"EFFECT OF *CORIANDRUM SATIVUM* LINN EXTRACT ON EXPERIMENTALLY INDUCED ALLERGIC CONDITIONS AND MAST CELL DEGRANULATION ON INVESTIGATIONAL ANIMALS".

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Abstract

Background:

Coriandrum sativum Linn. is a plant belongs to the family **Apiaceae** has been extensively used in Indian traditional medicine It is used in pharmaceuticals, nutraceuticals and industrial uses.The health promoting perceptive of coriander attributed to its rich phytochemicals.

Objectives:

The present study was designed to evaluate the anti-allergic activity of hydroalcoholic extract of areal parts of *Coriandrum sativum* Linn in experimental animals.

Methodology:

The antiallergic activity of hydro-alcoholic extract of *Coriandrum sativum* Linn was evaluated in compound 48/80 induced mast cell degranulation in rat mesentery and milk induced leucocytosis and eosinophils in mice was studied.

Results:

The hydro alcoholic extract of areal parts of the plant of *Coriandrum sativum* Treatment of HAECS (100 and 200 mg/kg *p.o.)* showed significant ($p<0.001$) protection against compound 48/80 (1 mg/kg *s.c*.) induced mast cell degranulation in and mesenteric pans. Administration of milk (4 ml/kg *s.c*) to group of mice showed significant ($P<0.001$) increase in leucocytes and eosinophils. the different doses of of HAECS (100 and 200 mg/kg *p.o*.) was found to decrease significantly ($p<0.001$) reduced the milk (4 ml/kg *s.c*.) induced elevated levels of blood total leucocyte and eosinophils counts.

Conclusion:

This study confirmed the traditional use of title plant in treatment of allergic diseases exhibiting significant anti allergic activity. Hence, further studies on the exact molecular mehanisms(s) of actions of *Coriandrum sativum* Linn are recommended.

Keywords: *Coriandrum sativum* Linn; Anti-allergic; Mast cell; Compound 48/80;

Leukocytes; Eosinophilia

Introduction:

An **allergy** is a chronic condition caused by hypersensitivity of the immune system to typically harmless substances in the environment[1]. It is potentially life-threatening disease is common worldwide with a high prevalence reported in all age groups[2]. The symptoms may includes red eyes, an itchy rash, sneezing, a runny nose, shortness of breath or swelling[3]. This disease includes hay fever, food allergies, atopic dermatitis, allergic asthma, and anaphylaxis[4]. Anaphylaxis is a hyperactive response to antigen crosslinking of IgE bound to mast cells. It provokes degranulation of mast cells leading to the discharge of bioactive mediators such as histamine, prostaglandins, lipid derived mediators and proteases, leukotrienes along with some of the pro-inflammatory and chemo tactic cytokines[5]. Infiltration of these mediators to the tissue triggers smooth muscle contraction, broncho-constriction,vasodilatation, increased vascular permeability and mucous hyper secretion[6]. The allergic diseases are of two phases which includes development and sensitization of T and B cell responses and IgE dependent activation of mast cells and infiltration of eosinophil, innate lymphoid cells that are arranged by numbers of activated CD4+ T helper type 2 (Th2) lymphocytes. These play a critical role in allergic inflammation leading to severe allergic disorders, which causes tissue injury[7]. Environmental health troubles, rising dust mite populations, dietary factors, and deskbound lifestyle are causing a surge in allergic diseases. Formal economic evaluation is playing an increasingly important role in health care decisions and hence allergic diseases are on the rise at alarming rates[8]. Globally 300 million people suffer from asthma and about 200 to 250 million people have an abnormal medical condition from food allergies. About $1/10^{th}$ of the population were suffering from drug induced allergies and 400 million people from rhinitis. Moreover, allergic diseases commonly

occur together in the same individual, one disease with the other, approximately 20% to 30 % of total population experience at least one of these allergic diseases in India[9].

