AN OVERVIEW ON GOSSYPIN AS PHARMACEUTICALLY IMPORTANT PHYTOCONSTITUENT

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ABSTRACT

Oils, food supplements, nutraceuticals, and dyestuffs are just few of the many examples of chemicals that can be derived from nature. Many of the capsules currently on the market come from natural resources such plants, animals, microorganisms, minerals, and marine life. The unique sun shades of plants, such as orange, yellow, and crimson, are caused by flavonoids, and one of the most important secondary flavonoids is benzo-c-pirone derivates. The unique safe to eat plant life that is also determined by within the typical human diet contains around 4000 flavonoids, including flavanols, flavonols, isoflavones, flavanones, flavanonols, and flavones. Gossypin, a flavonol glucoside, is one of the most important chemicals found in plants of the 'Malvaceae' family. Our comprehensive review of gossypin's research thus far has led us to the conclusion that it possesses a wide variety of beneficial actions. It also provides defence against the toxicity caused by beta-amyloid. Researchers from various fields of technology may benefit from the information provided in the present overview, which could help them design better treatments for a variety of illnesses. Based on the information provided in this review, we may draw the conclusion that Gossypin can be utilised to effectively treat a wide range of illnesses.

Key-words: Flavone, Gossypin, Phytochemistry, Pharmacological profile

1.0 INTRODUCTION

Flavonoids, a family of natural chemicals that are extremely abundant in all higher plants. Flavonoids can be broken down into more than ten distinct chemical classes. As a result, their chemical diversity is quite high; over 5,000 variants arising in nature have been catalogued thus far. This variability may explain why flavonoids have so many different biological actions [1, 5]. A lower incidence of cardiovascular disease, neurological ailment tumour, and other chronic diseases has been epidemiologically linked to eating of flavonoid-rich foods, especially

vegetables and fruits [6-9]. Several flavonoid-based formulations have showed promise in clinical studies for the treatment of bone loss, vascular disease, and cancer [10–14]. Majority of flavonoids in nature are found in form of flavonoid glycosides. Glycosylation results in a extensive range of variability in both the number and types of carbohydrate units added. Glycosylation significantly modifies in vivo bioavailability and potential pharmacological activities by affecting chemical and physical characteristics [15]. Systemic administration of gossypin [16], myricitrin [17–18], linarin [19], and hesperidin [20] has also been demonstrated to have antinociceptive effects. Research into the underlying molecular mechanisms that cause these central effects has yielded conflicting hypotheses about the roles played by specific receptors, enzymes, and ion channels. Anxiolysis, sedation, and antinociception are all mediated by similar neural pathways, yet flavonoid glycosides' effect on anxiety has received surprisingly little attention. Although opiates are typically used for their analgesic effects in the clinic [21]. In addition, morphine has been demonstrated in preclinical research to be an opioid agonist that, when administered peripherally or centrally, can result in anxiolysis [22, 23]. Second, the anxiolytic effect of benzodiazepines is widely believed to be mediated through the endogenous opioid system. Opioid antagonists, according to a number of research [24], can counteract the calming effects of benzodiazepines and barbiturates. In addition, anxiogenic phenotypes were observed in various tests of behaviour in mice lacking the delta opioid receptor compared to wild-type mice [25]. Third, several benzodiazepines have been reported to produce mild antinociceptive activities [26]. It is noteworthy to note that the a2 subunit of GABAA receptors mediates this GABAergic pain manage in spinal cord; this is the same subtype of GABAA receptors that regulates the anxiolytic effect [27]. It has been observed that the analgesic effects of morphine can be enhanced by injecting the benzodiazepine alprazolam [28-30] or the sedative flavonoid glycoside hesperidin [31].

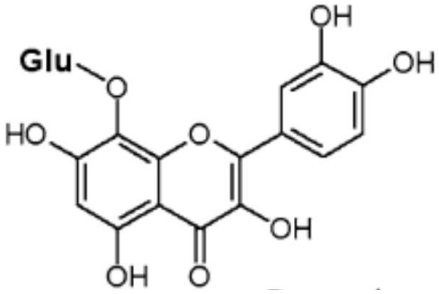

Fig. no. 01: Structure of Gossypin

2.0 PHARMACOLOGICAL ATIVITIES

2.1. Antidiabetic activity

Streptozotocin-induced diabetic rats received 20 mg/kg Gossypin for 30 days. Gossypin's antidiabetic effects were shown by lesser blood glucose and HbA1c levels and elevated plasma insulin and haemoglobin. Plasma protein and blood urea levels normalised and liver and muscle glycogen stores increased. These findings suggest gossypin lowers diabetes [32-34]. Gossypin inhibited glucose uptake in rat jejunum basolateral membrane vesicles (BLMV) in the presence of flavonoids [35].

