Lokesh Kumar *et al*, International Journal of Pharmaceutical Sciences & Medicine (IJPSM), Vol.8 Issue. 4, April 2023, pg. 110-131

ISSN: 2519-9889
Impact Factor: 5.9

Evaluation of Anti-Inflammatory Activity of Gum Resin Extract of Boswellia Serrata

Lokesh Kumar[1]; Rinkee Verma[1]; Gurdeep Sharma[2]; Anamika Nishad[2]; Sagar Sharma[3]

Shri Shankaracharya Institute of Pharmaceutical Sciences and Research[1]
Rungta College of Pharmaceutical Sciences and Research, Raipur, C.G. (India)[1]
Apollo College of Pharmacy, Anjora, C.G. (India)[2]
Bharti University, Durg, C.G. (India)[2]
Apollo College Of Pharmacy, Anjora, C.G. (India)[3]

DOI: 10.47760/ijpsm.2023.v08i04.009

ABSTRACT: The present investigations of gum resin extract of *Boswellia Serrata* were studied against experimentally anti-inflammatory activity studies. The work demonstrates that ethanolic gum resin extract and aqueous gum resin extract of *Boswellia Serrata* has anti-inflammation activity in mice and rat by carrageenan-induced inflammation and cotton pellet-induced granuloma. From the above observations we can conclude that ethanolic extracts and aqueous fum resin extract of *Boswellia Serrata* anti-inflammatory activity at both the dose level which is comparable with the standard. The ethanolic gum resin extract of *Boswellia Serrata* (200mg/kg), markedly increased the percentage of average mean increased in paw volume and weight in cotton pellet by the animals. The anti-inflammatory effect of both the doses (150-200 mg/kg in mice and 200-250 mg/kg in rat) showed significant activity and being that (200 mg/kg) showed higher activity. The inflammatory effects of ethanolic extract and aqueous gum resin extract of *Boswellia Serrata* may be attributed to any of or combination of chemicals present in the extract. Further studies are required to identify the active phytoconstituents responsible for the observed inflammatory effect of ethanol extract and aqueous extract. It is suggested and assumed that a further exploration of the present research work is needed to come up with an active anti-inflammatory.

Keywords: *Boswellia Serrata*, mice, anti-inflammatory, phytoconstituents

ISSN: 2519-9889
Impact Factor: 5.9

1. INTRODUCTION: Herbal medicinal plant:-

Herbal medicine is the most widely used system of medicine in the world today. They are made exclusively from plants. According to World Health Organization, medicinal plants would be the best source to obtain a variety of drugs. About 80% of individuals from developed countries use traditional medicine, which has compounds derived from medicinal plants. [1]

Herbs are staging a comeback and herbal 'renaissance' is happening all over the globe. The herbal products today symbolise safety in contrast to the synthetics that are regarded as unsafe to human and environment. Although herbs had been priced for their medicinal, flavouring and aromatic qualities for centuries, the synthetic products of the modern age surpassed their importance, for a while. However, the blind dependence on synthetics is over and people are returning to the naturals with hope of safety and security. [2]

Plant drug have been the major source for treatment of disease for along time. They have been used in traditional used in traditional medicine on basis of experience and and practice. With the advent of modern systems of medicine need has been felt to investigate the active constituents present in these plants. Various molecules have been isolated, characterized and tested for their related pharmacological activities. The active molecules have provided significant leads in the development of more effective synthetic molecules.[3]

Traditional use of medicine is recognized as a way to learn about potential future medicines. Researchers have identified number of compounds used in mainsteam medicine which were derived from "ethno medical" plant sources. Plants are used medicinally in different countries and are a source of many potent and powerful drugs. Four thousand years ago, the medical knowledge of the Indian subcontinent was termed as Ayurveda. Ayurveda remains an important system of medicine and drug therapy in India. Plant alkaloids are the primary active ingredients of Ayurvedic drugs. Today the pharmacologically active ingredients of many Ayurvedic medicines are being identified and their usefulness in drug therapy being determined. As mentioned in the introduction only a certain percentage of plants are used in traditional

ISSN: 2519-9889
Impact Factor: 5.9

medicines. It is roughly estimated that of the discovered 17,000 species, nearly 3,000 species are used in medicinal field. The therapeutic action of important medicinal plants and its parts used. The indigenous systems of medicine in India are reported in under supplementary material. The pharmacological properties of some Ayurvedic crude drugs support for their therapeutic claims.[4]

The World 'Environment' has originated from French word "environ". It mean surroundings. It includes each and everything outside the plant, which influences directly or indirectly the life of the plant. This is an integral part of the earth's ecosystem. Each component of the environment is called environmental factor.[5] Plants grow best within certain ranges of various factors includes temperature, soil moisture, soil nutrients, light, air pollutants, humidity, soil structure and pH. Although these factors affect all plants are frequently grown or kept in cultural particles (fertilization, irrigation, spraying with pesticides) that may affect their growth considerably.[6]

1.2 Inflammation

Inflammation (from Latin *inflammatio*) is part of the complex biological response of body tissues to harmful stimuli, such as pathogens, damaged cell, or irritants,[27] and is a protective response involving immune cell, blood vessels, and molecular mediators. The function of inflammation is to eliminate the initial cause of cell injury, clear out necrotic cell and tissue damaged from the original insult and the inflammatory process, and to initiate tissue repair. [7]

2. MATERIALS AND METHOD

- **Collection of Plant Materials:-**The plant materials of Boswellia Serrata were collected from the local Indore region (Madhaya Pradesh).
- **Authentication of Plant:-**The Plant Boswellia Serrata were identified and authenticated by Dr. S. K. Mahajan, Ex. Professor of Botany, Govt. P. G. College, Khargone, M. P.