The current therapeutic agents for allergic diseases drugs such as anti histamines, Leukotriene inhibitors, thromboxane A2 (TXA2) inhibitors, Th2 cytokine inhibitors, mast cell stabilizing agents, corticosteroids, bronchodilators, and anti-inflammatory drugs, although these medications have tremendous advantages. In despite of these, some of the drugs associated with disadvantages such as calmative effect on long term daily administration and these exert its side effects such as loss of appetite, local irritation and drowsiness. The anti-histamines have systemic side effects, especially dry mouth and sedation and many of the second- generation anti histamines undergo extensive first pass metabolism in the liver. Currently, β2-adrenoceptor agonists are major therapeutic treatment for asthmatic diseases [10,11].

Medicinal plants have been used in healthcare since time immemorial. Hence, they are considered as the preferred treatment option for various common ailments in almost all parts of India because of their traditional values, lesser known side effects, easy accessibility, affordability and so on [12]. Indian Materia-Medica comprises about 2000 drugs of natural source of which approximately 400 are of mineral and animal source while the rest are of vegetable source.

Recently, World health organization (WHO) estimated that 80% of people worldwide on herbal medicines for some facet of their prime health care needs. According to WHO, around 21,000 plant species have the potential for being used asmedicinal plants **[13]**.

Coriander (*Coriandrum sativum* L.) is a glabrous, aromatic, herbaceous annual herb belonging to the family Apiaceae[14]. Coriander is one of the oldest spices mentioned in recorded history, with evidence of its use more than 5000 years ago. Its use was mentioned in Egyptian, Sanskrit and Roman literature. Egyptians called this herb the spice of

happiness[15]. Traditionally, this plant has been used to cure alleviate spasms, gastric complaints, bronchitis, gout and giddiness[16]. The phytochemical screening of *Coriandrum sativum* showed that it contains a essential oil, tannins, terpenoids, reducing sugar, alkaloids, phenolics, flavonoids, fatty acid, sterols and glycosides etc[17].

The previous pharmacological studies revealed that it possessed anxiolytic, antidepressant, sedative-hypnotic, anticonvulsant, memory enhancement, improvement of orofacial dyskinesia, neuroprotective, antibacterial, antifungal, anthelmintic, insecticidal, antioxidant, cardiovascular, hypolipidemic, anti-inflammatory, analgesic, antidiabetic, mutagenic, antimutagenic, anticancer, gastrointestinal, deodorizing, dermatological, diuretic, reproductive, hepatoprotective, detoxification and many other pharmacological effects[18].

Materials and Methods

Chemicals

Compound 48/80, dexamethasone, xylene, RPMI-1640 medium(at 150), toludine blue, formaline solution, disodium chromoglycate, acetone, WBC diluting fluid, Leishmans stain and boiled and cooled milk.

Animals

Adult female Albino wistar rats weighing around (200-250g) and Swiss albino mice of either sex (25-30g body weight) were used for the present study. The animals were housed in animal house Sree Siddaganga College of Pharmacy. Experimental animals were housed in an appropriate polypropylene cages with free access to food and water with a sterile paddy husk as a bed and maintained in a standard condition with temperature 22 ± 2°C, relative humidity of 45–60%, and a 12 h light: 12 h dark normal cycle (lights on at 7 am) in a quarantine room. Animals were adapted to laboratory conditions 48 h prior to initiation of experimental studies to minimize any non-specific stress. All the animal experiments were initiated after obtaining prior permission by Institutional ethical committee of Sree

Siddaganga College of Pharmacy, Tumkur Karnataka, Approval No. SSCP/IAEC/clear/209/20-21, according to prescribed guidelines of committee for the Purpose of Control and Supervision of experiments on Animals (CPCSEA), government of India.

Plant Material and Extraction

The *Coriandrum sativum* Linn. Whole plant will be purchased from local region of Tumakuru District in january 2021. The Plant material will be identified and authenticated by Dr.R.Nandeesh Head, Department of Pharmacognosy, Sree Siddaganga college of pharmacy, B.H.Road, Tumakuru. and herbarium will be stored in the department.

