Red gram (Cajanus cajan) proteins induce symptoms of atopic dermatitis in BALB/c mice following intraperitoneal route of exposure

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Aims: Legumes play a major role in the induction of food allergic manifestations. Allergy to red gram has been reported in allergic rhinitis as well as BALB/c mice. Information about the atopic dermatitis (AD) like symptoms induced by red gram is yet to be explored. In this study, attempts have been made to elucidate the AD like symptoms induced by red gram proteins following intraperitoneal route of exposure.

Methods: To establish the correlation between red gram allergy and AD, we have studied the coexistence of AD and food allergy in red gram allergic patients (n=210) and healthy individuals (n=10 as a control) at the Department of Respiratory Medicine, King George Medical University (KGMU), India. Further, BALB/c mice were sensitized with red gram crude protein extract (CPE) via intraperitoneal route to explore the red gram induced AD like symptoms. Serum levels of specific IgE and IgG1 antibodies were measured by indirect ELISA. Anaphylactic signs and symptoms were evaluated 40 min after the challenge by two investigators using the scoring. Histopathological responses were analyzed in the skin of treated mice. Further, mast cell count was performed in the skin. Moreover, expression levels of cytokines, transcription factors and filaggrin were studied in the skin of treated mice.

Results: To observe the clinical prevalence of AD in red gram sensitized patients, 210 allergic patients were screened. Out of which 3.33% patients showed possible symptoms of AD, followed by positive SPT for red gram allergen. In the Balb/c mice, elevated levels of specific IgE and IgG1 in the serum along with symptoms of anaphylaxis were found in the treated mice when compared to their respective controls. Further, histopathological analysis of skin revealed characteristics of AD in the treated groups. Significantly enhanced numbers of mast cells were observed in the skin of treated mice as compared to control. Mixed profiles of GATA-3, T-bet, IL-4 and IL-13 at the mRNA were found in the skin of treatment groups when compared to their respective controls. Similarly, enhanced expressions of GATA-3, T-bet as well as filaggrin were observed at the protein levels in the skin of treated mice.

Discussion: We have endeavored to understand the allergenic potential of red gram in the context of AD because in our previous study, we have observed the health concern related to skin in the pigeon pea’s allergic patients. Increased levels of specific IgE and IgG1 antibodies were evident in treated group as compared to control group; illustrate the allergenic potential of red gram CPE. In our study, treated group mice have shown significantly fall in body temperature (4-5ºc) as well as symptoms of systemic anaphylaxis upon challenge with red gram CPE. Histopathological results showed the AD like pathological changes, including epidermal thickening, mixed inflammatory cellular infiltration along with hyperplasia indicating that these changes may be evidences for AD. In this study, elevated levels of mast cells were found in the skin, suggesting the massiveness bearing of red gram specific IgEs bound to mast cell receptors. Further, treated skin also over expressed with IL-4 and IL-13 and associated transcription factors like GATA-3 and reduced expression of T-bet at mRNA level, suggesting that local skin expression of Th2 cytokines have crucial role in the development of AD. Present study showed decreased level of filaggrin in the skin, supporting our finding related to the prevalence of AD induced by red gram.

Conclusion: Little is known regarding the association between food allergy and atopic dermatitis. In this report, intraperitoneal exposure of red gram proteins may lead to symptoms of atopic dermatitis in BALB/c mice.