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RESEARCH ARTICLE
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INVESTIGATING THE THERAPEUTIC POTENTIAL OF MEDICINAL PLANTS TRIBULUS TERRESTRIS, PIPER NIGRUM AND CICHORIUM INTYBUS IN THE MANAGEMENT OF ARTHRITIS

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Abstract
Arthritis, encompassing over 200 rheumatic diseases affecting joints and connective tissues, is a prevalent inflammatory bone disorder. Osteoarthritis (OA), osteoporosis (OP), and rheumatoid arthritis (RA) are among the most common types, with OP and RA exhibiting higher prevalence rates. This study focuses on the anti-arthritic potential of specific medicinal plants—*Tribulusterrestris, Piper nigrum*, and *Cichoriumintybus*—from Zygophyllaceae, Piperaceae, and Asteraceae families, targeting gouty arthritis. The research involves preparation of hydro-ethanolic extracts from these plants and assessing their anti-arthritic efficacy. The goal is to contribute to understanding and managing arthritic disorders through comprehensive methodologies. Auto-antigen synthesis is implicated in arthritis, leading to tissue protein denaturation. Hydro-ethanolic extracts of the plants demonstrate a significant reduction in albumin denaturation, comparable to NSAIDs' anti-inflammatory effects. Effect of ethanolic 70% extracts of medicinal plant *Piper nigrum*prevented 70.24%, 58.92%, 47.00% protein denaturation at the concentration of 250, 125, 62.5µg/ml. Similarly, *Cichoriumintybus*and *Tribulusterrestris*prevented 76.72%, 60.01%, 45.89% and 71.95%, 59.76%, 47.0% at the concentration of 250, 125, 62.5µg/ml anti-arthritic activity. In conclusion, this study provides anti-arthritic potential of these medicinal plants, emphasizing their role in managing arthritis. The observed effects on protein denaturation suggest a novel avenue for developing natural interventions for arthritic disorders.

Keywords: Arthritis, Medicinal plant, Osteoarthritis, osteoporosis, Anti-inflammatory

INTRODUCTION

Arthritis is one of the most common inflammatory bone disorders, and it encompasses over 200 different rheumatic diseases that affect joints and connective tissues. One of the most common types of arthritis is osteoarthritis (OA). In comparison to other recognized forms of arthritis, osteoporosis (OP) and rheumatoid arthritis (RA) have shown a much higher prevalence rate(Vishwakarma, Ahmed et al. 2021).There are a variety of risk factors that have a role in the development of these common forms of arthritis. Age, gender, and hereditary components are non-modifiable arthritis risk factors, but overweight, obesity, joint traumas, infection, and occupation are modifiable arthritis risk

factors. Persons of all ages are affected by these rheumatic conditions at some point in their lives, despite these risk factors. Unfortunately, these rheumatic illnesses do not have a complete cure. The majority of current treatment options use pharmacological drugs, physical therapy, and patient education and support to reduce pain, minimize joint damage, and improve or maintain quality of life. Patients with untreated arthritis may suffer from significant disability, joint degradation, the onset of concomitant disorders (such as heart disease, peripheral neuropathy, anxiety and depression, and malignancies, among other things), and premature mortality(Gonzalez, Maradit Kremers et al. 2007, Aviña-Zubieta, Choi et al. 2008, Yadav, Roy et al. 2019).

Arthritis is a complex disease with many causes. There are numerous varieties of arthritis, each with its unique set of causes. It disorders are major causes of illness, suffering and disability all around the world. They account for a considerable number of healthy years of life lost, accounting for more than 4% of the overall illness burden in terms of disability-adjusted life years(Mathers and Penm 1999). Arthritis and musculoskeletal disorders account for more than half of all chronic diseases worldwide, and they are the leading cause of severe, long-term pain and physical disability (Murray, Lopez et al. 1996).
Aim of the following study was exploring the antiarthritic potential of specific medicinal plants, focusing on *Tribulusterrestris*, *Piper nigrum*, and *Cichoriumintybus* from the Zygophyllaceae, Piperaceae, and Asteraceae families, respectively, specifically targeting gouty arthritis. The research aims to create hydro-ethanolic extracts from these plants, conduct a thorough anti-arthritic efficacy of the extracts. The overall goal is to contribute to the understanding and potential management of arthritic disorders through comprehensive research methodologies.