ISSN: 2519-9889
Impact Factor: 5.9

❖ **Preparation of Extract:-** Preparation of extracts by continuous hot soxhlet and decoction method using following solvents.

- Ethanol
- Aqueous

❖ **Phytochemical Studies:-**

- Tests For Carbohydrates and Glycosides by
  - ➢ Molisch test
  - ➢ Legal's test
  - ➢ Brontrager's test
- Test For Alkaloids by
  - ➢ Dragondroff's reagent
  - ➢ Wagnor's reagent
  - ➢ Mayer reagent
- Test For Proteins and Free Amino Acid by
  - ➢ Millon's reagent
  - ➢ Ninhydrine reagent
  - ➢ Biuretn's test
- Test For Phenolic Compounds and Tannins by
  - ➢ Dil. Ferric chloride
  - ➢ Sodium chloride
  - ➢ Lead acetate
- Test For Flavonoids by
  - ➢ Aqueous Sodium hydroxid
  - ➢ Con. Sulphuric acid
  - ➢ Shinoda's test

ISSN: 2519-9889
Impact Factor: 5.9

- Test For Saponins
  - Foam test

❖ **Experimental Animals:-**

Albino mice (25-30 gm) of either sex were be procured from Institute of Animal Health & Veterinary Biological Rasalpura, Mhow (M.P.) India.

Animal experimentation were performed in Charak Institute of Pharmacy, Mandleshwar under CPCSEA, Registration no: 1575/PO/a/11/CPCSEA.

❖ **Acute toxicities study:-**

LD_{50} of prepared extracts were evaluated using OECD guideline no. 425.

❖ **List of Instrument and chemicals:-**

- **Drugs:-** Carrageenan, Ibuprofen, Cotton pellet, Diclofenac Sodium Abbott healthcare Pvt. Ltd. Mumbai.
- .**Chemicals:-** Ethanol (95% v/v) and Aqueous used in the present study were of general grade and were procured from Sun-Chem. Chemicals Pvt. Ltd Satna, M.P.
- **Glassware:-** Soxhlet assembly, Round bottom flask, Beaker, Funnel, Glass rod Manufactured by (ASCO) Alka Scientific corporate manufacturer of scientific glass apparatus (Nagpur).
-

Name of Chemical	Manufacture
Ibuprofen	Granules India Limited, Hyderabad, India
Diclofenac sodium	Abbott heathlcare Pvt. Ltd. Mumbai.
Carrageenan	Chemicals Pvt. Ltd. Satna, M.P.
Cotton pellets	Ambient Healthcare Pvt. Ltd.
Diethyl ether	Chemicals Pvt. Ltd. Satna, M.P.
Ethanol	Chemicals Pvt. Ltd. Satna, M.P.

Table No. 2:- List of Chemicals

ISSN: 2519-9889
Impact Factor: 5.9

Name of Instruments	Manufacturer
Soxhlet Apparatus	Profit India An ISO 9001 company
Hot Air Oven	Lab Hosp Corporation Mumbai
Heating Mental	Lab Hosp Corporation Mumbai
Weighing Balance	Weigh PAD series Digital Scale
Desiccator	Besto
Refrigerator	Videocon

Table No:-3 List Of Instruments

- **Evaluation of Anti-inflammatory activity by:-**
  - I. Carrageenan-induced inflammation
  - II. Cotton pellet-induced granuloma

STATISTICAL ANALYSIS

The data were expressed as mean ± standard error mean (SEM). The significance of differences among the group will be asscssed using one way analysis of variance (ANOVA) by prism software. The test was followed by Dunnett's, $p<0.05$ were considered as significance.[8]

3. RESULTS

3.1 Preparation of Extract:-

The fresh gum resin of *Boswellia Serrata* were collected from Indore, India. This plant sample as herbarium was authenticated by Dr. S. K. Mahajan. Collected gum resin of plant were washed well with tap water prior to distilled water deprived of dusts and insects, dried, powdered in a Willy Mill to 60-mesh size.[9]

About 250 gm. Of gum resin of *Boswellia Serrata* was packed in soxhlet apparatus and

ISSN: 2519-9889
Impact Factor: 5.9

maceration separately and extracted with ethanol and aqueous. The extracts were filtered while hot and the solvents were removed by distillation and the last traces of solvent being removed under reduced pressure. The ethanolic and aqueous extracts were stored in refrigerator for futher experimental work.[10]

Extractive values of extracts are given in table no.-4.