For preparation of hydroalcoholic extract, The fresh areal parts of *Coriandrum sativum* Linn were dried in shade and powdered coarsely in an electric grinder. The powder was extracted in hydroalcoholic solution (70%) in the ratio of 70:30, (100 gm of powdered drug was taken into 700 ml of hydroalcoholic solution) with the help of a Soxhlet's apparatus for 8 hrs. Thereafter, the extract was filtered and concentrated on water bath. The concentrated extract was weighed and the yield percentage was calculated with reference to the weight of crude drug. A semi solid residue of Hydro-alcoholic extract of *Coriandrum sativum* Linn obtained. The obtained semi-solid yield was stored in an air tight container in vacuum desiccator for further studies[19].

Preparation of *Coriandrum sativum* doses

Test samples including solutions or suspensions of drug or plant extract were freshly prepared every day. The plant extract was prepared as a suspension in 0.3% W/V CMC (Carboxymethyl cellulose) and administered through oral route, at the doses of 100 mg/kg and 200 mg/kg for each animal as per the previous study.

Preparation of Compound 48/80

Compound 48/80 was prepared using normal saline and administered through subcutaneous injection to experimental animals.

Preparation of disodium chromoglycate

Reference standard drug Disodium chromoglycate was prepared using normal saline and administered through *i.p*. to experimental animals.

Experimental design

Model 1: Compound 48/80 induced mast cell degranulation in rat mysentery[20]

Animal grouping

Six groups of rats with 6 animals in each were studied. Normal control group: Normal rats received vehicle (2ml/kg normal saline, p.o.). Drug alone group: Rats received HAECS (200mg/kg *p.o*). Inducer control group: Rats received compound 48/80 (1mg/kg *s.c.)* Test groups: Rats received increasing doses of hydroalcoholic extract of *C. sativum* (HAECS) (100, 200 mg/kg *p.o.)* Reference group: Rats received disodium chromoglycate (10mg/kg *i.p*) All the treatments were carried out 2 hours before induction and continued for 7 days on a daily basis. Finally, the animals were euthanized by ether overdose inhalation 2 hours after the last dose (a period of seven-day treatment).

Compound 48/80 induced mast cell degranulation on rat mesentery	
Groups	**Treatment**
I	Vehicle (1 ml/kg *p.o*)
II	HAECS (200mg/kg *p.o*)

III	Compound 48/80 (1 mg/kg *i.p*)
IV	Compound 48/80 (1 mg/kg *i.p*) + HAECS (100mg/kg *p.o*)
V	Compound 48/80 (1 mg/kg *i.p*) + HAECS (200mg/kg *p.o*)
VI	Compound 48/80 (1 mg/kg *i.p*) +Disodium chromoglycate (10 mg/kg *i.p*)

Procedure:

Wistr albino rats of either sex weighing between 180-200 g were divided into six groups, selected and each group containing six animals. Animals belonging to Group-I received normal saline (1 ml/kg, *p.o*) while Group-II was treated with HAECS extract alone (200 mg/kg, *p.o*). On 1st day the rats of Group-III and Group-VI were sensitized with compound 48/80(1mg/kg, *s.c*) Group-III served as inducer control. Group-IV and Group-V served as test group and administered with HAECS extract (100 and 200 mg/kg, *p.o*) whereas Group-VI received Disodium chromoglycate (10 mg/kg, *i.p*) asreference standard drug.

On the 7thday 2 h after assigned treatment, rats were sacrificed and intestinal mesentery were taken for study of mast cells. Mesenteries of sacrificed rats along with intestinal pieces were spread on petridish Containing Ringer Locke's solution at 37°C which was transferred on a slide and stretched with the help of needles. The intestinal tissues pieces were cut and removed. The pieces of mesentery were then challenged with 5µg/ml of compound

$$\%\ Protection = [1 - (\frac{\text{Test}}{\text{Control}})] * 100$$

48/80Solution in vitro for 10 mines and then stained with 0.1% toludine blue in 4%aqueous

formalin solution. The stained cells are then immersed in xylene for 5-10 mins and finally rinsed 2 or3 times with acetone and observed under microscope (45X). Total 100 mast cells were counted from different visual areas. The numbers of intactand degranulated cells were counted and percentage protection was calculated.

