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Research Article

In Vivo Evaluation Of Anti – Inflammatory Effect Of Kakamachi (Solanum Nigrum Linn) - An Experimental Study

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ABSTRACT:

Sotha (Inflammation) is the commonest problem faced many times by human beings. It can be observed as a symptom in various diseases like amavata(Rheumatoid arthritis), vatarakata(Gout), sandhigata(Osteoarthritis) etc and also explained as separate disease in Ayurvedic classics. The word sotha means the part of the body which is utsedayukta. Inflammation is a tissue reaction to infection, irritation or foreign substances. It is a part of host defence mechanism. The various anti-inflammatory drugs available though very potent are not devoid of untoward side effects. To find an alternative herbal remedy effective in sotha the drug kakamachi is taken up for the study.

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INTRODUCTION:

Ayurveda mainly concentrates on preventive & curative aspects of the disease. Right from the existence of universe human beings are struggling to lead a disease-free life & is trying to solve this problem.

Ayurveda is concerned with a broad view of complete health. To meet this goal, it preaches to follow the natural way. It cures physical and mental disturbances by using the things which are naturally available & not harmful to the body. Herbal drugs prepare our body to combat the pathogens. While explaining chatushpadas^[1] (The Four Quarters of Treatment Aspect) all the Samhita karas have given prime importance to vaidya, next to the vaidya they emphasized the importance of Dravya. Complete

knowledge of drug is very much necessary to vaidya. He is considered as the best physician one who knows about the selection and administration of the drug in accordance with place, time, nature of the drug & the person etc.

Ayurveda says "There is in the world, no substance that cannot be used as medicine, in one or the other manner for different purposes. The drug whose name, form and properties are not known or the drug which though known if not properly administered will cause disaster"^[2].

Medicine is that which being well administered becomes an equalizer of increased and diminished elements at the

same time. It brings down the excessive elements and augments the deficient one.

Sotha(Inflammation) is a symptom which is mostly always associated with any ailment affecting the human body during a life time. It is considered to be a reflection of derangement of many bodily functions conventionally understood with inflammation or oedema.

Ayurveda signifies Inflammation as a disease in accordance to Sotha. Sotha can also be seen as a Lakshana(symptom), Upadrava(Complication) in several ailments and is one among the Mahagadas.^[3] (Diseases difficult to treat) Sotha is known by many other terms viz., Sopha, Swayathu, Vranasotha, Vranasopha. Sotha is defined as a thick elevation, Sama or Vishama, residing between Twak(Skin) and Mamsa(Muscle), due to accumulation of doshas, arising in any part of the body.^[4]

Inflammation is defined as the local response of living mammalian tissue to injury, due to any agent. It is often associated with changes that affect the body as a whole, in particular, leucocytosis and fever. Inflammatory reaction is local at first, consisting primarily of changes in blood vessels, the escape of cells and fluids from the blood into the tissues and the consequent changes in the tissues.^[5]

Depending upon the severity of injury and the adequacy of host defence the inflammation may remain localized to its site of origin and evokes no systemic reaction or may call in to play systemic responses. Timely intervention from the part of physician is very essential in controlling inflammation.

The knowledge of plants for an Ayurvedic physician is absolutely essential to alleviate human sufferings. Without this he stands in the battle field like a warrior without a weapon. Since the age of Vedas, the plants have been brought in to use for many purposes including its utility as food and medicine. Many of the ideas have been assimilated by constant observation of the nature and its application through trial and error. Thus, came into being the science of dravyaguna vijñana.

INTERVENTION:

Sl.No	GROUPS	DRUG / INTERVENTION	DOSAGE
01.	Control Group	Distilled Water	2ml/Kg
02.	Standard Group	Indomethacin	0.9ml/Kg
03.	Trial Group	Kakamachi Swarasa	0.43ml/Kg

Healthy albino rats weighing 150-200 gms were selected for the experimental study. The albino rats were fed with standard laboratory rat feed. Clean water was supplied to the rats. Before beginning the experiment, food was withdrawn to all groups for 12 hrs. Only water was supplied. Albino rats were divided into 3 groups each containing 6 rats.

Inducing Inflammation:

The albino rats were fed orally in the groups 2 and 3 with indomethacin and Kakamachi swarasa respectively one

Ayurveda aushada or bhesaja are those which cure pain and sorrowful experience. They are divided into 3 main groups namely Audbhida (Plant origin), Jangama (Animal origin), Parthiva (Mineral origin)^[6].

Most of the Ayurvedic drugs are made up of the plant sources. Since olden days, man has been practicing Ayurveda thus constantly utilizing the plant resources.