PLANT NAME	PARTS USED	METHOD	95% ETHANOL	AQUEOUS
Boswellia Serrata	Gum resin	Soxhlet assembly and Maceration	28.18%	22.13%

Table No.4:- Extractive values of different extracts of gum resin of *Boswellia Serrata*

3.2. PRELIMINARY PHYTOCHEMICAL SCREENING [11]

Preliminary phytochemical screening of ethanolic & aqueous extracts of gum resin of *Boswellia Serrata* was performed to identify presence of Carbohydrates, Alkaloids, Flavonoids, Saponins, Glycosides, Proteins & Steroids. The observations of various tests are given in following table:

ISSN: 2519-9889
Impact Factor: 5.9

Table No.5:- Preliminary phytochemical screening ethanol and aqueous gum resin extracts of *Boswellia Serrata*

S. NO.	TESTS	OBSERVATION	INFERENCES	
			Ethanolic Extract	Aqueous Extract
1.	**TEST FOR CARBOHYDRATES:** ➢ **Molisch's Test:** Crude extract was mixed with 2 ml of molisch reagent and the mixture was shaken properaly. After that, 2 ml of concentrated was poured carefully along the side of the test tube.	A violet ring at the inter phase was observed.	Indicated the present of carbohydrates.	Indicated the absent of carbohydrates .
	➢ **Fehling's Test:** Equal volume of fehling A and fehling B reagents was mixed together and 2 ml of it was added to crude extract and gently boiled.	A brick red precipitated appeared at the bottom of the test tube.	Indicated the present of carbohydrates.	Indicated the present of carbohydrates .
	➢ **Benedict's Test:** Crude extract was mixed with 2 ml of benedict's reagent and boiled.	A reddish brown precipitate was observed.	Indicated the present of carbohydrates.	Indicated the absent of carbohydrates

ISSN: 2519-9889
Impact Factor: 5.9

2.	**TEST FOR ALKALOIDS:** ➢ **Mayer's test:** To 1 ml of extract, 1 ml of mayer's reagent was added. (Potassium mercuric iodide solution).	Whitish yellow or cream colored precipitate was observed.	Indicated the moderately present of alkaloids.	Indicated the present of alkaloids.
	➢ **Dragendroff's Test:** To 1 ml of the extract, 1 ml of dragendroff's reagent was added. (Potassium bismuth iodide solution).	An orange-red precipitate was observed.	Indicated the moderately present of alkaloids.	Indicated the present of alkaloids.
	➢ **Wagner's Test:** To 1 ml of the extract, 2 ml of wagner's reagent was added. (Iodine potassium iodide).	Formation of reddish brown precipitate was observed.	Indicated the moderately present of alkaloids.	Indicated the absent of alkaloids.
3.	**TEST FOR FLAVONOIDS:** ➢ **Shinoda Test:** Crude extract was mixed with few fragments of magnesium ribbon and concentrated HCL was added drop wise.	Pink scarlet colored appeared observed.	Indicated the absent of flovonoids.	Indicated the absent of flavonoids.
4.	**TEST FOR SAPONINS:** ➢ **Foaming Test:** Crude extract was mixed with 5 ml of distilled water in a test	Formation of stable foams was observed.	Indicated the absent of saponins.	Indicated the present of saponins.

ISSN: 2519-9889
Impact Factor: 5.9

	tube and it was shaken vigorously.			
5.	**TEST FOR GLYCOSIDES:** ➢ **Liebermann's Test:** Crude extract was mixed with each of 2 ml chloroform and 2 ml of acetic acid. The mixture was chilled in ice. Carefully concentrated H_2SO_4 was added.	A reddish brown colored was observed.	Indicated the present of steroidal nucleus, i.e, glycine portion of glycosides.	Indicated the moderately present of steroidal nucleus, i.e, glycine portion of glycosides.
	➢ **Modified Brontrager's Test:** Crude extract was mixed with of 5 ml, added 5% $FECL_3$ & 5 ml, Dil.HCL. Heat for 5 min, in boiling water both. Cool & add benzene or any organic solvent lear. Add equal volume dilute ammonia.	Ammonia layer shows pinkish red colored.	Indicated the absent of anthraquinone glycosides.	Indicated the absent of anthraquinone glycosides.
	➢ **Keller-Kilant Test:** Crude extract was mixed with 2 ml of glacial acetic containing 1-2 drop of 2% solution of $FeCL_3$. The mixture was then poured into	A brown ring at the interphase was observed.	Indicated the presence of cardiac glycosides	Indicated the presence of cardiac glycosides.

ISSN: 2519-9889
Impact Factor: 5.9

	another test tube containing 2 ml of concentration H_2SO_4.			
6.	**TEST FOR PHENOLS AND TANNINS:** Crude extract was mixed with 2 ml of 2% solution of $FeCl_3$.	A blue-green or black colored was observed.	Indicated the moderately present of phenols and tannins.	Indicated the present of phenols and tannins.
7.	**TEST FOR PROTEINS:** ➢ **Millon's Test:** Crude extract was mixed with 2 ml of millon's reagent.	White precipitate was appeared which turned red upon gentle heating.	Indicated the present of protein.	Indicated the absent of protein.
8.	**TEST FOR STEROIDS:** ➢ **Salkowsli Reaction:** Crude extract was mixed with 2 ml chloroform & 2 ml conc.H_2SO_4. Shake well Sepreted two layers.	Chloroform layer appears red & acid layer shows greenish yellow fluorescence	Indicated the present of steroids.[78]	Indicated the absent of steroids.