Where, T =no of degranulated cells of test.

C=no. Of degranulated cell of inducer control

Model 2: Milk induced leucocytosis and eosinophilia in mice[21,22]:

Leucocytes and eosinophils can regulate local immune response,which derived from bone marrow cells. Elevated concentrations of leucocytes and eosinophils in blood stream closely resemble many pathologic conditions including asthma, airway obstruction and allergic inflammation.Sensitization of mice with milk illustrates elevated levels of leucocytes and eosinophils in blood stream.This experimental model is an easiest and fast screening method to test compounds against several immune responses.

Milk-induced leucocytosis and eosinophilia in mice.	
Groups	**Treatment**
I	Vehicle (1 ml/kg, *p.o*)
II	HAECS(200mg/kg, *p.o*)
III	Milk(4 ml/kg, *s.c*)
IV	Milk(4 ml/kg, *s.c*) HAECS (100mg/kg, *p.o*)
V	Milk(4 ml/kg, *s.c*) + HAECS (200mg/kg, *p.o*)
VI	Milk(4 ml/kg, *s.c*) + Dexamethasone (50 mg/kg, *i.p*)

Procedure:

Swiss albino mice of either sex weighing (20-25g) were selected and randomized into five groups, each housing six animals.

Animals belonging to Group -I received Vehicle (1 ml/kg, *p.o*), Animals belonging to Group -II received freshly boiled and cooled milk (4ml /kg, *s.c*). Animals belonging to Group -III and VI were pre-treated with hydro alcoholic extract of *Coriandrum sativum* Linn (100 mg and 200 mg/kg *p.o*. respectively) and 45minutes later boiled and Cooled milk (4 ml/kg, *s.c*) was administered to the same animal. Whereas Group-V received dexamethasone (50mg/kg, *i.p*.) as reference standard drug.

1. Blood samples were collected from each mouse via retro-orbital plexus before drug administration and collected in an EDTA coated tubes for further analysis.(leukocytes and eosinophils)

2. After 45 minutes of the respective treatments to the same grouped mice recieves boiled and cooled milk through subcutaneous route except group I and II.

3. After 24h blood was withdrawn from retroorbital plexus and collected in an EDTA coated tubes for count from group I to VI.

Leucocyte count:

Samples were diluted with WBC diluting fluid (1:1) using WBC pipette. Diluted blood in a pipette was shaken and kept aside for 5 min and Neubauer's chamber was charged with above mentioned fluid and total leukocytes count was done.

Eosinophil count:

Smear on plane slide were pepared using collected blood samples.Leishman's stain was used for staining the smears,this causes eosinophils to show up as orange-red granules. Then the eosinophils cells were counted under light microscope at 45X and tabulated.

Statistical analysis

The data were expressed as mean ± SEM. The statistical analysis of data was done by using One-way analysis of variance (ANOVA), followed by Tukey's multiple comparison test was used using Graphpad prism 5.0 software (Graphpad, San Diego, CA)

Results

Model 1: Compound 48/80 induced mast cell degranulation in rat mesentery

Subcutaneous injection of Compond 48/80 (1mg/kg) significantly increases ($p<0.001$) the degranulation of mast cells in C-48/80 alone group (85.41±1.60) Compared to normal control group. In the treatment groups with difference doses of *HAECS* (100,200mg/kg) and Disodium chromoglycate (10mg/kg) showed 51.84±1.35, 26.60±1.57 and 28.56±1.62 degranulation of mast cells with a significancant reduction ($p<0.001$) and percentage(%) protection was found to be 39.4%, 68.9% and 66.6% respectively. *HAECS* (200 mg/kg) alone showed significantly increased ($P<0.001$) in the degranulation of mast cells when compared to normal group.(Table 1 figure 1)

