ANTI-INFLAMMATORY ACTIVITY OF BOERHAVIA DIFFUSA ZINC OXIDE NANOPARTICLE

RUNNING TITLE: Anti Inflammatory activity of boerhavia diffusa zinc oxide - a nanoparticle study

ABSTRACT:

INTRODUCTION:

Boerhaavia diffusa is a species of flowering plant in the four o'clock family which is commonly known as punarnava, red spiderling, spreading hogweed, or tarvine. It is taken in herbal medicine for pain relief and other uses. Zinc oxide is used to treat or prevent minor skin irritations such as burns, cuts, and diaper rash. Some products may be used as sunscreen.

MATERIALS AND METHODS:

Bovine serum albumin was used for the assay. 2ml of bovine albumin was mixed with 400micro microliter of hyaluronic acid mediated zinc nanoparticles in different concentrations. Diclofenac sodium in different concentrations was used as standard and then incubated for 55 c for 20 min and then the result was analysed spectrometrically.

RESULTS:

According to the results, at 10µl, 20µl ,30µl , 40µl and 50µl concentration the percentage of inhibition is 25%, 50%, 75%, 85%, 90%, when compared to standard concentration and its percentage of inhibition is 95% . As the concentration increases, the percentage of inhibition also increases.

CONCLUSION:

From the above study, it is evident that zinc sulphate nanoparticles synthesised by Boerhevia diffusa based showed a potent anti-inflammatory effect.

INTRODUCTION:

Boerhavia diffusa, commonly called hogweed, is known as erimmirii by the Ibos of southeastern Nigeria. The leaves are cooked and eaten as vegetables,The plant is used as folk medicine to treat convulsions and as a mild laxative .(1),(2) The roots and leaves are considered to have an expectorant action, to be emetic and diuretic in large doses and are used in the treatment of asthma(3),(4). The roots of Boerhavia diffusa possess diuretic action , anti-inflammatory, antifibrinolytic , anti- convulsant and hepatoprotective activities(5),(6).Its leaf extract has hypoglycemic effects .The effects of B. diffusa leaf extract on antioxidant status in liver and kidney of alloxan diabetic rats are reported. Boerhavia diffusa comes under the family Nyctaginaceae and is considered as a tropical plant commonly seen in swampy areas in Nigeria, India and other parts of the world in both dry and rainy seasons(7),(8). The local population of Nigeria uses extracts of the crushed soaked leaves of boerhavia diffusa in the management of diabetes. B. diffusa aqueous root extract has been reported to show marked protection against thioacetamide- induced hepatic injury maintaining the various liver enzymes and serum bilirubin(9) (10) . The liquid extract of thinner roots of Boerhavia diffusa is used in traditional medicine for inflammatory disorders, bacterial infections and heart diseases.It is also used in the treatment of elephantiasis, night blindness , corneal ulcers , various hepatic disorders and as an antiviral agent(11). About forty species are distributed in tropical, subtropical and temperate regions. Among these, six species are reported in India and Boerhavia diffusa is indigenous B. diffusa is described as Punarnava by an Indian system of medicine, Ayurveda (12). Roots and whole plants of Boerhavia diffusa are used in the Ayurvedic system of medicine in Arabian countries and even today many tribal communities in India still use it for the treatment of jaundice and various other liver disorders(13). It has anti-inflammatory, diuretic, fibrinolytic, anticonvulsant properties and is also used as carminatives . Boerhavia diffusa , a well- known indigenous medicinal plant, also known as pun- arnava, has pleiotropic medicinal properties and is also a main ingredient of many ayurvedic formula- tions for the treatment of jaundice, inflammation, oedema, hypertension etc(14),(15). This plant is also being used as a green leafy vegetable in different parts of Asia and Africa due to its nutraceutical properties. It is rich in sources of minerals, vitamins and carbohydrates. It contains a large amount of compounds such as alkaloids ,rotenoids flavonoids, amino acids, lignans, saponins, b-sitosterols and tetra-cosanoic, eicosanoic, stearic and ursolic acids(16) .

