidiabetic, hypolipidemic, antioxidant, immunological, haematinic and hepatoprotective effects. This review described and discussed the chemical constituents, pharmacological and therapeutic properties of *Hibiscus cannabinus*.

**Plant profile:**

**Synonyms:**

*Abelmoschus congener* Walp., *Abelmoschus verrucosus* Walp., *Furcaria cannabina* Ulbr., *Furcaria cavanillesii* Kostel., *Hibiscus malangensis* Baker f. and *Hibiscus vanderystii* De Wild[11].

**Taxonomic classification:**

**Kingdom:** Plantae, **Subkingdom:** Viridiplantae, **Infrakingdom:** Streptophyta, **Superdivision:** Embryophyta, **Division**: Tracheophyta, **Subdivision**: Spermatophytina, **Class**: Magnoliopsida, **Superorder**: Rosanae, **Family**: Malvaceae, **Genus**: *Hibiscus*, **Species**: *Hibiscus cannabinus*[12].

**Common names:**

**Arabic :** Jaljal; **Chinese:** da ma jin; **English:** Bastard-jute, bimli-jute, Deccan-hemp, Indian-hemp, Java-jute, Kenaf, Kenaf hibiscus; **French:** chanvre de Bombay, chanvre de Guinée; **German:** Ambari, Dekkanhanf, Gambohanf, Jawa-Jute, Kenaf; **Hindi:** Ambary, mesta, patsan, pitwa; **Italian:** ibisco; Japanese: kenafu; **Korean:** yangma**; Spanish:** apocino**; Swedish:** kenaf[13].

**Distribution:**

*Hibiscus cannabinus* was a warm-season annual fiber crop. It was native to Africa [Kenya, Tanzania, Uganda, Chad, Ethiopia, Somalia, Sudan, Angola, Malawi, Zambia, Mozambique, Zimbabwe, Botswana, Namibia, South Africa, Ghana, Mali, Nigeria, Senegal, Burundi, Cameroon, Central African Republic, Rwanda and Zaire], and has been commercially cultivated in Asia, such as Russia, China, India, Malaysia, Thailand, Iran, Iraq and many other countries[13-15].

**Description:**

Annual herb, up to 2 - 5 m, stem erect, slender, cylindrical, prickly on wild accessions. Leaves alternate, simple; stipules filiform, 5–8 mm long, pubescent; petiole 3–30 cm long; blade 1–19 cm × 0.1–20 cm, 3–7-lobed in lower part of plant, often unlobed in upper part or even bractlike near the apex, base cuneate to cordate, apex acuminate, margins serrate or dentate, upper surface glabrous but with a prominent, 3 mm long nectary at the base of the midrib, lower surface hairy along the veins. Flowers axillary, solitary or sometimes clustered near the apex of the plant, bisexual, 5-merous, 7.5–10 cm in diameter; pedicel 2–6 mm long, articulated at the base; epicalyx of 7–8 linear segments 7–18 mm long, persistent; calyx campanulate with acuminate to subcaudate lobes 1–2.5 cm long [up to 3.5 cm in cultivars], persistent, green, bristly and with a characteristic white, woolly, arachnoid tomentum especially near the base and margins, with a prominent nectary gland on each midrib; petals free, usually spreading, twisted clockwise or anticlockwise, obovate, 4–6 cm × 3–5 cm, outer side stellate-pubescent, usually cream to yellow with red inner base, sometimes blue or purple; stamens numerous, filaments united into a column surrounding the style, 17–23 mm long, dark red, with yellow or red anthers; ovary superior, ovoid, villose, 5-celled, style branching into 3–5, hairy arms 2–4 mm long, each branch ending in a capitate stigma. Fruit an ovoid, shortly beaked capsule 12–20 mm × 11–15 mm, densely appressed pubescent, 20–25[–35]-seeded. Seeds reniform to triangular with acute angles, 3–4 mm × 2–3 mm, grey to brown-black with pale yellowish spots, hilum brown[16].