Model 2: Milk-induced leucocytosis and eosinophilia in mice

Subcutaneous administration of milk (4 ml/kg) showed significant increase in the levels of leucocytes and eosinophils count after 24h compared to normal control group. Whereas, group of mice pre-treated with *HAECS* (100 & 200 mg/kg) exhibited significant decrease ($P<0.001$) in the levels of leucocytes and eosinophils count. Reference standard of Dexamethasone (50 mg/kg) showed significant reduction ($P<0.001$; $P<0.001$) in the levels of leucocytes and eosinophils counts respectively.(Table 2 & Figure 2 and 3)

Discussion

Immune dysfunction, which is a major global health issue, is what causes allergies. Allergens are things like food, pollen, dust mites, cosmetics, mold spores, and animal hairs that induce allergic reactions. Mast cells and blood basophils release histamine as a result of hypersensitivity type I, an allergic reaction that is mediated by IgE. The early phase reaction of allergy occurs within minutes after allergen exposure, whereas the late phase reaction occurs hours later and involves in cytokines' secretion such as TNFα and IL4. Since, b-hexosaminidase is usually released along with histamine from mast cells or basophils, this enzyme is therefore used as the marker for mast cell degranulation in RBL-2H3 cell line[23].

Allergic inflammation involves a complex interaction of many different inflammatory cells that release a spectrum of chemical mediator's ultimately affecting various target tissues. The most commonly used anti- allergic medications like antihistamines and corticosteroids are associated with unavoidable side effects[24]. To avoid these adverse effects researchers focused on search of new pharmacologically active agents obtained by screening natural sources such as plant extracts has led to the discovery of many clinically useful anti-allergic drugs. In view of exploiting the natural sources, the present study was undertaken to evaluate the action of hydroalcoholic extract of the ***Coriandrum sativum L.***on various aspects of allergy like mast cell degranulation, leukocytosis and eosinophilia using various *in vitro* and *in vivo* models[25].

Mast cells, which come from the hematopoietic lineage, are crucial immune system cells. The pluripotent progenitor cells that give rise to mast cells are from the bone marrow, and mature under the influence of the c-kit ligand and stem cell factor in the presence of other distinct growth factors provided by the microenvironment of the tissue where they are destined to reside Mast cells are found in mucosal and epithelial tissues throughout the body. Mast cells are also found in the peritoneal and thoracic cavities of rodents. Human

mast cells come in two different phenotypes: connective tissue mast cells, which produce chymase, tryptase, and carboxypeptidases, and mucosal mast cells, which exclusively produce tryptase. The primary mode of action of mast cells is IgE-mediated allergic responses via the Fc€RI receptor. IgE antibodies are produced by mature B cells in response to CD4+ Th2 cells. IgM and IgD antibodies are produced by naive mature B lymphocytes. B cells will multiply once an antigen activates them. If these B cells interact with cytokines, such as IL-4 (which is modulated by CD4+ Th2 cells), the antibody class switches from IgM to IgE. Very little IgE is present in circulation as a soluble antibody; the majority of IgE is found attached to Fc RI receptors on mast cells. The release of granules from mast cells is activated when an antigen interacts with the mast cell by crosslinking two or more Fc€RI molecules[26].

Mast cell non-immunological stimulator compound 48/80 (C48/80) is a mixed polymer of p-methoxy-N-methyl phenylethylamine that is crosslinked by formaldehyde.Although C48/80 is a well-established inducer of degranulation and histamine release, C48/80 also induces the induction of mediators and cytokines such as prostaglandin D_2 (PGD_2), TNF-alpha and IL-4 that are involved in antibody synthesis[27]. Degranulation of mast cells can be readily initiated by a synthetic phenyl alkylamine substance called compound 48/80 . This drug is a potent releaser of histamine in mouse and rat[28]. In present investigation, it was observed that groups of animals pre-treated with the hydroalcoholic extract of *C. sativum* significantly reduced the mast cell degranulation and probably the subsequent release of histamine and further array of inflammatory cytokines in mesenteric cells. The prevention of degranulation process by HAECS indicates a possible stabilizing effect on the biomembrane of mast cells, suggesting its mast cell stabilizing activity.