Nanostructured Zinc oxide materials have received broad attention due to their distinguished performance in electronics, optics and photonics(17),(18). From the past years, synthesis of Zinc oxide thin films has been an active field because of their applications as sensors, transducers and catalysts. In the last few decades, especially since the nanotechnology initiative led by the US, study of one- dimensional materials has become a leading edge in nanoscience and nanotechnology(19),(20). With reduction in size, novel electrical, mechanical, chemical and optical properties are introduced, which are largely believed to be the result of surface and quantum confinement effects(21),(22). Nanowire-like structures are the ideal system for studying the transport process in one-dimensionally confined objects, which are of benefit not only for understanding the fundamental phenomena in low dimensional systems, but also for developing new generation nanodevices with high performance(23)(24).Zinc oxide is a key technological material. The lack of a centre of symmetry in wurtzite, combined with large electromechanical coupling, results in strong piezoelectric and pyroelectric properties and the consequent use of Zinc oxide in mechanical actuators and piezoelectric sensors(25)(26). In addition, Zinc oxide is a wide band-gap compound semiconductor that is suitable for short wavelength optoelectronic applications. The high exciton binding energy of Zinc oxide crystal can ensure efficient excitonic emission at room temperature and room temperature ultraviolet luminescence has been reported in disordered nanoparticles and thin films(27)(28) Zinc oxide is transparent to visible light and can be made highly conductive by doping.(29)

MATERIALS AND METHODS:

Plant extract preparation;

The fresh leaves of *Boerhavia diffusa* were collected in an unbiased manner and sampling was done by Randomised sampling method and washed thoroughly with distilled water. From clean and dried plant leaves fine powder was made with a homogenizer, only dried leaves of Boerhavia diffusa were included and other parts of the plant such as stem, root, flower were excluded in this study. About 1gm of clean dried leaves of Boerhavia diffusa was added to 50 ml of distilled water it was allowed to dissolve the weighted extract in conical flasks and mixed well. This mixture is boiled at 60 degrees Celsius for 7 minutes with the help of a heating mantle. Then the boiled extract is filtered with the help of filter paper.

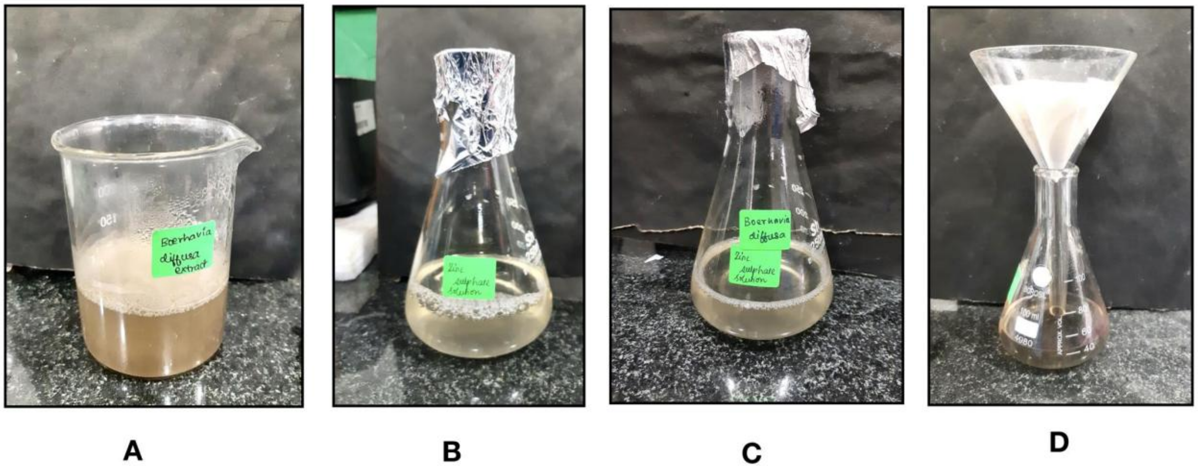

Fig 1: A denotes Boerhavia diffusa extract, B denotes the zinc sulphate solution , C denotes boerhavia diffusa and zinc sulphate solution and D denotes the the boiled extract getting filtered in filter paper