2.2. Antiinflammatory activity of gossypin

Work on gossypin, chrysin, methyl hespiridin, and procumbentin revealed that the latter two exhibit antinociceptive activity, but only gossypin shown anti-inflammatory properties. Both gossypin and procumbentin suppress COX-2 activity in vitro [36]. One more study found that gossypin and other flavonoids prevented carrageenan-induced paw edoema in mice when given orally[37-40]. Flavonoids were tested for their impact on arachidonic acid metabolism in sonicated sheep platelets. These findings suggested that blocking lipoxygenase might be crucial to the anti-inflammatory effect [41].

2.3. Anticancer activity of gossypin

Gossypin was discovered to decrease cell proliferation in human glioma U251 cells while being rather harmless to healthy human astrocytes in studies examining its anticancer effects. These findings show that gossypin inhibits U251 cell proliferation via Chk1 and Cdc25C [42]. Gossypin's anticarcinogenic and anticancer activity was measured in mutant Saccharomyces ceriviseae topo I and topo II inhibition experiments. It greatly reduces tumour burden in animals with solid tumours by blocking the growth of new blood vessels within the tumour mass. It also inhibited papilloma development in a mouse model of cutaneous papilloma caused by DMBA/croton oil[43]. Gossypin, which was isolated from H. vitifolius, was tested for its cytotoxic effect in vitro and was found to inhibit vero cell lines by 68.75% at a dosage of 1,000 mg. Gossypin's importance in the inhibition of carcinogenesis was further clarified by a study showing that it suppressed NF-kappa B activation in tumour cells[44-46].

2.4. Analgesic activity of gossypin

In a mouse model of acetic acid-induced pain, gossypin dose-dependently reduced writhing, whereas naloxone inhibited it. Gossypin's analgesic activity involves opiate receptors, as its pA2 values are similar to those of morphine-naloxone [47-50].

2.5. Antiallergic activity of gossypin

Using a mast cell driven allergy paradigm, researchers found that gossypin suppressed antiprurities, systemic anaphylactic responses, and histamine production in rats, suggesting that

the compound had anti-allergic properties. Gossypin blocks the effects of mast cells in triggering allergic reactions[51-55].

2.6. Antiviral activity of gossypin

HSV-2 & HSV-1 plaque growth in Vero cells: an evaluation of 12 flavonoids, including gossypin. Hesperetin and naringenin were found to be mainly proficient against herpes simplex virus 1 (HSV-1) and herpes simplex virus 2 (HSV-2) compared to other 11 flavonoids, including gossypin, which were tested[56-63].

2.7. Antioxidant activity of gossypin

Gossypin's antioxidant capacity was evaluated using in vitro antioxidant techniques, and results confirmed, like BHT, possesses significant antioxidant activity. Gossypin and BHT decrease DPPH radical contents by 88.52 and 91.45%, respectively, supporting its antioxidant activity [64–70]. Gossypin and a few other extracts were studied for their antioxidant activity, and at the quantities employed in the study, gossypin fared pretty well.

2.8. Effect of gossypin on CNS

Gossypin's anticonvulsant potential was evaluated using maximal electroshock convulsive techniques & seizures generated with results demonstrating a considerable reduction in the length of convulsion. Strychnine and maximal electroshock both cause tonic extensor convulsions, but gossypin considerably reduces both[71-76]. Prominent plus maze test used to determine anxiolytic effects of gossypin, myrcitrin, and naringin. Both gossypin and naringin were found to be effective at a dose of 1 mg/kg, however at a level of 30 mg/kg, gossypin exhibited sedative and anxiolytic properties. These findings suggest that gossypin may exert its effects via several distinct central nervous system pathways[77–80]. Results from an acetic acid-induced writhing assay in mice indicated that pretreatment with gossypin greatly decreased development of acute tolerance to morphine, indicating its potential as a substitute for morphine[81]. The neurotransmitter systems involved in gossypin's antinociceptive impact were studied, specifically the cholinergic and gamma-aminobutyric acid (GABA) ones [82].

2.9. Effect of gossypin on CVS

To further understand its cardiovascular potential, gossypin's effect on cholesterol metabolism in HepG2 cells was studied, Gossypin therapy reduced overall cholesterol. Gossypin activates ERK to promote LDLR expression without SREBP-2 [83].