3.3 Determination of LD_{50} of the Ethenolic & Aqueous Extracts *Boswellia Serrata* in mice by Acute Toxicity Studies[12]

Dose fixation:- Acute oral toxicity study was done according to OECD guideline (AOT 425) as albino mice. A dose of 2000 mg/kg was selected. One animal was administered a dose of 2000 mg/kg on first day. The animal was observed for 24 hours. The animal showed no sign of discomfort or system so, the same dose was repeated on same animal, the next day. The animal survived without any symptom. Based on the above observation, LD_{50} of the compound was

ISSN: 2519-9889
Impact Factor: 5.9

confirmed to be greater than 2000 mg/kg for the prepared ethanolic extract. Any dose below 2000 mg/kg could be used a dose for animals.[12]

Table No. 6:- Preliminary phytochemical screening ethanol and aqueous extracts of gum resin of *Boswellia Serrata*

S.N.	Phytochemical Constituents	Ethanol (95%)	Aqueous
1.	**Test for carbohydrates**		
	➢ Molisch's Test	++	-
	➢ Fehling's Test	++	++
	➢ Benedict's Test	++	-
2.	**Test for alkaloids**		
	➢ Mayer's Test	+	++
	➢ Dragendroff's Test	+	++
	➢ Wagner's Test	+	-
3.	**Test for flavonoids**		
	➢ Shinoda Test	-	-
4.	**Test for saponins**		
	➢ Foaming Test	-	++
5.	**Test for glycosides**		
	➢ Liebermann's Test	++	+
	➢ Modified brontrager's Test	-	-
	➢ Keller-kilant Test	++	++
6.	**Test for phenols and tannis**	+	++
7.	**Test for protenins**		
	➢ Millon's Test	++	-
8.	**Test for steroids**		
	➢ Salkowsli Reaction	++	-
Present ++	**Moderately Present +**	**Absent -**	

ISSN: 2519-9889
Impact Factor: 5.9

3.4. Acute Toxicity Study

Observation All the animals survived without any symptom or toxicity during the observations up to 24 hrs. Based on the above observation, LD_{50} of the compound was confirmed to be greater than 2000mg/kg for the test compound[13].

Inference Any dose below 2000mg/kg could be used as a dose for animals. The biological evaluation of Anti-inflammatory activity was carried out at doses of 200 and 250 mg/kg body weight in rat and 150 and 200 mg/kg body weight in mice.

3.5. Statistical Analysis

The results of this study were analyzed on the basis of mean ± SEM from 6 animals. Statistical analysis was carried by using Student one-way analysis of variance (ANOVA) Test and by the Dunnett's test using $P < 0.05$, $P < 0.01$ was considered significant.

3.6. Anti-inflammatory Studies

I. Carrageenan-induced inflammation
II. Cotton pellet-induced granuloma

I. Carrageenan-induced inflammation:-

Test compound:- The Aqueous and Etanolic extract of flowers of *Boswellia Serrata* and standard drug Ibuprofen were used.

Chemicals and Reagent:- Carrageenan-induced inflammation, Saline.

Instrument:- Plethysmometer (USO Basile, Italy)

Experimental Animal:- Albino mice (18-25gm) used in the present study. The animals were fed with pellet diet and water add libitum. All the animals were acclimatized for a week befor use.

Procedure:- Albino mice (25-30g) of either sex were used in the entire study. They were housed in standard polypropylene cages and kept under controlled room temperature (24±2^{o}C; relative humidity 60-70%) in a 12 h light – dark cycle. The animals were fed with standard laboratory diet and water add libitum. Food was withdrawing 12 h before and during the experimental hours. The experimental protocol was approved by Instutional Animal Ethics Commmittee.[14]

ISSN: 2519-9889
Impact Factor: 5.9

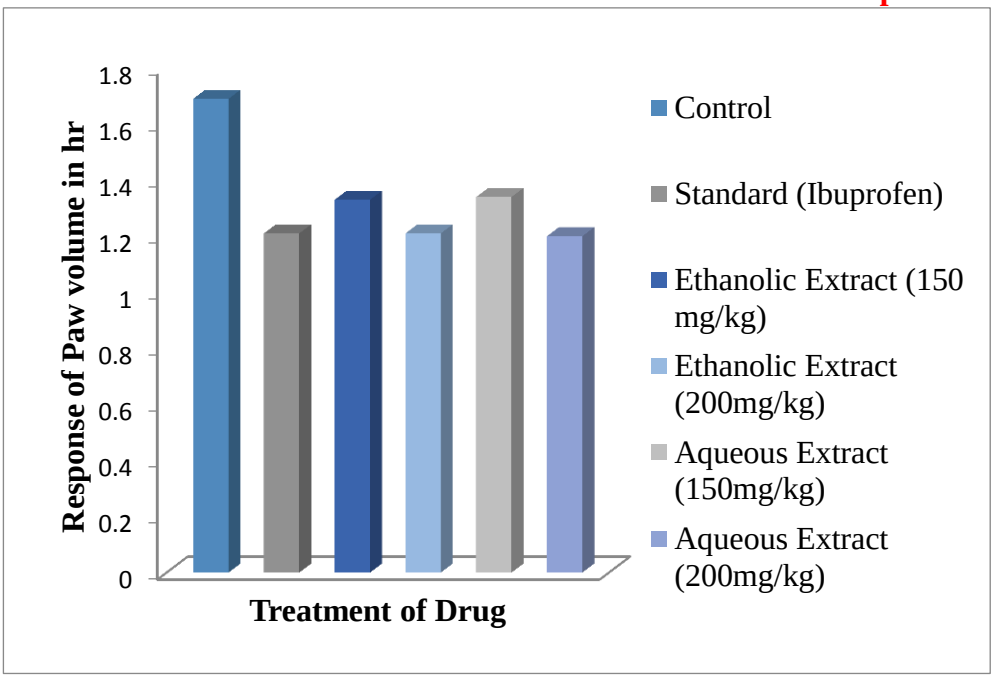
The hind-paw oedema induced by sub plantar injection of, control group treated (I) 0.1ml Carrageenan (1% w/v), (II) ibuprofen (standard) 40mg/kg, (III), (IV) 150-200mg/kg of aqueous extract, (V), (VI) 150-200mg/kg ethanolic extract, was evaluated according to the method described by, 0.1ml of 1% w/v carrageenan was injected into the sub plantar tissue of left hind paw of each rat. Swelling of carrageenan injected foot was measured at 0, 1, 2, 3 h using Plethysmometer (UGO Basile, Italy). Animals were treated with test extract 1 hour before the carrageenan injection. Measurement was carried out immediately before and 3 hrs following carrageenan injection. Percent inhibition of test drugs was calculated in comparison with vehicle control (100%).[15]