<u>Synthesis of copper Nanoparticles:</u>

This *Boerhavia diffusa* is treated with 0.507g of zinc sulphate and 90 ml of distilled water and it is placed in a semi-automatic shaker at 900 rpm. With the help of a double beam U-V spectrophotometer, the synthesis of nanoparticles for every one hour is noted. Then this formulation is placed in a centrifuge for 10 minutes. Now the synthesized nanoparticles which are settled at the bottom are collected. The randomized sampling method was done in an unbiased manner.

<u>Anti Inflammatory activity:</u>

BSA assay:

2ml of bovine albumin was mixed with 400 micro microliter of zinc nanoparticles in different concentrations. Diclofenac sodium in different concentrations was used as standard and then incubated for 55 degree celcius for 20 min and then the result was analysed spectrometrically.

<u>RESULTS:</u>

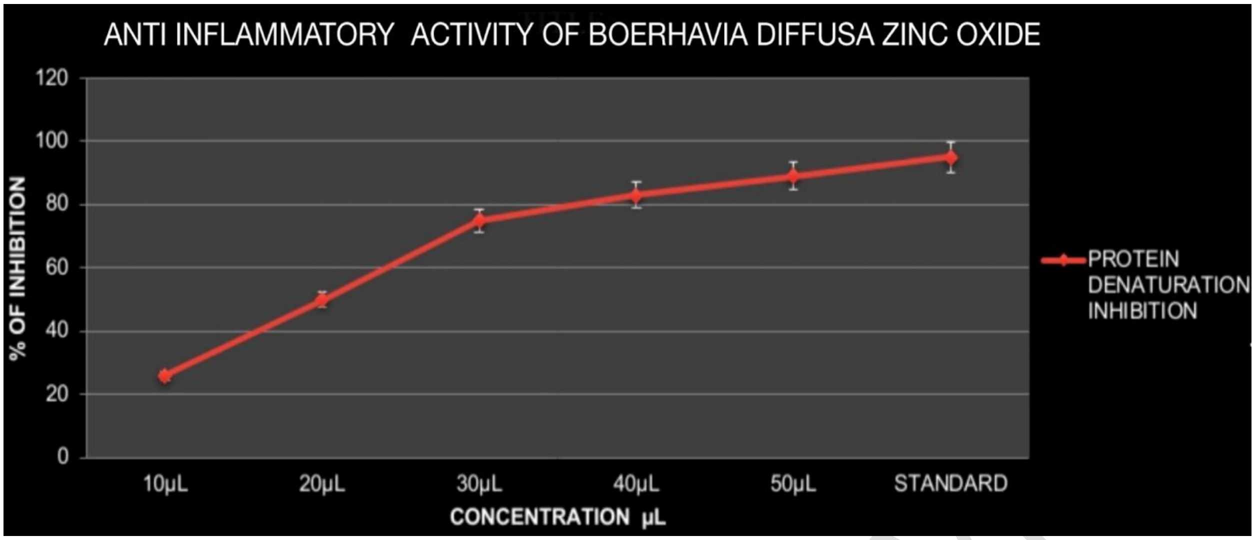

Figure 2: The graph represents the percentage of inhibition on y axis and concentration on x axis,The red line denotes the protein denaturation inhibition, data implies as mean±SEM

According to the results, at 10µl the percentage of inhibition is 25% at 20µl the percentage of inhibition is 50% at 30µl the percentage of inhibition is 75% and at 40µl the percentage of inhibition is 85% and at 50µl concentration the percentage of inhibition is 90%, when compared to standard concentration its percentage of inhibition is 95% . As the concentration increases, the percentage of inhibition also increases.