METHADOLOGY

Hydro-ethanolic extract preparation:

Three plants were subjected to research study, primarily *Piper nigrum, Cichoriumintybus,* and *Tribulusterrestris*. After collection and drying, plants were subjected to identification and assignment of voucher numbers. The plants were purchased from the market. One kilogram of the plant samples was thoroughly rinsed and washed twice with freshwater followed by deionized water, to remove dust and other contaminants. After being washed, the samples were kept under shade at room temperature and dried completely. The dried mass of plants was then crushed, using a grinder, into a fine powder, and extracted using the maceration method in the hydro-ethanolic solvent with a ratio of 70:30. The resulting hydro-ethanolic mixture was filtered on muslin cloth. After 72 hours of soaking, the filtrate was filtered again on Whatman filter paper. This process was replicated once more, three times in total, combining all three filtrates. The solvent (Ethanol) was evaporated to concentrate crude extract on the rotary evaporator. This concentrated crude extract was further air dried and the semi-solid mass of crude drugs was obtained. This collected crude extract was processed at 4°C in the fridge for future use in pharmacological activities.

Anti-arthritic (protein denaturation assay): The anti-arthritic action of the extracts was determined using the method of (Daram, Jitta et al. 2021)withslight modifications. The sample and distilled water makeup the blank. As a negative control, only distilled water was used. Diclofenac sodium (final concentration 0.61–0.78) was used as a positive control. Percentage inhibition was calculated using the following formula:

$$\boldsymbol{Percentage\ inhibition} = \mathbf{100} \times \frac{\boldsymbol{Abs.Sample - Blank}}{\boldsymbol{Control - 1}}$$

A graph plotting inhibition against different concentrations will be used to compute the IC_{50}. The experiment will be repeated three times.

RESULTS

Anti-arthritic Activity:

Table No: 1. Anti-arthritic activity of medicinal plants

Sr. #	Samples	Conc. µg/ml	Absorbance	Product Control	% inhibition	IC_{50}
1	*Piper nigrum*	250	0.082	0.020	70.24 ±2.0	72.65
2		125	0.072	0.016	58.92±1.0	
3		62.5	0.068	0.014	47.00±3.0	
4	*Cichoriumintybus*	250	0.091	0.018	76.72±4.8	77.64
5		125	0.086	0.015	60.01±0.9	
6		62.5	0.069	0.010	45.89±2.0	
7	*Tribulusterrestris*	250	0.090	0.014	71.95±3.3	71.63
8		125	0.084	0.012	59.76±1.1	
9		62.5	0.068	0.010	47.0±2.1	
10	Positive control	250	0.066	0.025	79.06±1.0	64.49
11		125	0.049	0.020	63.85±2.7	
12		62.5	0.030	0.013	47.03±2.0	

Table No: 2. ANOVA table of anti-arthritic activity

		Sum of Squares	df	Mean Square	F	Sig.
Per.Inhibition.piper.nigrum * Antiartheritic.values	Between Groups(Combined)	810.326	2	405.163	86.821	.000
	Within Groups	28.000	6	4.667		
	Total	838.326	8			
Per.inhibition.cichorium.intybus * Antiartheritic.values	Between Groups(Combined)	1438.155	2	719.078	74.924	.000
	Within Groups	57.585	6	9.597		
	Total	1495.740	8			
per.inhibition.ttibulusterrestris * Antiartheritic.values	Between Groups(Combined)	878.702	2	439.351	78.734	.000
	Within Groups	33.481	6	5.580		
	Total	912.183	8			
positive.control *Antiartheritic.values	Between Groups(Combined)	1539.688	2	769.844	183.928	.000
	Within Groups	25.113	6	4.186		
	Total	1564.801	8			

