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PHARMACOLOGICAL PROPERTY OF *HIBISCUS SABDARIFFA*- A REVIEW

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ABSTRACT

Hibiscus sabdariffa belongs to the family Malvaceae known as Roselle, Gonguru, and Sorrel. The each part of this plant is effective in many diseases such as diabetes, hypertension, obesity and cancer. The plant contains powerful antioxidant. It has good amount of anthocyanin, flavonoids and phenols. Due to the presence of bioactive compounds it shows anti-inflammatory activity, anti-bacterial activity, anti-diabetic activity, anti-obesity activity and anti-hypertensive activity. As the plant contains many beneficial properties so it also used traditionally in herbal drinks, in hot and cold beverages, as a flavoring agent in food industries and as a herbal medicines. In this review nutritional, pharmacological and phytochemical properties of this plant are concluded.

Key Words:- Malvaceae, Anthocyanin, Anti-diabetic, Anti-inflammatory, Anti-obesity.

INTRODUCTION

Today herbs are widely use as medicines to cure many diseases and infections. The herbs are also considered safe for health as they have no side effects as compare to synthetic drugs. The plants contain many medicinal properties and use from the ancient time. Plants are the rich source of all elements which are essential for human being (Vermani A *et al.*, 2010; Gami B and Parabia MH, 2010; Indrayan AK *et al.*, 2005). One of the important plants is *Hibiscus sabdariffa* is a species of hibiscus and includes more than 300 species for an annual herb, shrub and trees (Wang ML *et al.*, 2012). The old world tropics, commonly known as Roselle plant, with an attractive flower are cultivated in Sudan, India, Malaysia and Taiwan. The plant is widely grown in tropics like Caribbean, Central America, India, Africa, Brazil, Australia, Hawaii, Florida and Philippines as a home garden crop of export especially in western part where it

occupies second place area wise after pearl millet followed by Sesamum (Mahadevan N *et al.*, 2009)

MORPHOLOGY

The Hibiscus flowers are belongs to the family Malvaceae is an annual or perennial herb or woody-based- shrub, growing to 2-2.5 m tall. The leaves are deeply 3-5 lobed, 8-15 cm long, arranged alternately on the stem. The flowers are 8-10 cm in diameter, white to pale yellow with a dark red spot at the base of each petal, and have a stout fleshy calyx at the base, 1-2 cm wide, enlarging to 3-3.5 cm, fleshy and bright red as fruit matures. It takes six months to mature. The plant is widely cultivated for its strong fibers and it is well known for its edibility and medicinal properties, though the calyx is the most frequently used portion of the plant, the leaves and seeds are made into salads, curries and potherbs (Prenseti E *et al.*, 2005; Okereke CN *et al.*, 2015).

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Vernacular names

Hibiscus sabdariffa has common names such as “Roses of anthea” “Africa mallow”, ‘Roselle’, “Roselle

mallow”, “Indian sorrel”, “Flore de Jamaica tea. *Hibiscus sabdariffa* is known as “Roselle” in Australia, ‘Tengamoron’ in Assam, ‘Gongura’ in Hindi, ‘Krajeab’ in Thailand, “Bissap” in Senegal, Guinea Bissau, Mali, Burkina Faso, Ghana, Benin, Niger, Congo and France. ‘Wonjo’ in Gambia, ‘Torosh’ in Iran, ‘Sorrel’ in Caribbean, ‘Karkade’ in Egypt, ‘Assam Paya’ in Malaysia, “Luosshen Hua’ in Chinese, ‘Lamanda’ in Zambia and “Zobo’ in Nigeria (Mohamed BB *et al.*, 2012).

Biochemical components

The nutritional analysis of roselle plant by proximate method found 68.7% carbohydrate content was highest followed by crude fiber 14.6% and ash content 12.2%. The plant is also rich in minerals especially potassium and magnesium. Vitamins (ascorbic acid, niacin, and pyridoxine) were also present in appreciable amounts. Plants have the capacity of producing secondary metabolites like proteins, steroids, alkaloids, etc that will enhance its nutritive value (Puro K *et al.*, 2016, Ismail A *et al.*, 2008).

The chemical components present in the flowers of *Hibiscus sabdariffa* include anthocyanins, flavonoids and polyphenols. The petals are good source of antioxidant agents as anthocyanins and ascorbic acid (Tzu-Li Lin HH *et al.*, 2007; Formgio ASN *et al.*, 2015). The flowers are rich in anthocyanins which is responsible for red color of flowers (Arab AAA, 2011; Cisse *et al.*, 2009) while the acid taste is due to the presence of organic acid.