Table:- 7. Carrageenan induced paw in mice.

Treatment (mg/kg)	Mean increase in paw volume (ml)				% Decrease in paw volume at 3 h
	0 h	1h	2h	3h	
Control	0.92±0.01	1.50±0.007	1.86±0.004	2.48±0.007	-
Ibuprofen	0.89±0.008	1.08±0.01**	1.28±0.002**	1.62±0.001*	52.30
EE(150mg/kg)	0.94±0.037	1.20±0.035*	1.49±0.32**	1.70±0.049*	50.29
EE(200mg/kg)	0.92±0.046	1.18±0.061**	1.30±0.037*	1.44±0.035*	66.45
AE(150mg/kg)	0.93±0.035	1.26±0.037*	1.48±0.30**	1.69±0.047**	52.32
AE(200mg/kg)	0.91±0.045	1.20±0.063*	1.28±0.035**	1.68±0.035*	68.49

N=6, treatment, mg/kg, data were analyzed using ANOVA and expressed as Mean ± SEM followed by Dunnett's and differences between means were regarded significant at *[P<0.05], **P<0.01 Saline, EE-Ethanolic extract.

ISSN: 2519-9889
Impact Factor: 5.9



Graph No. 1.:- Carrageenan induced paw in mice.

- **Cotton pellet-induced granuloma:-**

Test compound- The Aqueous and Etanolic extract of flowers of *Boswellia Serrata* and standard drug Diclofenac were used.

Chemicals and Reagents- Cotton pellet-induced granuloma, Diclofenac Sodium.

Experimental Animal- Rat (150-200gm) of either sex were used in the present study. The animals were fed with pellet diet and water add libitum. All the animals were acclimatized for a week before use.

- **Procedure:-**

Rats (150-200g) of either sex were kept for one week to acclimatize to laboratory conditions before starting the experiment they were deprived of food but not water. The study was conducted after obtaining clearance from the Institution Animal Ethical Committee.

ISSN: 2519-9889
Impact Factor: 5.9

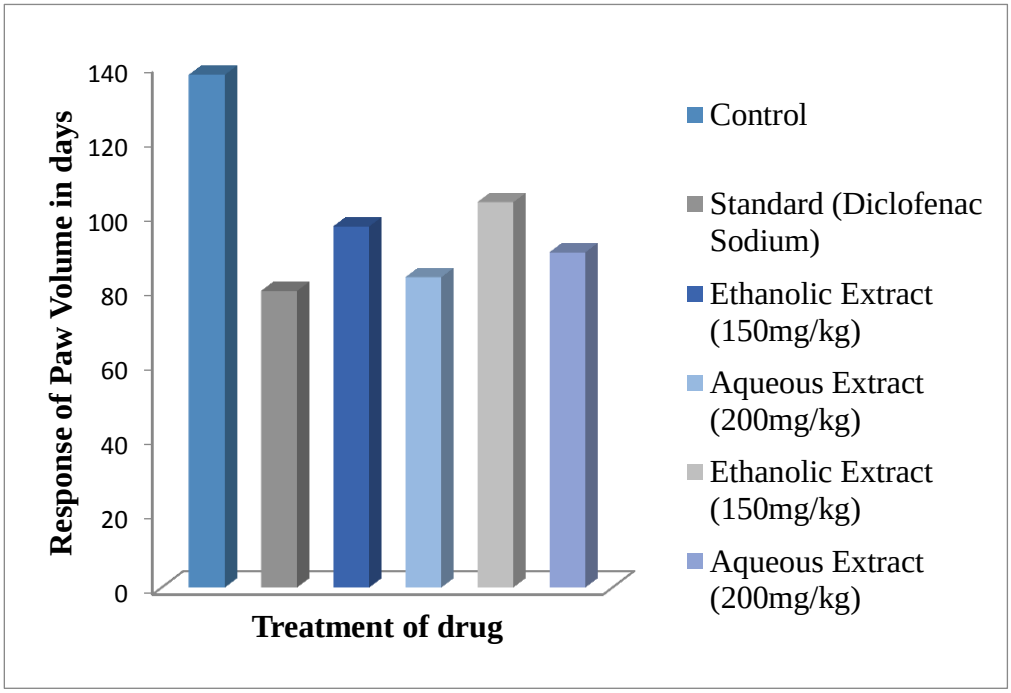
Rats were divided into six groups of six rats each. Absorbent cotton wool cut into pieces weighing 20±1 mg and made into pellets. The pellets were then sterilized in a hot air oven at 120^{o} for 2 h. The abdomen was shaved cleanly, swabbed with 70% ethanol and two sterilized cotton pellets were implanted subcutaneously, one on each side of the abdomen of the animal under light ether anesthesia. Control group are induced (I) cotton pellet, (II) diclofenac sodium (standard) 40mg/kg, (III), (IV) group are treated aqueous extract 200-250mg/kg, (V), (VI) group are treated ethanolic extract 200-250mg/kg are used. Test drugs were administered once daily throughout the experimental period of 7 days. On the 8th day after implantation, rats were anaesthetized with ether. The pellets were dissected and dried at 60^{o} for 18 h, weighed after coling. The mean weight of the cotton pellets of the control group as well as of the test groups was calculated. The transudative weight, granuloma formation and percent granuloma inhibition of the test compound were calculated.[16]