**Traditional uses:**

The flowers were considered emollient, and an infusion of the petals was used as a demulcent. Its decoction was given in bronchial catarrh in India[17]. Seeds were considered aphrodisiac, fattening, aphrodisiac, purgative, for stomachic, bilious conditions, bruises, fever, and puerperium. Powdered leaves were applied to Guinea worms in Africa. Africans use peelings from the stems for anemia, fatigue, lassitude, etc. In Gambia, the leaf infusion was used for coughs. In local medicine in Kenya, pounded roots were administered to spider bites, and leaves were used to treat stomach disorders. In West Africa, powdered leaves were applied to sores and boils, and a leaf infusion was administered for

treatment of cough. In India, juice from the flowers was taken against biliousness. Seeds were applied externally to aches and bruises, juice of the flowers with sugar and black pepper was used in biliousness with acidity[16,18-22].

It was also used as antidote to poisoning with chemicals [acid, alkali, pesticides] and venomous mushrooms[22].

**Parts used:**

Flowers, leaves and seeds[16, 18, 19-22].

**Chemical constituents:**

Phytochemical analysis showed the presence of phytosterols, flavonoids, polyphenols, tannins, steroids, alkaloids, saponins, lignans, essential oils, glucosides such as cannabiscitrin, cannabiscetin and anthocyanin glycoside, cannabinidin[17, 20, 23-26].

*Hibiscus cannabinus* contained moisture 11.82 ± 0.45 %, ash content 5.11 ± 0.15 %, crude fibre 29.61 ± 0.22 %, lipids 2.33 ± 0.34%, crude protein 13.78 ± 1.17 % and carbohydrate 37.67 ±1.03 %. It also contained phytic acid 19.78 ±1.80 mg/100g, tannins 2.74 ± 0.47 mg/100g and oxalates 158.5 ± 0.07 mg/100g[27].

Seeds from nine kenaf genotypes [Cubano, Everglades 41, Everglades 71, GR2563, Guatemala 48, Indian, 178-18RS-10, Tainung 1, and Tainung 2] were evaluated for oil, fatty acid, phospholipid, and sterol content. Oil content was ranged from 21.4 to 26.4% with a mean of 23.7%. Total phospholipids was ranged from 3.9 to 10.3% of the oil, with a mean of 6.0%. Mean sterol percent was 0.9 and ranged from 0.6% of the total oil for 178-18RS-10 accession to 1.2% for Everglades 71. Palmitic [20.1% of the total fatty acids], oleic [29.2%], and linoleic [45.9%] were the major fatty acids, and palmitoleic [1.6%], linolenic [0.7%], and stearic [3.5%] were the minor components. Medium [C12-C14] and long [C22-C24] chain fatty acids were less than 1%. Sphingomyelin [4.42% of the total phospholipids], phosphatidyl ethanolamine [12.8%], phosphatidyl choline [21.9%], phosphatidyl serine [2.9%], phosphatidyl inositol [2.7%], lysophosphatidyl choline [5.3%], phosphatidyl glycerol [8.9%], phosphatidic acid [4.9%], and cardiolipin [3.6%] were identified in the nine genotypes. Phosphatidyl choline, phosphatidyl ethanolamine, and phosphatidyl glycerol were the dominant phospholipids[28].

