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Mast cell as a biomarker during hypersensitivity reactions against experimental ascaridiasis in *Gallus domesticus*

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Abstract

The mast cell is the most important cell type participating in type -1 hypersensitivity reactions; mast cells also play a subsidiary role in the generation of hypersensitivity , and associated tissue damage, in some other immune phenomena.(Rimmer et al; 1984).The mast cell is widely distributed granulated, cellular component of most tissues, although it is more prevalent in the area that come into the frequent contact with the external environment such as skin, lungs, upper airways, and gastrointestinal tract(Barrett K.E et al; 1954). For larger worms as for gastrointestinal nematode the host will often develop inflammation and hypersensitivity. Gastrointestinal nematodes (*A.galli*) produce allergens in sensitized and hyper sensitized chicks. Proliferation of the mast cell is correlated with the dose of the egg antigen in sensitized and hyper sensitized chicks. The mast cell release pharmacological mediators that produce the inflammatory responses typical of type 1 hypersensitivity reactions. The` intestinal mast cell provide protective immunity against gastrointestinal nematodes. Experimental investigation show mastocytosis condition is more prevalent during parasitic infection.

Keywords: mast cell, hypersensitivity, gastrointestinal nematodes, mastocytosis

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Introduction

Most of the micro parasitic and macro parasitic infections and infectious disease are flourishing successfully in present day era. These parasites induce primary and secondary immune responses. Adaptive immunity plays important functions of host defense mechanism. The host immunity can cause a variety of structural, biochemical, haematological and immunological changes by micro and macroparasites (Rothwell et. al 1989).The immune responses are also capable of causing injuries. The injury is referred as sensitivity in the host. Sometimes secondary immune responses are excessive inducing various changes in the host. Sometimes these responses are severe. These inappropriate responses called hypersensitivity reactions. Mast cells play subsidiary role in the generation of hypersensitivity, and associated tissue damage, in some other immune phenomena. Type-1 hypersensitivity is dependent on the specific triggering of IgE- sensitized mast cells by allergen. Mastocytosis condition is more prevalent during hypersensitivity reaction. Mast cell works as a biomarker to show pathogenesis during hypersensitivity reaction against helminth allergen of gastrointestinal nematode (*Ascaridia galli*). For larger worms as for gastrointestinal nematode the host *(Gallus domesticus*) will often develop inflammation and hypersensitivity. The mast cell release pharmacological mediators that produce the inflammatory responses typical of type 1 hypersensitivity reactions. Proliferation of the mast cell is correlated with the dose of the egg antigen in sensitized and hyper sensitized chicks.

2. MATERIALS AND METHODS

2.1 **Experimental host**- white leghorn chicks *(Gallus domesticus)*

Experimental parasite- *Ascaridia galli*

Dose of infection-

low dose-1000 eggs of the *A.galli*/chick.
High dose-2000 eggs of the *A.galli* /chick.

2.2 Culturing of the eggs

Adult worms were isolated from the intestine of fowl from the local abattoir. *A .galli* eggs were cultured upto infective stage. The worms were gently squeezed with uniform pressure until the entire reproductive organs passed out into the culture medium in the petridish. Now fertilized eggs have been separated from the uteri. The eggs were kept in sterile solution at 32˚C for embryonation for 2-3 weeks. Now these embryonated eggs per dose (estimated by dilution technique) have been given orally for sensitization and hypersensitization of the chicks.

2.3 Experimental design

During present investigation, one day old white leg horn chicks (*Gallus domesticus*) were purchased from the local hatchery and kept at normal room temperature. After 15 days, chicks were divided into three groups: Group (A)-control, Group (B) -sensitized and hypersensitized with the low dose and Group(C)-sensitized and hypersensitized with the high dose. Each group comprises of 10 chicks.15 days old white leg horn chicks were sensitized with the low and high doses. 2 Chicks from each group were autopcised after 10 days of the sensitization (25th day) and on the same day, rest of the chicks (4 sensitized chicks) from Group (B) and Group(C) were hypersensitized with the low dose and high dose subsequently. Then 2 chicks from each group were autopcised at 35th and 45th days of the experimental design.