Only at the site of inflammation do leukocytes escape the circulation. Leukocytes adhere to the vessel wall in a series of adhesion stages, move along the wall to the endothelial

boundaries, and then pass through the endothelium and subendothelial basement membrane, and migrate through the interstitial tissue. Circulating leukocytes move passively in the bloodstream swept along in the center of the channel by the laminar flow of blood[29]. Eosinophilia defined as a peripheral blood eosinophil count greater than 450 cells per microliter, is associated with numerous disorders including allergies, drug reactions, helminth infections, and metabolic disorders. Eosinophils are bone marrow-derived leukocytes that typically make up less than 5% of the blood's leukocyte population but can be found in greater quantities in organs including the gastrointestinal tract and bone marrow. Diverse circumstances can result in the recruitment of active eosinophils from the circulation into tissues, which releases preformed and freshly created products like cytokines, chemokines, lipid mediators and cytotoxic granule proteins, that can initiate, quickly escalate and sustain local inflammatory and remodeling responses[30]. Inflammatory mediators such cytokines, histamine, and major basic protein are released by leukocytes that are recruited during asthmatic inflammation, promoting persistent inflammation. The eosinophil are the most characteristic inflammatory cells in bronchial biopsies taken from asthma patients and may be seen in the submucosal and epithelial layers. An abnormal increase in peripheral eosinophil count to more than 4% of total leukocyte is termed as eosinophilia. In asthmatic patients, there is increase in eosinophil count. Eosinophil participation in allergic inflammation of the bronchial mucosa is a significant factor in the development of the late asthmatic symptoms of congestion and mucus hypersecretion. In the late phase, especially in the development of allergic asthma, eosinophil plays role as inflammatory cell. Epithelial shedding, bronchoconstriction, and the stimulation of inflammation in the respiratory tract, which is frequently allergic, are all caused by the mediators secreted by eosinophils, including eosinophil cationic protein, tumor necrosis

factor, eosinophil-derived neurotoxic, and prostaglandin. It has been shown that giving milk to children by their parents causes an increase in their leukocyte and eosinophil counts that lasts for 24 hours[31]. In the present study, it was observed that after 24 h of parenteral administration of milk to the vehicle treated group significantly increased the total Eosinophils and leucocytes count. Treatment with *C. sativum* exhibited reduction in milk induced leukocytosis and eosinophilia in mice. This probably indicates the adaptogenic activity of HAECS, which may help to contribute its anti- allergic and anti asthmatic activity.

Conclusion.

The present investigation reveals that the hydro-alcoholic extract of *Coriandrum sativum* possess anti-allergic activity through their ability to inhibit the release of mediators from mast cells and thus influence by limiting the negative consequences of the released mediators, the disease's course can be stopped. HAECS has anti-allergic potential against compound 48/80 and milk induced allergic activity in rats and mice. The stabilizing impact on mast cells may result from suppression of histamine release brought on by antigens or stabilization of the mast cell membrane. The anti-allergic activity can be attributed to antihistaminic (H1antagonist), mast cell stabilizing and anti-inflammatory activity of the title plant. It can be concluded that hydro- alcoholic extract of *Coriandrum sativum* Linn possess anti-allergic activity thus validating the ethno pharmacological claims. However, further studies are required to find its mechanisms of actions.

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Conflict of interest.

The authors declare that there is no conflict of interest.

Table 1: Effect of Hydroalcoholic extract of *Coriandrum sativum* Linn. (HAECS) in compound 48/80 - induced mast cell degranulation in rat mesentery.