*Hibiscus cannabinus* seeds yield vegetable oil which was edible for human consumption. GC/MS studies of the light petroleum extracts of *Hibiscus cannabinus* bark and core showed that the non-polar lipid constituents were essentially fatty acids [30.7% in bark; 53.3% in core], long chain alcohols [19.3% in bark], alkanes [22.0% in bark], sterols [12.5% in bark; 25.4% in core] and triterpenes [11.2% in bark]. Octacosanyl eicosanoate [15.7%] was detected only in the bark extract. The chemical composition of the light petroleum extract of the bark and core of *Hibiscus cannabinus* % respectively were: lauric acid - and 0.3, myristic acid 0.3 and 0.5, pentadecanoic acid – and 0.4, palmitoleic acid – and 0.5, palmitic acid 7.1 and 14.1, linoleic acid 6.2 and 10.4, oleic acid 5.9 and 9.8, stearic acid 2.4 and 4.9, eicosanoic acid 1.7 and 1.7, eicosanol 0.5 and - , eicosanoic acidc 3.6 and - , uncosanoic acid – and 0.6, docosanol 1.2 and 0.7, docosanoic acid 2.1 and 3.6, tricosanoic acid 0.6 and 2.8, tetracosanoic acid 0.8 and 2.7, nonacosane 2.2 and -, pentacosanoic acid – and 1.0 1, hexacosanol 3.5 and - , untriacontane 19.7 and - , octacosanol 10.8 and -, campesterol 1.6 and 5.5, stigmasterol 2.8 and 6.9 , β-sitosterol 8.1 and 12.9, lupeol 2.2 and - , tricontanol 3.3 and - , glutinol 7.8 and -, motiol 1.2 and - , stigmast-4-en-3-one - and 1.4 , stigmast-4-en-3,6-dioned - and 2.2 and stigmast-4-en-3,6-dionee - and 0.9[29].

Amino acid composition of *Hibiscus cannabinus* leaves [ g/100 g protein] were: lysine 3.96, threonine 3.25, cysteine 0.90, valine 3.85, methionine 0.91, isoleucine 2.81, leucine 7.05, tyrosine 3.06, phenylalanine 4.55, histidine 2.41, arginine 5.02, aspartic acid 7.02, serine 1.45, glutamic acid 11.11, proline 2.50, glycine 0.72 and alanine 1.65[27].

Proximate analysis of carotenoids [mg/100 g dry weight] in the leaves of *Hibiscus cannabinus* showed that they contained [mg/ 100 g dry weight]: xanthophylls [neoxanthin: 5.95, violoxanthin: non detectable, leutin: 33.97 and zeaxanthin: 0.14]; total xanthophylls: 40.06, provitamin A carotenoids: 26.02 [α-carotene non detectable and β-carotene: 26.02 [30].

About 70–80% of the core hemicelluloses, and 60–70% of the hemicelluloses of the bark were extracted with 5% KOH aqueous solutions. The extracted hemicellulose was composed mainly of glucuronoxylans with high content of uronic acids [xylose: uronic acid: 3–5: 1 for bark and 5–10: 1 for core]. The hemicellulose fraction extracted with 24% KOH aqueous solutions was composed mainly of glucuronoxylans [80–90%] and glucomannans [10–15%]. The results obtained by the permanganate oxidation method indicated that kenaf lignins were H-G-S type with approximate H: G: S molar proportions of [9–13]: [55–60]: [27–34] in bark and [14–20]: [57]-[74]: [12–23] in core, which evidenced a high content of H and G units and a relatively low content

of S units when compared with traditional dicotyledons. The relative proportion of H, G and S units as well as the structural features of lignins depends on the stage of maturity and on the morphological region of the plant[31].

**Pharmacological effects:**

**Cytotoxic effect:**

*Hibiscus cannabinus* seed oil [KSO] from supercritical carbon dioxide extraction fluid [SFE]. was screened for cytotoxicity towards human colorectal cancer cell lines [HT29] and mouse embryonic fibroblast [NIH/3T3] cell lines using MTS assay. KSO-SFE showed the strongest cytotoxicity towards HT29 with IC50 of 200 $\mu$g/ml. Cell cycle analysis showed a significant increase in the accumulation of KSO-SFE-treated cells at sub-G1 phase, indicating the induction of apoptosis by KSO-SFE[32].