There are various drugs enlisted by Acharyas to cure sotha. Among these, many have been included and used in combination as compounds and only a few have been singularly identified to have the particular action. Kakamachi is one such drug which has been mentioned by Bhavamishra in his Nighantu to have Sothahara quality^[7].

MATERIALS AND METHODS:

Literary Sources:

Collection of drug:

The drug Kakamachi was collected from the natural source. The drug was collected in the month of October. The drug procured was authenticated by the botanist. The drug was cleaned thoroughly with water.

Include method of swarasa preparation and experimental study.

Preparation of the swarasa:

Swarasa is prepared according to the procedures mentioned in Sharangadhara samhita. The leaves are crushed and made into paste form and it is kept in cloth and squeezed. The extract obtained is called swarasa.

Observation:

Homogenous thick liquid was obtained and Greenish in colour.

Inclusion Criteria:

Adult healthy albino rats of either sex.

Albino rats weighing 150 – 200 gms.

Albino rats of 90 – 120 days are included.

hour before inducing oedema by 1% suspension of 4 lambda carrageenan (0.1ml – 1%w/v) (Type of Hi-media Laboratory, Bombay) into the sub-plantar region of left hind paw of all the 3 groups. Paw volume of all 18 albino rats were measured soon after injecting carrageenan and was repeated for every 1 and 3 hours in all the 3 groups of rats. The comparative change in the paw volume of the control group, standard group and trial group is expressed as percentage oedema inhibition^[8].

Plethysmograph – Estimation of rat paw volume - Methodology:

The apparatus used for measurement of rat paw volume was Plethysmograph - a device designed by Winter C.A., Risley G.A., and Nuss G.W., Proc. Soc. Exp. Bio Med, 1962, employed for measurement of paw volume of experimental rats.

The apparatus consists of Limb 'G' made of a 2 ml. burette graduated to 0.02 ml and connected to a glass U tube. Another limb, which divides into two identical chambers A & B (internal diameter 14 mm and length 4 cm) at the upper end.

S₁ and S₂ are two glass stoppers and t and t₁ are side tubes, which are connected by polythene tubes through stopper to a 5 ml syringe for refilling the apparatus with coloured water and readjustment. Immediately above the stopper (S₂) there is a glass constriction.

The apparatus is filled with solution of potassium permanganate up to the mark (M) of the chamber B, keeping all stoppers opened and avoiding air bubbles. The side tube t and stopper S₂ are then closed with this

syringe. Solution level in 'G' is brought to zero and the side tube t is closed.

The volume of rat paw is measured by holding with one hand the unanaesthetised rat and vertically dipping the animals inflammation induced extended hind paw, already marked at the ankle joint with water proof ink into chamber.

Dose Fixation:

Recommended human dose of swarasa according to classics is ½ pala (24 ml).

This is converted to rat dose using the formula.

Rate dose = Human dose x 0.018 per rat

= 24 ml x 0.018

= 0.43ml per rat.

So, the dose of swarasa for rats = 0.43ml. The rat dose of Indomethacin suspension is 0.9ml.

All the results obtained through experimental observations are statistically analysed by Students t-test at level of significance considering P < 0.005.

RESULTS:

Table No: 1 Showing reading pf the inflamed hind paw volume (ml) before and after treatment in control group.

Sample	Intial Paw Volume	Paw Volume After 3hrs	Difference
01	1.32	1.31	0.01
02	1.49	1.48	0.01
03	1.38	1.37	0.01
04	1.40	1.39	0.01
05	1.33	1.31	-0.02
06	1.49	1.48	0.01

Table No: 2 Showing statistical data of control group.

Sl.No	Standar Deviation	Standard Error	t Value	P Value
01	0.013	0.005	0.938	> 0.10

Table No: 3 Showing reading pf the inflamed hind paw volume (ml) before and after treatment in standard group.

Sample	Intial Paw Volume	Paw Volume After 3hrs	Difference
01	1.65	1.39	0.26
02	1.63	1.55	0.08
03	1.75	1.45	0.30
04	1.70	1.56	0.14
05	1.71	1.45	-0.26
06	1.66	1.46	0.20

Table No: 4 Showing statistical data of control group.

Sl.No	Standar Deviation	Standard Error	t Value	P Value
01	0.08407	0.003415	60.518	< 0.001

Table No: 5 Showing reading pf the inflamed hind paw volume (ml) before and after treatment in trial group.

Sample	Intial Paw Volume	Paw Volume After 3hrs	Difference
01	1.58	1.5	0.08
02	1.52	1.46	0.06
03	1.52	1.35	0.17
04	1.6	1.52	0.08
05	1.68	1.54	0.14
06	1.58	1.46	0.1

Table No: 6 Showing statistical data of control group.