2.4 Analysis of Mast cell

The pieces of intestine are taken out, from the sensitized and hypersensitized chicks, have been fixed in 10% formalin. Regular washing has been done after fixation and histopathological slides were prepared by the help of the stain chrysodin Y which react with the mast cells present in muscularis to mucosal surface. Intestines were processed for counting of mast cells from muscularis to mucosal surface. Sections were subjected to microphotography for mast cell. The results were expressed as the number of cells per 20 microscopic fields.

2.5 Statistical Analysis

Data on mast cell values were statistical calculated by using t- test and two way method of analysis of variance.

3. RESULTS AND DISCUSSION

The data of mast cell during hypersensitivity reactions against gastrointestinal nematode in white leghorn chicks (presented in table 1, 2, 3) revealed significant ($p<0.05$) increased in mast cells in hypersensitized and sensitized chicks during experimental ascaridiasis. The reason behind it was that mast cell play an important role during host's cellular reactions against parasitic infections. Mast cells secrets the significant amount of numerous proinflammatory mediators that are associated with inflammatory reactions (hypersensitivity reaction) in the intestine during the development of a partially protective immune response against parasitic nematodes. Wells investigated the same result after 25th day of infection with *Nippostrongylus brasiliensis* in rats (Wells et al; 1962). Mast cell plays an important role in worm 33 on (Kelly et al; 1972). These rapidly generated mast cells in the intestinal mucosal played an important role in the mucosal defense against intestinal parasite (Miller, 1984). It was also investigated the significant increase in the number of cells associated with an inflammatory reaction in the intestine during the development of partially protective immune response to these parasitic nematodes (Winter et al; 1997). An increase in mast cell numbers was also find out in the mucosa at the site of infection (Barth et al; 1998 and Murray et al; 1971A). Mast cell are closely associated with the rejection of helminthes from the alimentary tract (Woodburry et al; 1984 and Ishish 1992) and the number of these cells rise rapidly if animals are repeatedly infected (Huntley et al; 1992). The role of mast cells and basophils was also found in inflammatory responses and in most, it generally appreciated in immediate hypersensitivity reactions, such an allergic responses mediated by immunoglobulins (IgE) antibodies (Askenase 1977). The number of mast cells and IgE markedly increased after three weeks of infection with *Hymenolepids diminuta* in rats (Akria et al; 2000). Thus the number of mast cell increased subsequently in hypersensitized chicks in comparison to sensitized chicks and control group with low dose and high doses of embryonated eggs of *A.galli* to develop protective immunity against gastrointestinal nematode.

Table-1 Mast cell study in sensitized and hypersensitized *Gallus domesticus* sensitized and hypersensitized with the low and high doses of embryonated eggs of *A.galli* at 25th day of the experimental design

Parameters		Nonsensitized	Sensitized with low dose	Sensitized with high dose
Mast cell	S.D	92	155	180
		±2.55	±2.55	±3.162
	S.E	±1.14	±1.14	±1.414

Table-2 Mast cell study in sensitized and hypersensitized *Gallus domesticus* with the low and high doses of embryonated eggs of *A.galli* at 35th day of the experimental design.

Parameters	Non-sensitized		Sensitized with low dose	Hypersensitized with low dose	Sensitized with high dose	Hypersensitized with high dose
Mast cell	S.D	95	158	164	182	180
		±4.528	±5.523	±3.162	±2.55	±10.22
	S.E	±2.025	±2.47	±1.414	±1.14	±4.572

Table-3 Mast cell study in sensitized and hypersensitized *Gallus domesticus* with the low and high doses of embryonated eggs of *A.galli* at 45th day of the experimental design

Parameters	Non-sensitized		Sensitized with low dose	Hypersensitized with low dose	Sensitized with high dose	Hypersensitized with high dose
Mast cell		98	162	175	191	184
	S.D	±4.472	±6.943	±4.123	±4.147	±5.099
	S.E	±2	±3.105	±1.844	±1.855	±2.28

4. Conclusion

Hence mastocytosis have been observed during hypersensitivity reaction which was the cause of high secretion of the proinflammatory mediators (e.g-histamine) that were associated with inflammatory reactions (hypersensitivity reaction) in the intestine during the development of a partially protective immune response against parasitic nematodes.

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