The cytotoxic activities of six lignans isolated from the core and bark acetone extracts of *Hibiscus cannabinus* were investigated *in vitro*. Two compounds showed strong cytotoxic activity against HeLa, Hep-2 and A-549 cell lines while one compound showed moderate activity on HeLa cells when they were in advanced stage of cellular division[22].

**Anthelmintic activity:**

The anthelmintic activity of *Hibiscus cannabinus* leaf extract was investigated against adult earthworm, *Pheritima posthuma*. The methanolic extract of the crude *Hibiscus cannabinus* leaf at concentrations of 10, 20, 30 and 40mg/ml were tested by the determination of paralysis time and death time. Methanolic extract of the *Hibiscus cannabinus* leaves showed good anthelminthic activity in comparison with albendazole[33].

**Antibacterial effect:**

The antibacterial effects of aqueous and ethanol extracts of *Hibiscus cannabinus* leaves [120000-12 µg/10ml] were studied against *Salmonella typhimurium*. The extracts showed different activity, the growth inhibition zones ranged between 12.67±1.52 to 6.67±1.15mm for the aqueous extract and 12.33±2.08 to 6.33±0.58mm for the ethanol extract[23].

In studying the antibacterial activity of *Hibiscus cannabinus* leaves extracts, acetone extract exerted antibacterial activity against *Klebsiella* Sp. [ 9mm at concentration of 10 µl]. Chloroform extract showed antibacterial activity against *E. coli* [10, 8 and 10 mm at concentration of 10, 20 and 30 µl], against *Klebsiella* Sp. [ 12mm at concentration of 10 and 30 µl], against *Pseudomonas* Sp. [ 14 and 12 mm at concentration of 20 and 30 µl] and against *Staphylococcus* Sp [11mm at concentration of 30 µl][34].

**Antiulcer effect:**

The antiulcer properties and percentage protection of *Hibiscus cannabinus* seed oil were evaluated towards many ulcer-inducing models in rats. *Hibiscus cannabinus* seed oil showed an ulcer protective effect towards ethanol, non-steroidal anti-inflammatory drugs [NSAIDs] and cold restrain stress induced ulcers. *Hibiscus cannabinus* seed extract [HSSE] exhibited an exceptionally high ulcer protection of 74.98 ± 0.78% against NSAIDs induced ulcer. The gastric lesions were controlled primarily by both mucosal protection and acid inhibition of the oil[35].

**Antidiabetic effect:**

The antidiabetic activity of methanolic extract of *Hibiscus cannabinus* leaves was evaluated in streptozotocin induced diabetic rats. The alcoholic extract was orally administered at a dose of 400mg/kg bw for 15 days. The result showed that the alcoholic extract of *Hibiscus cannabinus* leaves significantly lowered the blood glucose in hyperglycemic rats[17].

**Hypolipidemic effect:**

The hypolipidemic effect of 50% hydroalcoholic extract of *Hibiscus cannabinus* leaves was evaluated in high fat diet fed rat model. The extract exhibited a strong dose dependent antihyperlipidemic activity and at dose level of 400mg/kg po, the extract showed a significant decrease in the levels of serum TC, TG, LDL-C, VLDL-C and TBARS. The extract also markedly prevented the liver microvesicular steatosis in hyperlipidemic rats[24].

**Immunological effect:**

The total crude 80% ethanol extract of *Hibiscus cannabinus* fresh leaves, significantly suppressed TNF-alpha production and the mRNA expression of interleukin [IL]-3 and IL-12 in the RAW264.7 cells, stimulated by lipopolysaccharide [LPS, 2.5 microg/ml]. The secretion of inflammatory mediators [i.e., nitric oxide, reactive oxygen species and prostaglandin E2 ] was diminished by the ethanol extract. The extract induced the expression of heme oxygenase-1 [HO-1] mRNA, a potent cytoprotective molecule. The extract suppressed both the phagocytic uptake and the expression of co-stimulatory molecules [CD80 and CD86] of LPS-activated RAW264.7 cells. The extract also down-regulated both the functional activation of beta1-integrin

[CD29] and the LPS-induced up-regulation of the surface CD29 level[21].