Table:-8. Cotton pellet-induced granuloma in rat.

Treatment	Dosage mg/kg	Wet weight(mg)	Dry weight (mg)	Percentage of inhibition	Transudative weight(mg)	Percentage of inhibition
Control	--	217.3±8.81	57.83±1.67	--	159.5±7.64	--
Diclofenac Sodium	40	115.2±1.85*	43.78±1.95*	24.30	67.82±2.89*	57.52
Ethanolic Extract	200	142.4±1.67*	51.24±0.64*	11.39	91.62±1.25*	42.62
Ethanolic Extract	250	121.5±1.04*	44.87±1.07*	22.49	76.81±1.51*	51.89
Aqueous Extract	200	153.6±1.79*	53.05±1.77	8.28	102.2±1.65*	36.13
Aqueous Extract	250	130.6±1.84*	49.12±1.57*	15.05	81.5±0.98*	48.11

ISSN: 2519-9889
Impact Factor: 5.9

Values expressed as mean ± SEM n=6 animals in each group. The results were analyzed using One way ANOVA followed by Dunnett's multiple comparison tests.*P<0.05 was used to indicate statistical significance when compared to control.



Graph No. 2.:- Cotton Pellet-induced granuloma in rat.

4. Discussion:-

Extractive value:-

- The gum resin of *Boswellia Serrata* (500gm) was taken for extraction and the extraction was proceeding with two solvents using ethanol and water extraction process. From among the extracts Ethanolic extract afforded maximum yield (28.18%) and Aqueous extract yield (22.13%).

Phytochemical Screening:-

- Investigations on the Preliminary phytochemical screening of Ethanol extract showed

ISSN: 2519-9889
Impact Factor: 5.9

presence of Carbohydrates, Alkaloids, Glycosides, Phenols & Tannins, Protenins and Steroid.

- Aqueous extract showed presence of Carbohydrates, Alkaloids Saponins, Glycosides, Phenols & Tannins. Different solvents were prepared by ethanol and water extract using standardized procedure and also subjected to anti-inflammatory activity. Gum resin extract of *Boswellia Serrata* exhibited significant anti-inflammatory activity with respect to control.

Acute Toxicity Study:-

- The Ethanolic and Aqueous extracts of gum resin of *Boswellia Serrata* were administered orally to found that both the test compound, at a limit test one dose level for a dose 2000 mg/kg, showed any montality.

Anti-inflammatory Activity:-

- The present study showed that the ethanolic extract and aqueous extract of gum resin of *Boswellia Serrata* possess anti-inflammatory activity as evidenced by its significant effect by Carrageenan-induced inflammation in mice and Cotton pellet-induced granuloma in rat.

Carrageenan-induced inflammation:-

- Exposure of animals to gum resin extract of *Boswellia Serrata* were evaluated for anti-inflammatory activity using well established models i.e., carrageenan-induced inflammation model and Cotton pellet-induced granuloma model. The carrageenan-induced inflammation model was chosen since this is effective, cheap, simple, less time consuming and require no preliminary training to the mice and do not cause much discomfort to the animals while handling.
- In order to provide a scientific explanation for the folk use of *Boswellia Serrata*, we have investigated the biological effects of its extracts, mainly the ones related to the inflammatory process. The present data clearly showed that extracts of dried gum resin of *Boswellia Serrata* have anti-inflammatory activity by the highly significant responses of some extracts on inhibiting the edema formation after carrageenan subplantar injection.