DISCUSSION:

The results obtained in this study indicate that the Punarnavasava, a formulation mainly containing B. diffusa shows anti inflammatory.The plant has gained lot of importance in the field of phytochemistry because of its various pharmacological and biological activities such as immunomodulatory effects, immunosuppressive activity, anti- metastatic activity, antioxidant activity, antidiabetic activity antiproliferative and antiestrogenic activity, analgesic and anti-inflammatory activity, antibacterial activity, antistress and adaptogenic activity, anti lymphoproliferative activity, nitric oxide scavenging activity, hepatoprotective activity, antiviral activity, bronchial asthma, anti fibrinolytic activity, chemopreventive action, genetic diversity analysis, anticonvulsant activity (30)(31).They can also improve the condition of diabetes as indicated by parameters like body weight along with serum cholesterol and triglyceride levels(32)(33). The number of functionally intact β-cells in the islet organ is of decisive importance for the development course and outcome of diabetes(34) (35). Potent antibacterial activity against gram positive and gram negative bacteria shown by the leaves of B.diffusa might be due to the phytochemicals present in the leaves(36)(37). Boerhaavia diffusa extracts exhibited a strong inhibitory effect on the proliferation of human breast cancer cells in vitro and the antiestrogenic effects are mediated by ER (38).

Zinc oxide is a very promising material for semiconductor device applications . It has a direct and wide band gap in the near-UV spectral region , and a large free-exciton binding energy so that excitonic emission processes can persist at or even above room temperature(39)(40). Its properties have been studied since the early days of semiconductor electronics ,but the use of Zinc oxide as a semiconductor in electronic devices has been hindered by the lack of control over its electrical conductivity(41)(42). Zinc oxide crystals are almost always n-type, the cause of which has been a matter of extensive debate and research .Over the past decade we have witnessed a significant improvement in the quality of Zinc oxide single-crystal substrates and epitaxial films(43)(44).This, in turn, has led to a revival of the idea of using Zinc oxide as an optoelectronic or electronic material in its own right(45)(46). Zinc oxide, with its unique physical and chemical properties, such as high chemical stability, high electrochemical coupling coefficient, broad range of radiation absorption and high photostability, is a multifunctional material (47). In materials science, zinc oxide is classified as a semiconductor whose covalence is on the boundary between ionic and covalent semiconductors(48)(49). A broad energy band ,high bond energy and high thermal and mechanical stability at room temperature make it attractive for potential use in electronics, optoelectronics and laser technology (50)(51).The piezo- and pyroelectric properties of Zinc oxide mean that it can be used as a sensor, converter, energy generator and photocatalyst in hydrogen production .Because of its hardness, rigidity and piezoelectric constant it is an important material in the ceramics industry, while its low toxicity, biocompatibility and biodegradability make it a material of interest for biomedicine and in pro-ecological systems (52)(53).Our team has extensive knowledge and research experience that has translate into high quality publications(54–73) (74) (75) (76) (77) (78) (79) (80) (81) (82) (83) (84) (85) (86) (87)

CONCLUSION:

From the above study, it is evident that zinc sulphate nanoparticles synthesised by Boerhevia diffusa based showed a potent anti-inflammatory effect(88-97). It can be used as a potent antifungal agent against fungal infections in the form of gels for external use and in the form of mouthwashes to control oral thrush .Also further studies can be done to assess it's antioxidant , antibacterial bacterial and cytotoxic activity which could be used in the treatment of numerous diseases.

COMPETING INTERESTS DISCLAIMER:

Authors have declared that no competing interests exist. The products used for this research are commonly and predominantly use products in our area of research and country. There is absolutely no conflict of interest between the authors and producers of the products because we do not intend to use these products as an avenue for any litigation but for the advancement of knowledge. Also, the research was not funded by the producing company rather it was funded by personal efforts of the authors.

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