PHARMACOLOGICAL PROPERTIES

Anti-diabetic activity

The protective effect of polyphenols extract of Hs was studied in a type II diabetic rat model. At a dose of 200 mg/kg, the extract verified anti-insulin resistance properties as it reduced hyperglycaemia and hyperinsulinemia. It decreased serum triacylglycerol, cholesterol lipoprotein/high density protein (LDL/HDL), as well as reduced the plasma advanced glycation end products (AGE) formation and lipid peroxidation (Peng CH *et al.*, 2011). As a result, Hs extract was shown to be a potent pancreatic α -amylase inhibitor. Similar results were found for hibiscus acid (hibiscus- type (2S,3R)-hydroxycitric acid lactone) (Yamada T *et al.*, 2007), which inhibited pancreatic α -amylase and intestinal α -glucosidase enzyme (Hansawasdi C *et al.*, 2001). Hs is traditionally used to the liver and blood within a group of plants used for “cooling”, high cholesterol and urinary problems. When the respondents were asked which medicinal plants were used for high blood pressure, diabetes and jaundice, Hs was referred to hypertension (Lans CA, 2006). A study in alloxan-induced diabetic rats showed that an ethanolic

extract of Hs flowers (200 mg/kg) had a hypolipidemic. Thus, Hs extract showed therapeutic assure in declining and preventing the expansion of atherosclerosis and potential related cardiovascular pathologies linked with diabetes. The authors suggest that this activity might be linked to polyphenolic compounds and dihydrobenzoic acids, like protocatechuic acids, but further identification of the active compounds is acceptable (Farombi EO and Ige EE, 2007). A similar effect was reported (Huang CN *et al.*, 2009) with the extract suppressing the high-glucose-induced immigration in a vascular smooth muscle cell model (Rosemary *et al.*, 2014).

Antioxidant properties

Hibiscus anthocyanins are group of natural pigments existing in the dried calyx exhibited antioxidant activity and liver protection. Several studies reported that *Hibiscus* anthocyanins, at the concentration of 0.01 and 0.20mg/ml, significantly formation of malonaldehyde and decreased in leakage of lactate dehydrogenase and lowered the serum levels of hepatic enzyme markers (alanine and aspartate aminotransferase) and reduced oxidative liver damage (Ochani P, 2009; Esa NM *et al.*, 2010).

Anti-cancerous activity

The antiproliferative activities of roselle juice were evaluated by Akim using different cell lines like ovarian, breast and cervical cancer cell lines and found that it exhibited the strongest anti-proliferative potency towards the breast and cervical cancerous cells.

Effects on smooth muscles

Some recent studies reported that Hs WE (1–100 mg/kg) was found to restrain rat bladder and uterine contractibility in a dose dependent manner, but mechanism unrelated to local and remote autonomic receptors or calcium channels (Fouda AM *et al.*, 2007). It was shown that Hs crude extracts mainly induced the endothelium-dependent relaxant effect in the inaccessible thoracic aorta of rats, with stimulation of NOS enzyme by the Pi3-K/Akt pathway. It was suggested that this was due to polyphenols. The results in the activation of smooth muscle potassium channels via non endothelium dependent relaxation in direct smooth muscle activation (Sarr M *et al.*, 2009).

Antibacterial, antifungal and antiparasitic activity

The protocatechuic acid (5 mg/ml) inhibited the growth of methicillin-resistant *Staphylococcus aureus*, *Klebsiella pneumoniae*, *Pseudomonas aeruginosa* and *Acinetobacter baumannii* (Liu K *et al.*, 2005).

Protocatechuic acid (in a dose dependent manner) showed greater antimicrobial activity against these pathogens in broth than in human plasma. The study also revealed that antibacterial effect was independent in nature from temperature, as shown with heat treatment. Hibiscus extract also demonstrated antibacterial effect against *Streptococcus mutans*, cariogenic bacteria from the oral cavity, with a minimum inhibitory concentration of 2.5 mg/ml (Afolabi OC *et al.*, 2008) and *Campylobacter* species (*Campylobacter jejuni*, *Campylobacter coli* and *Campylobacter fetus* (Yin MC and Chao CY, 2008).

This time, the aqueous-methanol extract of dried cHs also showed an in vitro inhibitory effect against several bacterial strains, such as *S. aureus*, *Bacillus stearothermophilus*, *Micrococcus luteus*, *Serratia marseilles*, *Clostridium sporogenes*, *Escherichia coli*, *K. pneumoniae*, *Bacillus cereus* and *Pseudomonas fluorescens*, but did not affect the growth of fungus *Candida albicans* (Olaleye MT, 2007).

