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PHARMACOLOGICAL PROPERTIES OF *FELICIA MURICATA* THUNB. (NEES): A REVIEW

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ABSTRACT

Felicia muricata is a medicinal plant used for the management of different human and livestock diseases in the Eastern Cape Province of South Africa. The antioxidant potential of the leaves from this herb was investigated using its water, methanol, acetone and ethanol extracts. Secondary metabolites mainly flavonoids, sesquiterpene lactones, triterpenoids besides volatile oils are among 1the active principles reported in this family. Concerning the genus Felicia, no enough data is available in literature about it's phytoconstituents, in spite of its common traditional use in several areas of the world especially South Africa. The aim of the review is to provide collective and updated information about this genus including its taxonomy, description, active principles, ethno-pharmacology and pharmacological uses. We mainly aim to encourage researchers to discover this genus, particularly those species whose phytoconstituents and biological activities have not been explored until now.

KEYWORDS; Asteraceae, Felicia, Acetylenic compounds, Isocoumarins, Essential oils, Terpenes, Ethno-pharmacology, Anti-inflammatory and Antioxidant.

INTRODUCTION

The use of plants in various parts of the world for both preventive and curative purposes is an age-old tradition and is increasing empirically. With this upsurge however, a thorough scientific investigation of these medicinal plants is imperative, based on the need to provide information on their efficacies and toxicity risk. One such plant used in the folklore medicine of South Africa as an oral remedy for pain, inflammation and fever without scientific evaluation of its efficacy is Felicia muricata. *Felicia muricata* Thunb. (Nees) (Asteraceae) is a small drought resistant perennial aromatic herb growing up to 0.2 m high. In the Eastern Cape Province of South Africa, the rural dwellers use the plant in the management of headache, pain and inflammation (Hutchings & Van Staden, 1994).[1] The antibacterial and antifungal activities of the methanol and acetone extracts as well as the essential oil from this plant have been studied (Ashafa et al., 2008a, 2008b).[2,3] Toxicological studies on the aqueous extract of *F. muricata* leaves at the doses of 50, 100, and 200mg/kg body weight in Wistar rats for 14 days revealed that the extract possessed selective toxicity on the hematological and serum lipids parameters as well as the liver and kidney functional end points (Ashafa et al., 2009).[4] Several studies have also been carried out on the molecular mechanism of chronic inflammation as well as prevention and mitigation by botanicals in South Africa (Naidoo et al., 2006;),[5] but to the best of our knowledge, the anti-inflammatory, antinociceptive and antipyretic activities of aqueous extract of Felicia muricata leaves have not been investigated in animals. There is the need, therefore, to provide scientific evidence for the folkloric claim of the use of the plant as an oral remedy for inflammation, pain and fever. The Asteraceae is considered one of the widespread families of flowering plants include about 1000- 2000 genera and 23,000 species. This family is represented in numerous environments from sea level to mountain tops all over the world. More than 12 % of the plants mentioned in the Saudi Arabia flora belong to the Asteraceae family. Asteraceae is presented in Egypt by 97 genera including 230 species. This family contains different classes of phytoconsitutents as flavonoids, sesquiterpenes, triterpernoids, coumarins and volatile oil. Plants belonging to this family show a vast range of biological activities including cytotoxic, anticancer activities antiinflammatory, anti nociceptive and antipyretic activities, hypoglycemic action, antiviral against herpes simplex virus and selective Cox 2 inhibition activities. These Plants are also considered important sources of chemo-preventive agents due to their content of different classes of antioxidant compounds as flavonoids and triterpenoids. Felicia is a genus of small shrubs, annual or perennial herbaceous plants, with 85 known species. Like in almost all members of Asteraceae, leaves are alternate and linear or oblanceolate. The individual flowers are pentamerous, small and clustered in typical heads, surrounded by an involucre; there are two or four whorls of bracts. Capitulum is solitary, heterogamous and radiate. The disc florets of capitulum are colored yellow, seldom white or bluish black, while ray florets

one single whorl are colored purple but sometimes are blue, pink, white or yellow and rarely ligulate florets are absent. According to Nesom this genus is characterized by obovate and flat cypselas with two thickened lateral ribs and pappus with a single series of generally caducous bristles.