Sl.No	Standar Deviation	Standard Error	t Value	P Value
01	0.0418	0.0170	6.1511	< 0.01

After the application of all the test drug in all the groups of rats, the volume of reduction in oedema is noted in ml at specific time interval and comparative statistical analysis is done.

Table No: 7 Showing the comparative effect of all the three groups by statistical analysis.

Sl.No	Groups	Mean Score			SD	SE	't' Value	'P' value
		BT	AT	BT-AT				
01	Control Group	1.48	1.475	0.005	0.013	0.005	0.938	>0.100
02	Standard Group	1.68	1.476	0.204	0.084	0.0034	60.518	<0.001
03	Trial Group	1.58	1.475	0.105	0.0418	0.017	6.15	<0.01

The results obtained through experimental study which are shown in the tables are statistically analysed based on the student t test and can be interpreted as follows.

- In trial group, the result was moderately significant ($p < 0.01$) with mean value as 0.105 and SD (0.0418)
 - In standard group, the result was highly significant ($p < 0.001$) with mean value as 0.206 and SD (+0.08407)
 - In control, the result is insignificant ($p > 0.100$) with mean of 0.005 and SD (+0.013)
 - Comparison between Group I and Group II; the t value of group I being 0.938 in comparison to the t value 60.1511 of group III, shows that the result in trial group is definitely better than that of the control group ($p < 0.010$) Group3 > Group1.
 - Comparison between Group II and Group III - the t values being 0.518 and 6.151 respectively at 10° of freedom, statistically both the trial drug and the standard drug shows nearly equal results ($p < 100$) Group2 = Group3.
 - Comparison between Group I and Group II shows the standard group gives better results than the control group. The t values being 0.938 and 6.518 respectively. So Group2 > Group1 ($p < 0.010$).
- Therefore, it is ascertained that Kakamachi swarasa can play a significant role in reducing inflammation being almost equally as effective as the standard drug Indomethacin.

DISCUSSION:

The disease sotha is mentioned separately as well as a symptom in various diseases in Ayurvedic classical treatises such as Samhitas and Nighantus. Inflammation is the response of tissues to injury or infection, and is necessary for normal repair and healing. This section focuses on the generic inflammatory response, and its multisystem manifestations. Acute inflammation is the result of rapid and complex interplay between the cells and soluble molecules of the innate immune system. The classical external signs include heat, redness, pain and swelling (calor, rubor, dolor and oedema^[9]).

Until now various herbs were screened for their anti-inflammatory action. An attempt has been tried in this form of study to provide an alternative herbal remedy. Kakamachi is a drug popularly used in Kusta, Prameha, Jwara for its sotha hara property mentioned in

Bhavaprakasha Nighantu^[10]. Swarasa of kakamachi was prepared as per the proportions prescribed by Sharangadhara while explaining panchavidha kashaya kalpanas^[11]. The trial drug kakamachi is seen growing abundantly and easily available throughout the year. The pharmacodynamic properties such as Tikta rasa, Anusna Veerya, Katu vipaka and Laghu, Snigdha Gunas are attributed to Kakamachi^[12]. The drug was identified by botanists and the faculty members of the PG department of Dravyaguna, before beginning the study.

The design of the study on inflammation was made on animal experimentation. Albino rats weighing between 150 - 200gms were selected carefully for the evaluation. Three groups of animals were selected for the studies Control group G-I, Standard group with Indomethacin G-II and Trial group with Kakamachi swarasa G-III. Carrageenan (0.1ml of 1% w/v in saline) was used to induce inflammation in the left hind paw of all the rats keeping the right paw as control. The paw volume of the rats of the three groups before and after injecting Carrageenan was measured using Plethysmograph. Paw volume was measured hourly for three hours after injecting the Carrageenan and the observations done to see the difference in paw oedema. Signs of Inflammation was observed between 15-30 minutes after induction of Carrageenan. On analysis of the observations, it is found that the rats in the control group did not show any improvement by 3 hours. But the rats in the trial group and standard group showed improvement during 2nd and 3rd hour of injecting Carrageenan.

Statistical analysis showed that the result in the trial group is almost equal to that of the standard group i.e. G II = G III.

Development of edema induced by Carrageenan is commonly correlated with the early exudative stage of inflammation, one of the important processes of inflammatory pathology (Ozaki 1990). In the beginning of carrageenan injection, there is sudden elevation of paw volume in relation with histamine mediators (Geen, 1964). After 1 hour, the inflammation is increased gradually and was elevated during the later 3 hours. This second phase could be due to the liberation of prostaglandins and kinins (Garcia leme et al., 1973) which accompanies leucocyte migration. Animal experimentation has its limitations in the evaluation of inflammation. All the symptoms cannot be evaluated as

done in clinical study. Here only the utseda or tumor can be evaluated through the aid of Plethysmograph by which the reduction of inflammation can be calculated. The statistical data and graphs are presented in the tables. Thus, through animal experimentation it is found that Kakamachi has significant action as anti-inflammatory drug.