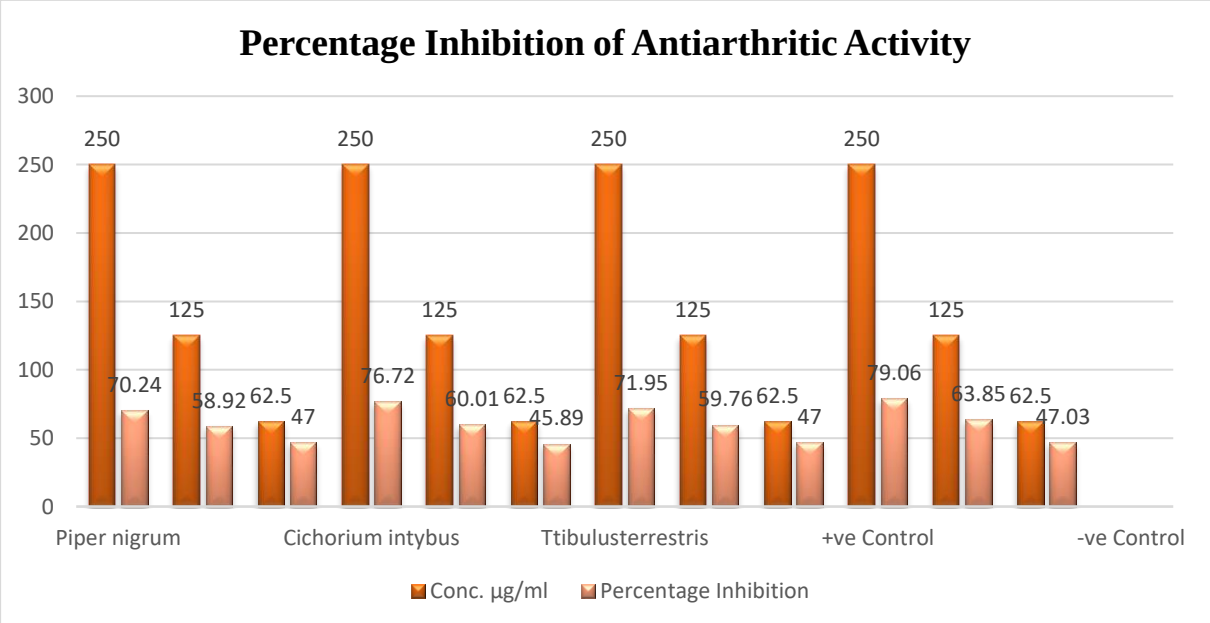

Figure 1. Graphical representation of Percentage inhibition

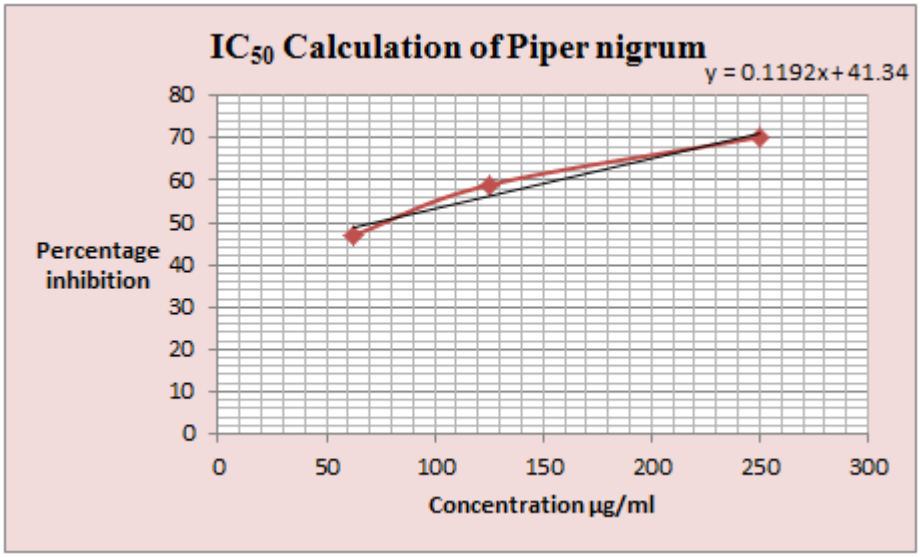

Figure 2. IC_{50} of *Piper nigrum*

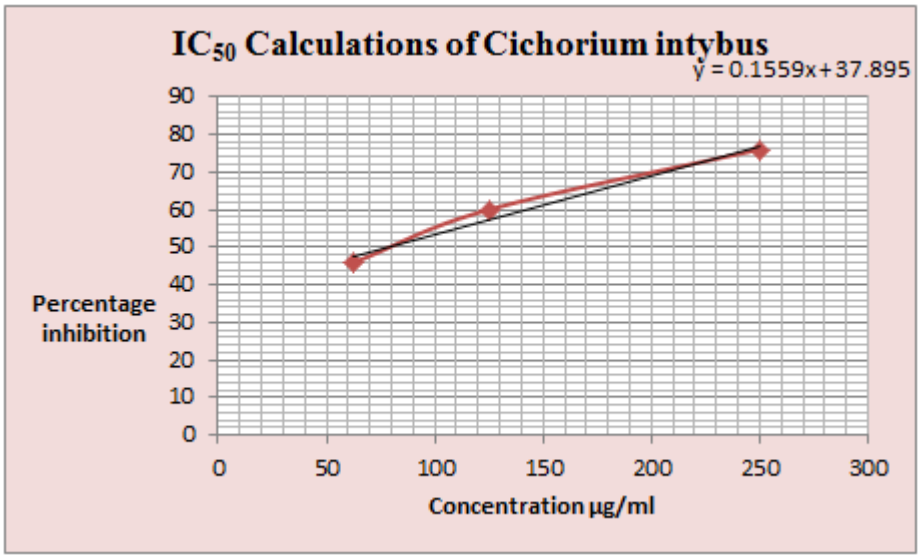

Figure 3. IC_{50} of *Cichorium intybus*

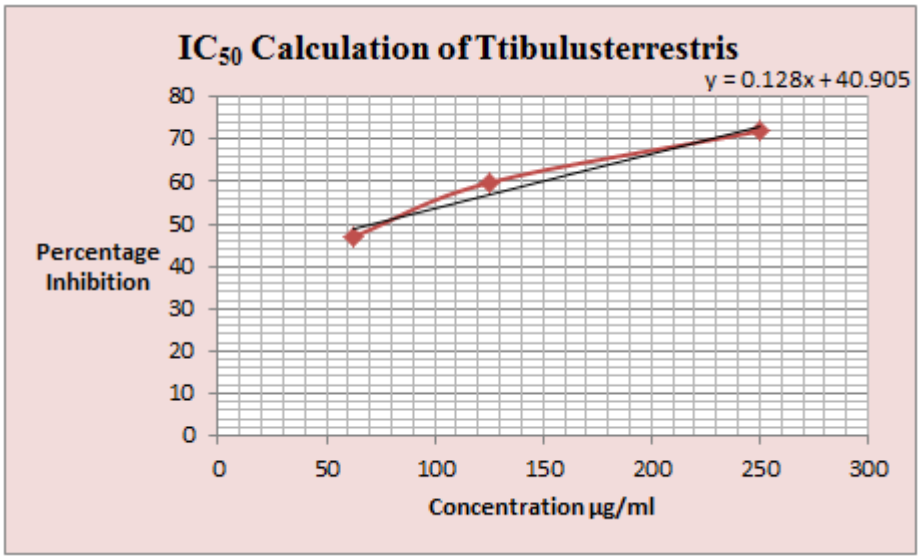

Figure 4. IC_{50} of *Tribulus terresteris*

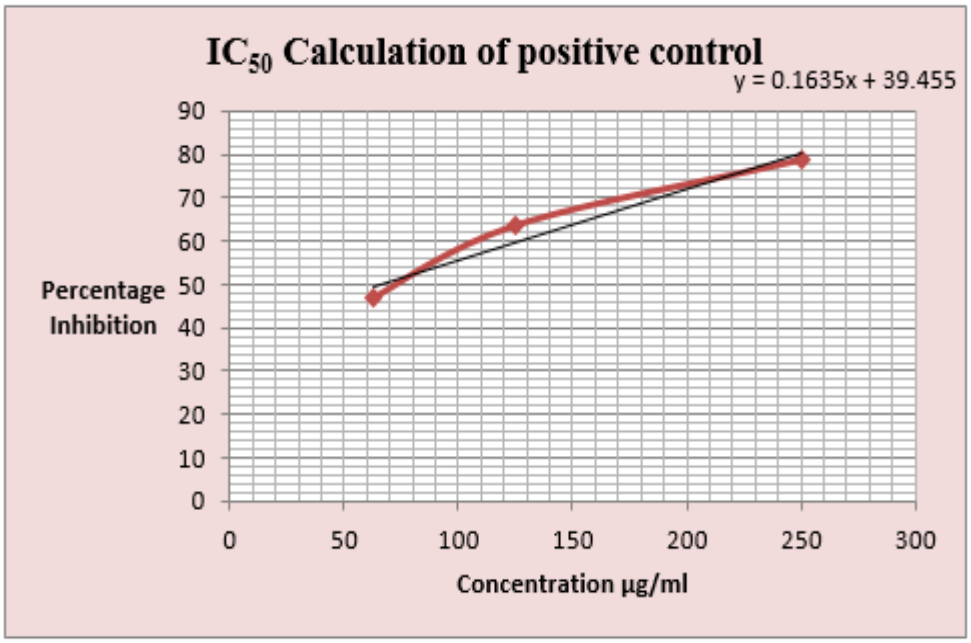

Figure 5. IC_{50} of *positive control*

DISCUSSION

The findings from this study shed light on the potential antiarthritic properties of medicinal plants, specifically *Piper nigrum, Cichoriumintybus*, and *Tribulusterrestris*. According to Saleem et al. (2020), arthritis involves denaturation of tissue proteins, possibly due to the synthesis of auto-antigens. The study demonstrates that the hydro-ethanolic extract of these plants exhibit a notable reduction in albumin denaturation(Saleem, Saleem et al. 2020).