PHARMACOLOGICAL ACTIVITY

Anti-inflammatory activity

The aqueous extract of Felicia muricata leaves was tested for its anti-inflammatory activity by rat paw edema test using carrageen and an egg albumin to induce rat paw edema. Egg albumin-induced rat paw edema test doses of 100 and 200mg/kg body weight of the aqueous extract started the decrease of the paw edema volume by 30min after treatment. While, 50mg/kg body weight did not show this effect until after 2 hr of administration. The 200mg/kg body weight of the extract showed the most astounding rate of inhibition on the egg albumin-induced paw edema compared with orally 10mg/kg body weight of indomethacin that reduce egg albumin induced paw edema from 60 to120min after administration (Ashafa et al, 2010a).[6] According to McGaw et al, (1997)[7], aqueous extract of Felicia muricata leaves showed 80 - 90% inhibitory activity against cyclooxygenase, an important enzyme in the prostaglandin biosynthesis pathway. Cyclooxgenase enzyme inhibitory activity of petroleum ether, dichloromethane, ethanol and water extracts of Felicia erigeroides was examined using methods of Jager et al, (1996)[8] as modified by Zschocke and Van Staden (2000)[9] and using Indomethacin as a reference drug with dose of 5μM for COX-1 and 200μM for COX-2 inhibition. Concentration of 250μg/ml for organic extracts and 2000μg /ml for water extracts were examined and COX inhibition of the extracts was calculated by comparing the amount of radioactivity present in the sample to that in the solvent blank. According to Aremu et al, (2010)[10], Felicia erigeroides dichloromethane leaves extract showed potent inhibitory activity of COX-1 followed by the petroleum ether fraction. F.erigeroides petroleum ether and dichloromethane stem extracts showed nearby equal potent inhibitory activity of COX-2. The aqueous extract of leaves and stem showed week activities on COX-1 inhibition and no activity on COX-2 inhibition.

Anti nociceptive activity

Felicia muricata leaves aqueous extract was tested for anti nociceptive activity using acetic acidinduced writhing test, formalin-induced pain and tail immersion method. Writhing test was carried out according to Gaertner et al, (1999)28 procedure. Subcutaneous morphine sulfate (5mg/kg) was used as reference agent. Different doses of the extract (50, 100, 200mg/kg) were administered orally and reduced the number of writhes induced by acetic acid. The best result was obtained with conc. of 200mg/kg body weight that showed more anti nocieceptive activity more than morphine (Ashafa et al, 2010a).[6]

Acetic acid-induced writhing test

The writhing test was conducted on the mice according to the procedure described by Gaertner et al. (1999).[11] Briefly, five groups of six mice each were intraperitoneally administered with 0.6% (v/v) acetic acid at a dose of 10mL/kg body weight. A known volume (0.5mL) of distilled water (negative control) and same volume of aqueous extract of Felicia muricata leaves containing 50, 100, and 200mg/kg body weight were orally administered to each animal (0.5mL/rat), 30min prior to treatment with acetic acid. Each mouse in the positive control group was pre-treated subcutaneously with morphine sulfate (5mg/kg) before the administration of acetic acid. The writhings (abdominal constriction and hind limb stretching) induced by the organic acid in all the groups were recorded for a 30-min duration after a latency period of 5min. The percentage antinociceptive activity was calculated according to the following expression: Percentage antinociceptive activity.

$X = -( ) Y X/ \times 100$

where X is the average number of stretchings of the control per group and Y is the average number of stretchings of the test per group.