ISSN: 2519-9889
Impact Factor: 5.9

- The results obtained from the carrageenan-induced inflammation model, indicated that Ethanol and Water extract showed significant ($p<0.05$) anti-inflammatory activity as compared to saline. The carrageenan induced edema inhibition after the treatment with the phlogistic agent. The % decrease in paw volume at 3 h from 52.30 (h) ibuprofen to 50.29 and 66.45 (h) in ethanol extract at a dose of 150 and 200mg/kg. and 52.32 (h) and 68.49 (h) in water extract at a dose of 150 and 200mg/kg. Results obtained are presented in table.

Cotton pellet-induced granuloma:-

- The cotton pellet granuloma method has been widely employed to access the transudative, exudative and proliferative components of subacute inflammation. Oral administration of ethanol and aqueous extract in two doses of 200 mg/kg and 250 mg/kg for 7 days did not induced gastric lesion in rats. Whereas, diclofenac produced significant gastriomucosal lesions. Cotton pellet implantantion caused an increased in serum alkaline phosphatase. As shown in the ethanol and aqueous extracts as wall as diclofenac reduced increased serum alkaline phosphatase when compared to control and were found to be statistically significant at value $p<0.05$.
- In Cotton Pellet-induced granuloma model the weight in cotton pellet were significantly ($p<0.05$) increased in each animals treated with Ethanol and Aqueous extract at 200 mg/kg and 250 mg/kg when compared to control animals. The average time weight in cotton pellet increased from percentage of inhibition diclofenac sodium 57.52 and 42.62 and 51.89 in ethanolic extract at dose of 200 and 250 mg/kg. and 36.13 and 48.11 in water extract at a dose of 200 and 250 mg/kg.

ISSN: 2519-9889
Impact Factor: 5.9

5. Summary & Conclusion: The present investigations of gum resin extract of *Boswellia Serrata* were studied against experimentally anti-inflammatory activity studies. The results are summarized as follows:

- In preliminary phytochemical screening Ethanolic and Aqueous gum resin extract showed positive results.
- Ethanolic extract showed presence of Carbohydrates, Alkaloids, Glycosides, Phenol & Tannins, Protenins and Steroid.
- Aqueous extract showed presence of Carbohydrates, Alkaloids, Saponins, Glycosides, Phenol & Tannins.
- Ethanolic and Aqueous gum resin *Boswellia Serrata* extract was studied for acute oral toxicity as per revised OECD guidelines number 425. *Boswellia Serrata* was devoid of any toxicity up 2000 mg/kg in albino mice and rat by oral route. Hence for further studies doses of mice in the 150 to 200 mg/kg and rat in the 200 to 250 mg/kg of *Boswellia Serrata* were used.
- In Carrageenan induced inflammation significant mean increased in paw volume was also observed in animals treated with standard (Ibuprofen) drug. The numbers of entries were significantly increased in animals treated with ethanol and aqueous extract and standard drug Saline when compared to control animal.

In Cotton Pellet-induced granuloma Model significant increase in weight in cotton pellet was also observed in each animals treated with standard (Diclofenic Sodium) drug. The numbers of transitions were significantly increased in animals treated with ethanol and aqueous extract and standard drug Diclofenic Sodium when compared to control animal. The present work demonstrates that ethanolic gum resin extract and aqueous gum resin extract of *Boswellia Serrata* has anti-inflammation activity in mice and rat by carrageenan-induced inflammation and cotton pellet-induced granuloma.

From the above observations we can conclude that ethanolic extracts and aqueous fum resin

ISSN: 2519-9889
Impact Factor: 5.9

extract of *Boswellia Serrata* anti-inflammatory activity at both the dose level which is comparable with the standard. The ethanolic gum resin extract of *Boswellia Serrata* (200mg/kg), markedly increased the percentage of average mean increased in paw volume and weight in cotton pellet by the animals. The anti-inflammatory effect of both the doses (150-200 mg/kg in mice and 200-250 mg/kg in rat) showed significant activity and being that (200 mg/kg) showed higher activity. The inflammatory effects of ethanolic extract and aqueous gum resin extract of *Boswellia Serrata* may be attributed to any of or combination of chemicals present in the extract. Further studies are required to identify the active phytoconstituents responsible for the observed inflammatory effect of ethanol extract and aqueous extract.

- ❖ It is suggested and assumed that a further exploration of the present research work is needed to come up with an active anti-inflammatory.

