

RESEARCH ARTICLE

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Evaluation of Eosinophilic Cationic Protein and Some Immunological Markers in Patients Infected with Scabies

Ali A. Mohy , Ahmed Abduljabbar Jaloob Aljanaby and Saleem Khteer Al-Hadrawy

Department of Biology, Faculty of Science, University of Kufa, Iraq.

Abstract

The current study is trying to identify some effects of scabies on some vital indicators such as (ECP, IgE, MCP-1 and IL-17). The results showed that levels of ECP has significant increase ($P < 0.05$) (9569.3 \pm 256.10 pg/ml), (9872.9 \pm 260.50) respectively in comparison with the control group (7665.2 \pm 385.72 pg/ml), (7834.1 \pm 251.43 pg/ml) respectively. The result proved that there was the significant increase (P (9721.1 \pm 181.15 pg/ml), (7749.7 \pm 226.75) respectively in concentration of (ECP) in patients with *S. scabiei* and total healthy individuals. The levels of IgE had significant increase (P (284.8 \pm 34.05 IU/ml), (249.85 \pm 13.682 IU/ml) respectively in comparison with the control group (119.5 \pm 11.24 IU/ml), (108.77 \pm 8.3 IU/ml) respectively. The result indicate that there was significant increase (P (267.134 \pm 18.334 IU/ml), (114.13 \pm 6.94 IU/ml) respectively in concentration of (IgE) in total patients infected with *S. scabiei* and total control group. The levels of MCP-1 has significant increase (P (271.76 \pm 29.88 pg/ml), (246.983 \pm 27.57 pg/ml) respectively in comparison with the control group (153.27 \pm 21.071 pg/ml), (154.67 \pm 22.973 pg/ml) respectively. Also it revealed the significant increase (P (259.29 \pm 20.22 pg/ml), (153.97 \pm 15.21 pg/ml) respectively in concentration of (MCP-1) in *S. scabiei* patients and total healthy individuals. IL-17 had significant increase (P (16.318 \pm 0.71 pg/ml), (16.847 \pm 0.58 pg/ml) respectively in comparison with the control group (5.6009 \pm 0.45 pg/ml), (5.2023 \pm 0.35 pg/ml) respectively. The current study shows that there was significant increase (P (16.583 \pm 0.45 pg/ml), (16.4016 \pm 0.28 pg/ml) respectively in concentration of (IL-17) in total patients infected with *S. scabiei* and total healthy individuals. The levels of IL-2 had significant increase (P (21.14 \pm 0.8081 pg/ml), (21.800 \pm 1.0644 pg/ml) respectively in comparison with total healthy individuals (7.447 \pm 0.2422 pg/ml), (7.7235 \pm 0.1716 pg/ml) respectively. Also it revealed the significant increase (P (20.972 \pm 0.6626 pg/ml), (7.5853 \pm 0.1480 pg/ml) respectively in concentration of (IL-2) in total patients infected with *S. scabiei* and total control group. Conclusions: the results indicate that infection of scabies influences on the human immunity represented by the ECP, IgE MCP-1 and IL-17 in patients infected with scabies and may be used as good biomarkers in detection of scabies.

Keywords: scabies, Eosinophilia, Cationic protein, IgE, IL-17, MCP-1.

*Correspondence: husamtbi@gmail.com

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INTRODUCTION

Scabies is an important skin disease infested human, domestic and wild animals caused by microscopic obligate ectoparasites called *Sarcoptes scabiei* that lives and reproduces in the epidermis of skin for human and many mammalian hosts and lead to significant human and animal morbidity and mortality (Beugnet *et al.*, 2016). It is one of the three most common skin diseases in children, along with ringworm and bacterial skin infections (Vos, 2012). As of 2010 it affects nearly 100 million people (1.5% of the world population) and is common in both sexes (Georgis, 2014). The symptoms may be worsens during the night and the skin is scratched, due to itching, and the skin layer breakdown and injury to other types of bacterial infection. The mites intersect into the skin to live and shed their eggs there (Al-Hadraawy and Hessen, 2017). Symptoms of scabies occur due to the sensitivity of the mites, Infection is usually caused by ten to fifteen mites and the scabies infection is caused by direct contact with the skin of the injured person as in intercourse, the disease may spread before the onset of symptoms, and overcrowded living conditions may increase the likelihood of spread of the disease such as child care centers, adjacent homes and prisons (Al-Hadraawy and Hessen, 2017). Immune response of the host displays delayed inflammatory and adaptive immune responses to this parasite for reason the ability of mites to modulate multiple features of the human's inflammatory and immune responses, In some cases small holes can be seen on the skin, symptoms usually appear after 4-6 weeks, they appear in most parts of the body or in

certain areas only, such as the wrists and between the fingers or along the waist circumference, the head may be affected (Al-Hadraawy *et al.*, 2016; Walton, 2010).

MATERIALS AND METHODS

This study was done on 58 patients consist of (29 male and 29 female) and 30 healthy control separate to (15 male and 15 female). All these cases were collected from Hospitals in University of Kufa and diagnosis by light microscopic method for examining on the *Sarcoptes scabiei* mite or its eggs, at zoological laboratory of faculty of science in An-Najaf province from March 2017 to February 2018.