**Haematinic effect:**
The haematinic effect of orally administered aqueous extract of *Hibiscus cannabinus* leaves was studied in haemolytic anaemic in rats. Anaemia was induced by an oral administration of phenylhydrazine for a period of 8 days. Phenylhydrazine induced a significant decrease [P<0.05] in the blood parameters indicating anaemia and also resulted in significant increase [P<0.05] in the mean cell haemoglobin, mean cell volume values, which indicated macrocytosis. Leaf extract of *Hibiscus cannabinus* induced a significant [P<0.05] increase in the red blood cell count, haemoglobin concentration, and pack cell volume [which had been originally decreased by phenylhydrazine administration] within one week of treatment. The presence of macrocytosis turn towards normal as the animals recovered from anaemic condition[20].

**Antioxidant effect:**
Different extracts of *Hibiscus cannabinus* flowers [HCF] were investigated for free-radical scavenging properties *in vitro*, and their capacity to protect DNA from oxidative damage and inhibiting gelatinolytic activity of collagenase type I and II. The DPPH free radical scavenging activity ranged from 440 to 700µg/ml for different extracts. A similar trend was visible in reducing power activity. Both activities reflected a strong anti-oxidant potential of HCF and in turn against stress. Furthermore, both extracts at 100 µg/ml were efficient in protecting DNA against oxidative damage and exhibited inhibition of gelatinolytic activity of collagenase type I up to 87% and type II up to 65%. Cumulatively, *Hibiscus cannabinus* flower extracts can be used as a potent functional food to control oxidative stress, free radical-induced DNA damage and bone related disorders like osteoarthritis[36].

**Hepatoprotective effect:**
The hepatoprotective activity of a daily oral dose [1.6 g/ kg bw] of aqueous leaf extract of *Hibiscus cannabinus* was investigated over a two week period in albino rats. Liver damage in rats was induced by carbon tetrachloride and paracetamol . The induction was confirmed by increased plasma transaminases activities, total bilirubin concentration and thiobarbituric acid reactive substance [TBRs, a measure of lipid peroxidation]. Histopathological examinations substantiated this liver damage with fatty deposits, severe inflammation and severe necrosis. The aqueous leaf extract of *Hibiscus cannabinus* possessed significant [P<0.05] hepatoprotective activity against hepatic damage represented by lowering the plasma transaminases and bilirubin concentration significantly [P<0.05], absents of necrosis in liver cells of rats pretreated with extrac and inhibition of lipid peroxidation[37].

**Side effects and toxicity:**
The toxicity study revealed that the methanolic extract of *Hibiscus cannabinus* was nontoxic up to 5g/kg bw[7]. The toxicity of dried aqueous extract of *Hibiscus cannabinus* leaves was investigated in mice and Wistar albino rats. Mice were used for acute toxicity test while rats were used for both subchronic and sub-acute toxicity test. Acute toxicity was determined by LD50 while serum biochemical parameters were used as makers of sub-acute and sub-chronic toxicity. The extract given orally was better tolerated than when given intraperitoneal [LD50: 4.47g/kg]. In the sub-acute and sub-chronic toxicity investigations, there was no significant [P>0.05] difference in some of the serum biochemical parameters between the control and the test animals. However, a significant [P<0.05] cholesterol, triglyceride and glucose lowering activity were observed in test animals when compared with the control animals. The results suggested that *Hibiscus cannabinus* extract was well tolerated by the experimental animals, furthermore, it possessed hypolipidaemic and hypoglycaemic activities[38].

## CONCLUSION:
The current review discussed the chemical constituents, pharmacological and toxicological effects of *Hibiscus cannabinus* as a promising herbal medicine as a result of effectiveness and safety.

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