Groups	Treatment	Percentage Intact mast cells	Percentage degranulated mast cells	Percentage protection
I	Normal control Vehicle(1ml/kg, *p.o*)	81.78±0.86	23.65±o.78	72.32%
II	HAECS alone (200 mg/kg *p.o*)	77.33±1.39	27.21±0.90	68.15%
III	Inducer control (C-48/80 1mg/kg, *s.c*)	13.28±0.59$^{###}$	85.41±1.60$^{###}$	---------
IV	C-48/80 + HAECS (100 mg/kg *p.o.*)	55.18±1.95***	51.84±1.35***	39.4%
V	C-48/80 + HAECS (200 mg/kg *p.o.)*	71.24±1.32***	26.60±1.57***	68.9%
VI	Disodium chromoglycate (10mg/kg, *i.p.)*	77±1.16***	28.56±1.62***	66.6%

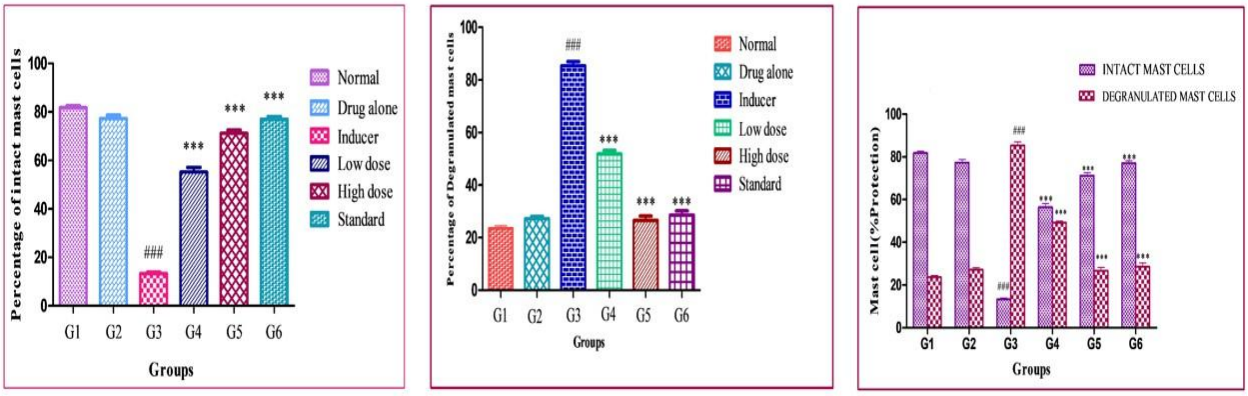
Each Value represent the Mean ± S.E.M (n = 6), $^{###}$ $P < 0.001$, compared to Normal control;$^{***}P < 0.001$ compared to compound 48/80 group. Statistical evaluation was done by One-way ANOVA followed by Tukey's posthoc test.

Table 2: Effect of Hydroalcoholic extract of *Coriandrum sativum* Linn. (HAECS) on milk- induced Leucocytosis and Eosinophilia.

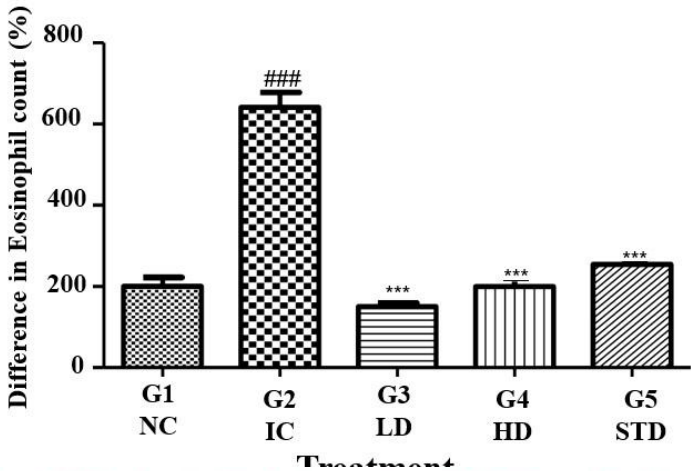
Groups	Treatment	Difference in No. of Leucocytes (permm^3)	Difference in No. of Eosinophils (%)
I	Normal control Vehicle(1mg/kg,*p.o)*	725.0±25.00	0.553±0.19
II	Inducer control (Milk 4ml/kg, *s.c*)	7042±684.4$^{###}$	15.13±0.68$^{###}$
III	HAECS (100 mg/kg *p.o*.)	3463±232.1***	2.253±0.56***
IV	HAECS (200 mg/kg *p.o.)*	4083±285.1***	1.251±0.12***
V	Dexamethasone (50 mg/kg, *i.p*)	5460±119.2***	1.654±0.42***

Values are given as Mean ± S.E.M. for group of six animals each. The intergroup variation was measured by One-way Analysis of Variance (ANOVA) followed by Tukey's post hoc test. *P<0.05, **P<0.01 and ***P<0.001 when compared with Milkalone group at significance level P<0.001 confidence interval.