Antipyretic activity

The different doses (50, 100, 200mg/ kg body weight) of Felicia muricata leaves aqueous extract decreased the raised body temperature caused by brewer's yeast of the animals at various times of the test. The 200mg/kg body weight of the aqueous extract decrease of the raised body temperature after 1 h, While indomethacin (10mg/kg body weight) decrease the raised body temperature of the animal after 30 min after administration. (Ashafa et al, 2010a).[6]

Antioxidant activity

The effect of aqueous and organic extracts from the leaves of Felicia muricata thumb on DPPH radical was estimated using the method of Liyana Pathiranan and Shahidi, 2005.[12] ABTS radical scavenging assay was conducted also for the same extract. *F.muricata* leaves extracts were effective scavengers of ABTS radical compared with standard antioxidant Butylated hydroxytoluene (BHT) 5mg/mL. The percentage inhibition for ABTS radical was 94.55%for aqueous extract, 99.21% for methanol extract, 98.66% for acetone extract, 97.27% for ethanol extract and 99.27% for ABTS. The scavenging of ABTS by the extracts was found to be higher than that of DPPH. This indicates that the extract can scavenge different free radicals in different systems, indicating that they may be useful therapeutic agents for treating radical-related pathologic damage (Ashafa et al, 2010).[6]

Antibacterial and antifungal activity

The minimum inhibitory concentration (MIC) values of Felicia muricata volatile oil were determined for different micro-organisms using the microplate dilution method. The result showed the essential oil inhibits many

gram positive bacteria for example Streptococcus aereus and Streptococcus faecalis and gram negative bacteria for instance klebsiella pneumonia, Escherichia coli and more active than streptomycin for some bacteria as Pseudomonas aeruginosa strain. (Ashafa et al, 2008).[13] The MIC values of Felicia erigeroides extracts against gram-positive bacteria as Bacillus subtilis and Staphylococcus aureus, and gram-negative bacteria as Escherichia coli and Klebsiella pneumoniae were determined using the micro plate technique. Neomycin (100µl, 0.4mg/ml) was used as standard anti-bacterial agent. Ethanolic extract of Felicia erigeroides leaves, dichloromethane and petroleum ether extracts of stem have a good antibacterial activity. Minimum fungicidal concentration (MFC) and MIC values of Felicia erigeroides extracts against Candida albicans were determined using micro plate technique. Amphotricin B (100µl, 0.25mg/ml) was used as standard anti-fungal agent. All fractions have low antifungal activity against Candida albicans. Extracts with MIC or MFC values less than 1.0mg/ml were considered to have a high antibacterial and antifungal activity (Aremu et al, 2010).[14]

Antiprolifertaive and cytotoxic activity

The methanolic extract of Felicia dentata aerial parts was examined for antiprolifertaive and cytotoxic activity using MTT assay in A2780 (ovarian carcinoma), MCF7 (breast carcinoma), HeLa (cervical carcinoma), RKO (colorectal carcinoma) and, Jurkat (leukemia) cell lines. The results showed that this extract had low activity in the MTT assay compared to Etoposide as reference drug (Bader et al, 2018).[15]

Anthelmintic activity

The effect of F.erigeroides leaves and stems extracts on the viability of the free living nematode larvae Caenorhabditis elegans (50µl contain 100 worms) was determined in vitro using colorimetric assay developed by James and Davey (2007)[16] and modified to determine minimum lethal concentration (MLC). MLC values of the petroleum ether, dichloromethane and ethanol extracts of F.erigeroides leaves and stems were determined using two-fold serial dilution. Levamisole 100µl of 1mg/ml was used as a reference drug. The best MLC values were exhibited by the dichloromethane leaves extract (520µg/ml) followed by petroleum ether leaves extract (1040µg/ml) then the stem dichloromethane extract (2080µg/ml), while MLC for the standard levamisole was 40µg/ml. Aqueous extract of both leaves and stems exhibited weak anthelmintic activities against Caenorhabditis elegans (Aremu et al, 2010).[17]

CONCLUSION

Although there is rare data about chemistry and biology of genus Felicia, this review shed light on the available phytoconstituents and biological activities on the few studied species. The review revealed species contained different classes of phytoconsituents as essential oils, esters, acetylenic compounds, isoeugenol, iso-coumarin derivatives and terpenes. It also showed some biological activities of certain studied species as antiinflammatory, anti-nocicptive, antipyretic, antioxidant, anthelmintic, antibacterial, antifungal and cytotoxicity. Hence, further research is needed to investigate and isolate other compounds from this genus and discover possible biological activities.

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