The observed ability of plant extracts to mitigate protein denaturation is noteworthy, paralleling the anti-inflammatory effects of NSAIDs. In particular, the ethanolic 70% extract of *Piper nigrum* demonstrated a significant inhibitory effect on protein denaturation, with percentages of 70.24%, 58.92%, and 47.00% at concentrations of 250, 125, and 62.5 µg/ml, respectively. Similarly, *Cichoriumintybus* and *Tribulusterrestris* displayed considerable anti-arthritic activity, preventing protein denaturation at varying concentrations. The calculated IC_{50} values further emphasize the efficacy of *Tribulusterrestris* in exerting anti-arthritic effects compared to *Cichoriumintybus* and *Piper nigrum*. These results suggest that *Tribulusterrestris* may possess a higher potency in inhibiting protein denaturation associated with arthritis. In conclusion, the study provides valuable insights into the potential therapeutic benefits of these medicinal plants against arthritis. The observed anti-arthritic activity, as indicated by the prevention of protein denaturation, opens avenues for further research into the specific bioactive compounds responsible for these effects. Additionally, exploring the mechanisms underlying the observed anti-arthritic properties could contribute to the development of novel and effective therapeutic interventions for arthritis management.

SUMMERY

In summary, this research provides valuable evidence supporting the potential therapeutic role of these medicinal plants in managing arthritis. The observed anti-arthritic effects, coupled with the dose-dependent response, offer a promising avenue for future investigations into the specific bioactive compounds responsible for these outcomes. The study encourages further exploration of these natural extracts as potential candidates for developing novel and effective anti-arthritic interventions.

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