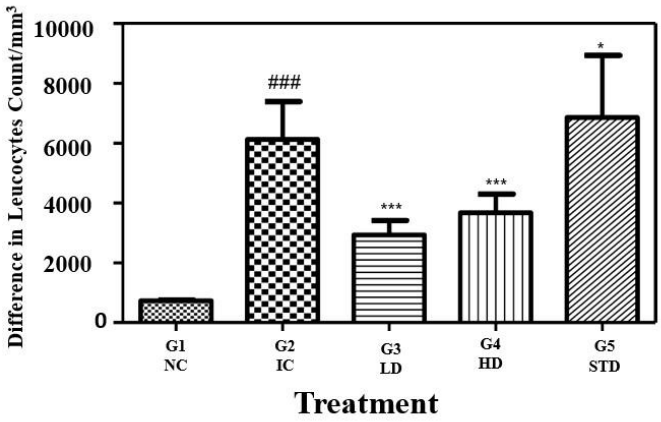
Graph 1: Showing mast cell stabilizing effect of different doses of hydroalcoholic extract of *Coriandrum sativum* (HAECS) in compound 48/80 induced mast cells (%) protection of intact mast cells and degranulated mast cells in rat mesentery.

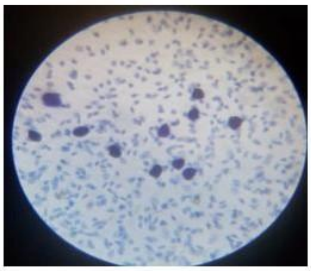


Graph 3: Effect of Hydroalcoholic extract of *Coriandrum sativum (HAECS)* on milk-induced eosinophilia in mice.

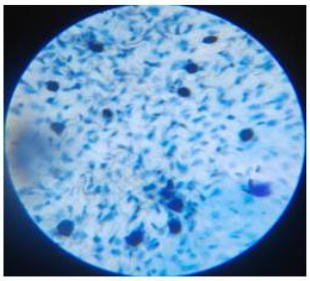


Graph 2: Effect of Hydroalcoholic extract of *Coriandrum sativum (HAECS)* on milk-induced leukocytosis in mice.

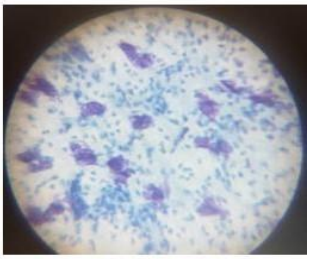




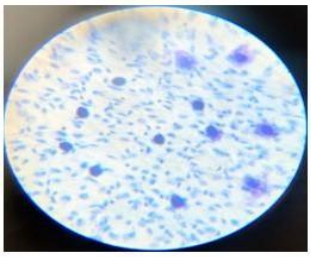
G1 - Normal control



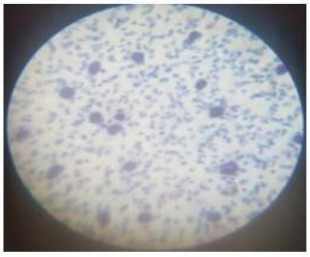
G2 - HAECS Alone



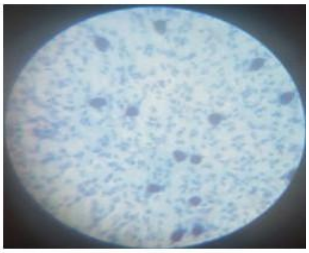
G3 – Inducer



G4 – Low dose



G5 – High dose



G6 – Standard

Protective effect of C-48/80 induced Mast cell degranulation activity in rat mesentery

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