2.10. Effect of gossypin on GIT

In a dose-dependent study on mice, it was observed that the chemicals epicatechin, hydroxyethyl rutosides, and gossypin all slowed down the movement of food through the mouse digestive tract [84-87]. P-glycoprotein is an organ-specific member of the vast family

of efflux transporters. Nitrendipine's transport rate was found to be lower in the ileum thanks to the interaction of gossypin and chrysin than in the jejunum and duodenum. Gossypin, methyl hesperidin, diosmin, quercetin, and chrysin are only a few examples of bioflavonoids that inhibit nitrendipine transport[88].

2.11. Effect of gossypin on microorganism

It was shown to have antimicrobial properties after being isolated from H. vitifolius [89]. It was found to have a moderate effect on E. coli and S. aureus, a minor effect on Pseudomonas aeruginosa and Salmonella typhi, and no effect on some of tested fungi.

2.12. Toxicity study of gossypin

Three weeks of research into the protective effects of gossypin against lead toxicity revealed that it increased glutathione levels, decreased superoxide dismutase activity, and decreased reactive oxygen species. Gossypin's protective action was demonstrated by the fact that it considerably reduced the occurrence of these changes in the treatment group [90]. Gossypin's protective effects against sulphur mustard in mice were studied over a range of doses, carriers (including water, PEG-300, and DMSO), and time points. As opposed to DMSO, gossypin administered in PEG-300 was found to provide greater protection against sulphur mustard poisoning than water did [91-92]. Different phenolic and flavonoid compounds were tested for their ability to mitigate CCl4's cytotoxicity in rat hepatocytes. The release of alanine amine transferase was considerably reduced by gossypin [93]. Flavonoids were studied for their potential preventive role against sulphur mustard-induced toxicity & had no effect on the amount of GSH but significantly reduced the level of MDA, providing more evidence for the beneficial effects of flavonoids [94]. When compared to the gold standard, tocopherol acetate, flavonoids including gossypin and quercetin were found to be more effective at preventing death caused by sulphur mustard. Research also demonstrated that gossypin provides substantial protection against glutathione peroxidase [94].

2.12. Effect of gossypin on other systems

Based on this discovery, we can extrapolate that a higher concentration of hydroxyl groups will result in a greater inhibitory impact of flavonoids on PRL-3[95]. Flavonoids with cyclin-dependent kinase 2 (CDK2) binding properties were identified by docking 347 flavonoid derivatives into CDK2 crystal structure. Binding affinity assay with NMR measurements [96] supported the results of the docking investigation showing that gossypin has a strong structural fit with CDK2. Eleven flavonoids and four phenolic acids had their transient spectra and reaction rate constants examined, and the results showed that certain groups in the basic skeleton were required for the corresponding activities. The four chemicals gossypin,

gossypetin, bharangin, and quercetin were found to have much higher activity than the conventional medicines [97-99]. Evaluation of -lactamase inhibition, inhibition type, and structure-activity relationships in a variety of flavonoids and phenolic acids. Noncompetitive inhibitory effects were seen for the flavonoid compounds fisetin, flavone, quercetin, catechin, and gossypin. The OH location in a molecule's structure also appears to be important [100,102].

3.0 CONCLUSION

Basic medical care and the vast majority of medicines were sourced from natural resources roughly 20-30 years ago. Several types of plants Many medical disorders are treated with derivative products. Many pharmaceuticals in current use The medication is derived from nature. There is still a great deal Medicines that have been utilised for centuries by the inhabitants of Africa and Asia. A wide variety of manmade and organic chemicals harvested from a wide range of organic and inorganic sources. Many botanical materials and products have been included in WHO's lists for this very reason. Substance used in medicine. Evolution of new foods Discusses the positive effects of advances in food science and technology on human health. Provided by sterols, Carotenoids, polyphenols, and anthocyanins, all of which are sourced from plants. As the use of natural ingredients grows, the discipline of food science opens itself to a new demographic of health-conscious shoppers. attachment The variety and abundance of secondary metabolites is remarkable. general Secondary-product metabolism entails Various kinds of vegetation. Flavonoids generate many different classes of phytochemicals, There are eight main categories for plants: flavonoids and flavanones Anthocyanidins, chalcones, flavonolignans, isoflavones, and flavones Chemistry and structure Chromosomes are hydrocarbons with a heterocyclic Substitution ring complexes of flavonoids At least a C.8000 So far, it's identity has been confirmed. Common occurrences of natural flavonoids include: Glycosides, include glucose, ribose, and xylose. Leaves, flowers, and other plant surfaces (not the core) are the primary sources of flavonol glycosides. Fresh produce, etc. Flavonols can be found in abundance in beverages like tea and red wine. The staples of the diet are tea, onions, and apples. Natural flavonol extracts sourced from the USA, the Netherlands, and Denmark. Flavonoids are a component of the European diet, with daily consumption of up to roughly 1 g possible.

4.0 REFERENCES

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