References

[1]. Sumenta Kumar Ghosh, Nonigopal Guria, Avijit Sarkar, Anupam Ghosh,**:** Traditional herbal remedies for various aliments within the rural communities in the District of Bankura and Purulia , Int. J. Pham. Sci, 2013, 5(4), 195-198.
[2]. P.P. Joy, J. Thomas, Aromatic and Medicinal Research Station, 1998, 3
[3]. http:// nopr.niscair. res.in/handle/123456789/9823.
[4]. Kirtikar KR, Basu BD. Indian Medicinal Plants, Vol.II,2nd Edn., Lalit Mohan Basu co, Allahabad, 1984.
[5]. The Plant List: A Working List of All Plant Species, Retrieved June 19,2014.
[6]. Ramar Perumal Samy, Peter Natesan Pushparaj and Ponnampalam Gopalakrishnakone, A compilation of bioactive compounds from Ayurveda, Bioinformation by Biomedical Informatics Publishing Group, (2008); 3(3): 100-110.
[7]. Mohd. Mazid, Taqi ahmed khan, Firoz Mohammad, Medicinal Plants of Rural India: A Review of Use by Indian Folks, Indo Global Journal of Pharmaceutical Sciences, 2012; 2(3): 286-304.
[8]. Singh R. Medicinal plants, Journal of Plant Sciences, 2015; 3(1-1): 50-55.
[9]. Longman Orient and Sala Vaidya Arya, J. of Indian Medicinal Plants, 2002, 2, 11.
[10]. Murali, KS (1993) Differential reproductive success in Boswellia Serrata in differenthabitants-A case of pollinator limitations In: Current Science (Bangalore), 65(3), 270-272.
[11]. Mohd.Danish, Pradeep Singh, Garima Mishra, Shruti Srivastava, K.K. Jha, R.L. Khosa, *Boswellia Serrata* Linn. (Amulthus)- An Importsnt Medicinal Plant: A Review of Its Traditional Uses, Phytochemistry and Pharmacological Properties, J. Nat. Prod. Plant Resour., 2011, 1(1): 101-118.
[12]. Sen AB, Shukia YN., Chemical examination of Boswellia Serrata, J Indian Chem Soc., 1986, 45: 744.
[13]. "*Boswellia Serrata* (aburnum, Purging Fistula, Golden Shower, Amaltas)", Ayurved-Herbs 4 to 40, retrieved 2011-01-20.
[14]. Kirtikar K.R., Basu B.D., Indian Medicinal Plants, International book distributors, 2006, 2,: 856-860.
[15]. "The Plant List: A Working List of All Plant Species", Retrieved June 19, 2014.
[16]. Deepika Priyadharshini S and Sujatha V*, Antioxidant assessment for various solvent fraction of Boswellia Serrata Linn. Flowers, 2012; 4(1): 113-125.
[17]. R. n. Chpora, S. L. Nayar, I. C. Chpora, Glossary of India Medicinal Plants, National Institute of Science Communication and Information Resources, 2006, page no. 54.

ISSN: 2519-9889
Impact Factor: 5.9

[18]. Pradeep K, Raj Mohan CV, Gobianand K, Karthikeyan S, Protective effect of Boswellia Serrata Linn. on diethyl nitrosamine induced hepatocellular damage and oxidative stress in ethanol pretreated rats, Biol Res. 2010, 43(1): 113-125.
[19]. Pradeep K, Mohan CV, Anand KG, Karthikeyan S, Effect of pretreatment of Boswellia Serrata Linn. leaf extract against subacute CCl4 induced hepatotoxicity inrats, Indian J Exp Biol. 2005, 43(6): 526-30.
[20]. Karthikeyan S, Gobianand K, Antiulcer activity of ethanol leaf extract of *Boswellia Serrata*, Pharm Biol. 2010, 48(8): 869-77.
[21]. Daisy P, Balasubramanian K, Rajalakshmi M, Eliza J, Selvaraj J, Insulin mimetic impact of catechin isolated from Boswellia Serrata on the glucose oxidation and molecular mechanisms of glucose uptake on Streptozotocin-induced diabetic Wistar rats, Phytomedicine. 2010, 17(1): 28-36.
[22]. Chauhan A, Agarwal M, Evaluating the antifertility potential of an aqueous extract from Boswellia Serrata seeds in male rats, Fertil Steril. 2010-15, 93(5): 1706-10.
[23]. Govindarajan M, Bioefficacy of Boswellia Serrata Linn. (Leguminosae) leaf extract againstchikungunya vector, Aedes aegypti (Diptera: Culicidae), Eur Rev Med Pharmacol Sci. 2009, 13(2): 99-103.
[24]. Senthil Kumar M, Sripriya R, Vijaya Raghavan H, Sehgal PK, Wound healing potential of Boswellia Serrata on infected albino rat model, J Surg Res. 2006, 131(2): 283-9.
[25]. Manonmani G, Bhavapriya V, Kalpana S, Govindasamy S, Apparanantham T, Antioxidant activity of Boswellia Serrata (Linn.) flowers in alloxan induced diabetic rats, J Ethnopharmacol. 2005-10, 97(1): 39-42.
[26]. Luximon-Ramma A, Bahorun T, Soobrattee MA, Aruoma OI, Antioxidant Act ivities of phenolic, proanthocyanidin and flavonoid components in extracts of Boswellia Serrata, J Agric Food Chem. 2002, 50(18): 5042-7.
[27]. Ferrero-Miliani L, Nielsen OH, Andersen PS, Girardin SE; Nielsen Andersen; Girardin (February 2007), chronic inflammation of NOD2 and NALP3 in interleukin-1 beta generation Clin. Exp. Immunol. 2007; 147(2): 217-56.
[28]. Abbas A.B., Lichtman A.H. (2009), "Ch.2 Innate Immunity". In Saunders (Elsevier). Basic Immunology. Functions and disorders of the immune system (3rd ed.).
[29]. Andreae S. Lexikon der Krankheiten and Untersuchungen. Stuttgart: Thieme; 2008.
[30]. Piira, Olli-Pekka; Miettinen, Johanna A.; Hautala, Arto J.; Huikuri, Heikki V.; Tulppo, Mikko P., "Physiological responses to emotional excitement in healthy subjects and patients with coronary artery disease". Autonomic Neuroscience, 2013; 177(2): 280.