Sotha has the samprapti in which there will be vitiation of Kapha, Raktha and Pitta which enter the bahya siras and in turn vitiates the vata located there. Thus, srothorodha is caused which spreads to the areas in the vicinity and sotha results.

The drug kakamachi is having tikta Rasa, anushna veery, katu vipaka and laghu- snigdha gunas. Tikta rasa does pitta - kapha samana. Laghu guna acts antagonistically on kapha. Katu vipaka subsides kapha. Thus the gunas or pharmacodynamic properties of kakamachi of the trial drug act altogether upon the pitta, rakta and kapha during the samprapti vigatana and eventually pacifies edema. Once the vitiated pitta, rakta and kapha are brought to their normal physiological conditions, the vayu gets pacified thus clearing the srotho rodha and relieving sotha.

CONCLUSION:

Through literary research it is found that the trial drug Kakamachi (*Solanum nigrum* Linn.) is having significant shothagna property.

Sotha is disease itself and also as an associated symptom in other conditions like amavata, sandhigata vata, vatarakta etc. It is considered as local defence mechanism of tissue at the site of damage, which is caused by bacteria, injury, chemicals etc.

By experimental research it is proved that the drug Kakamachi (*Solanum nigrum* Linn) is having remarkable antagonistic action against sotha on albino rats.

The Kakamachi swarasa was prepared according to the reference available in Sarangadhara samhita.

This trial drug is easily available and does not possess any sort of side effects or toxic effects in its therapeutic dose on rats. So, it is found to be a safe remedy.

Even though trial drug provided lesser result in the management of sotha than the standard drug, it is use full in the management of sotha which was highly significant by statistical analysis in the order of relief provided by the drug.

Thus, through experimental study, the trial drug Kakamachi swarasa was proved to have significant anti-inflammatory effect on albino rats. This drug may be further evaluated clinically to know the effectiveness on human beings in the management of sotha.

REFERENCES:

- 1) Dr. Sashirekha H K, Dr. Bargale Sushanth Sukumar, Caraka Samhita, First Edition, Vol 1, Choukambha Publicationa, New Delhi, 2017, Page No 157.
- 2) Dr. Sashirekha H K, Dr. Bargale Sushanth Sukumar, Caraka Samhita, First Edition, Vol 1, Choukambha Publicationa, New Delhi, 2017, Page No 37.

- 3) Dr. Sashirekha HK, Dr. Bargale SS. Charaka Samhita, First Edition, Vol 2, Choukambha Publications; Varanasi, 2018. Page No. 602.
- 4) Ambikadutta Sastri K, editor. Sushruta Samhita of Maharshi Susrutha. Reprint ed. Part 1, Choukambha Sanskrit Sansthan ,Varanasi; 2005. Page No. 70.
- 5) Mohan H. Textbook of Pathology, Inflammation and Healing. Fifth Edition, Jaypee Brothers; New Delhi: 2005. Page No. 134.
- 6) Dr. Sashirekha H K, Dr. Bargale Sushanth Sukumar, Caraka Samhita, First Edition, Vol 1, Choukambha Publicationa, New Delhi, 2017, Page No 26.
- 7) Dr. K C Chunekar, Edited by Late Dr. G.S. Pandey, Bhavaprakasha Nighantu, Revised and Enlarged Edition, Chaukambha Bharati Academy, Varanasi, 2010, Page No 423.
- 8) Kulkarni SK. Handbook Of Experimental Pharmacology. Chapter Pharmacology of Inflammation. Delhi: Vallabha Prakashan; 2013. Page No. 165.
- 9) Davidsons Principles & Practice of Medicine, Twenthy Edition, Elsevier, India, 2006, Page No 75-76.
- 10) Dr. K C Chunekar, Edited by Late Dr. G.S. Pandey, BHavaprakasha Nighantu, Revised and Enlarged Edition, Chaukambha Bharati Academy, Varanasi, 2010, Page No 423.
- 11) Dr. P Himasagara Candra Murthy, Second Edition, Chaukambha Samskrit Series, Varanasi, 2007, Page No 102.
- 12) Dr. K C Chunekar, Edited by Late Dr. G.S. Pandey, Bhavaprakasha Nighantu, Revised and Enlarged Edition, Chaukambha Bharati Academy, Varanasi, 2010, Page No 423.