The ethanolic extract showed greater antimicrobial effect than the aqueous extract. In the study both, ethanolic extract and protocatechuic acid, use as food additives to prevent contamination from these bacteria (Chao CY and Yin MC, 2009). A methanol-water extract of *Hibiscus sabdariffa* was effective against *E. coli* isolates from food, veterinary and clinical samples (Fullerton M *et al.*, 2011), most effective with the highest concentration (10%). The crude extracts of seeds (200 mg/l) also showed antimicrobial effects against Gram-negative bacteria. The extract shows higher activity against *Salmonella* like as *Shigella* and *Enterobacter* (Nwaiwu NE *et al.*, 2012).

Antipyretic, antinociceptic and anti-inflammatory activities

Hibiscus sabdariffa is effective in the relief of pyrexia in popular medicines, limited studies are available. The antipyretic and anti-inflammatory potential of the *Hibiscus sabdariffa* extract were studied. The ethanol and aqueous extracts showed antipyretic effects by significantly reversing yeast-induced fever in rats. The mechanism is different from the one of aspirin, a prostaglandin inhibitor. Nevertheless, fever entails enhanced formation of cytokines such as interleukins, interferons and tumour necrosis factor- α (TNF- α). The cHs extract may be involved in the inhibition of some of these substances, resulting also in an anti-inflammatory effect (Reanmongkol W and Itharat A, 2007). In recent study the ethanolic extract also showed antinociceptive effect in a rat model (Ali MK *et al.*, 2011). Other study showed that the two fractions of the crude aqueous-ethanolic extract of the dried cHs exhibited immune stimulatory activity by

raising the production of IL-10 and declining the production of TNF- α (Fakeye TO, 2008). Another mechanism in which the polyphenol extract exhibit the anti-inflammatory activity (Kao ES *et al.*, 2009).

Effect on lipid metabolism

The effect of *Hibiscus sabdariffa* on lipid profile, creatinine and serum electrolytes has been reported in study by (Mohagheghi A *et al.*, 2010) in hypertensive patients and reported the increasing of total cholesterol and high density lipid (HDL) which is significant HDL-Cholesterol is a protective factor for coronary heart disease (Yang MY *et al.*, 2010).

Anti-hypertensive effect

The anthocyanins extract of *Hibiscus sabdariffa* investigated for its therapeutic efficacy, safety and tolerability along with antihypertensive drug captopril (Herrera-Arellano AA *et al.*, 2014), Isininopril anthocyanin extract inhibition results exerting hypertensive effects.

Anti-obesity activity

Pre-clinical data from Brazil reported a probable role in the control of certain conditions associated with obesity, such as hyperlipidemia (Dickel ML *et al.*, 2007).

Lactating activity

The ethanolic seed extract of *Hibiscus sabdariffa* increased the serum prolactin level when compared to the control in a dose-dependent manner in lactating Albino Wistar rats (Gaya IB *et al.*, 2009).

Delayed puberty activity

A few studies with rats have shown that consumption of Hs WE during pregnancy and lactation resulted in increased postnatal weight gain, delayed onset of puberty and elevated body mass index at onset of puberty in the female off springs (Iyare EE and Adegoke A, 2008). The accelerated growth and delayed puberty observed in the offspring could be due to improved corticosterone and decreased leptin delivery through breast milk (Iyare EE and Adegoke A, 2008; Iyare EE *et al.*, 2010).

Anti-anaemic activity

A study on the use of Hs decoctions as an another source of iron for the treatment of anaemia and some other mineral deficiency diseases was conducted and showed that dry fermented calyces of hibiscus exhibited a very low pH value which improved mineral availability. Another reason for enhancing mineral (iron, zinc, calcium and magnesium) bioavailability is the high presence of ascorbic acid (Falade OS *et al.*, 2005).

Fig 1. Flowers of *Hibiscus sabdariffa*

CONCLUSION

Herbs are the natural source for the medication and it has no side effects. *Hibiscus sabdariffa* was a rich source of some phytochemical such as anthocyanin, flavonoids and phenols which increases their medicinal property and helps in preventing many diseases. The pharmacological properties were explained about the various diseases which can be cured by addressing *Hibiscus sabdariffa*. All parts of this plant have their

different quality of preventing various diseases and can be utilized for the well being of health.

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CONFLICT OF INTEREST:

The authors declare that they have no conflict of interest.

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