Isolation of serum

Six milliliters of blood were collected from two groups; healthy and patients, then drawn in sterile tubes and left at room temperature for 25 minutes. Then centrifugation was done at 3500 rpm for 6 minutes. Serum was collected and kept in sterile tubes at deep freeze at -20 until use.

Detection of immune markers

ECP, IgE MCP-1 and IL-17 human biomarkers were used in the current study provided from Elabscience Company, Bulgaria and determined by using ELISA device (Human reader, Germany) according to Manufacturer Company.

Statistical analysis

Graph pad prism version 10 computer software was used in the current study. T-test was used to comparison between mean of all samples. When P-value less than 0.05 considered as statistically significant (Al-Hadraawy, 2016; Aljanaby AAJ and Alhasnawi, 2017).

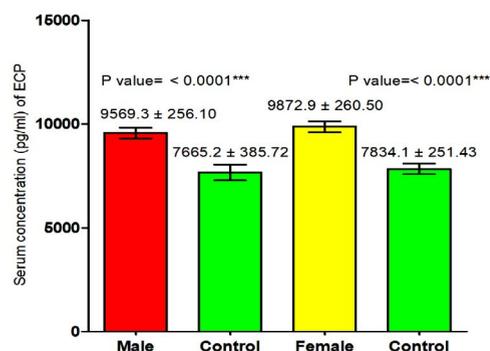


Fig. 1. Comparison between serum level of ECP in patients with *Sarcoptes scabiei* and control group

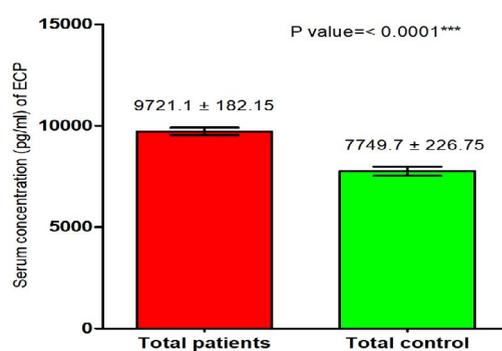


Fig. 2. Comparison between serum level of ECP in total patients infection with *Sarcoptes scabiei* and total control group

RESULTS

Eosinophilic cationic protein (ECP)

The results of the current study proved that there was significant increase in ECP level in male and female patients with *S. scabiei* were significant increase ($P < 0.05$) (9569.3 ± 256.10 pg/ml), (9872.9 ± 260.50) respectively in compared to the control group (7665.2 ± 385.72 pg/ml), (7834.1 ± 251.43 pg/ml) respectively. The results indicate that there was significant increase (P (9721.1 ± 181.15 pg/ml), (7749.7 ± 226.75) respectively in concentration of ECP in total scabies patients and total healthy individuals (Fig. 1,2).

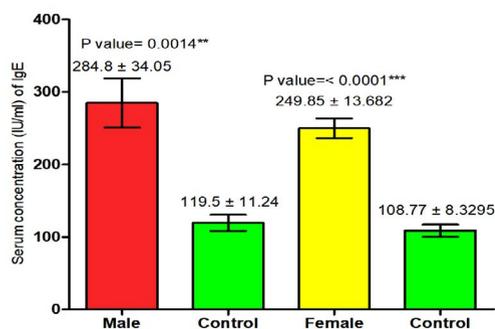


Fig. 3. Comparison between serum level of IgE in male and female with *Sarcoptes scabiei* and control group

Serum concentration of MCP-1 (pg/ml)

The current study revealed that concentration of (MCP-1) in both male and female patients with *S. scabiei* were significant increase ($P < 0.05$) (271.76 ± 29.88 pg/ml), (246.983 ± 27.57) respectively in compared to the control group

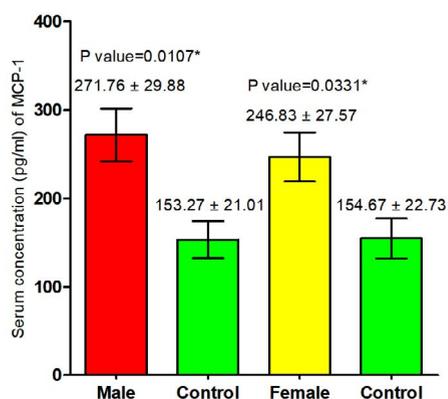


Fig. 5. Comparison between serum level of MCP-1 in male and female with *Sarcoptes scabiei* and control group

Serum concentration of IgE (IU/ml)

The current study revealed that concentration of IgE in both male and female patients with *S. scabiei* were significant increase ($P < 0.05$) (284.8 ± 34.05 IU/ml), (249.85 ± 13.682) respectively in compared to the control group (119.5 ± 11.24 pg/ml), (108.77 ± 8.3 IU/ml) respectively, on the other hand, it revealed the significant increase (P (267.134 ± 18.334 IU/ml), (114.13 ± 6.94 IU/ml) respectively in concentration of IgE in patients with *S. scabiei* and total healthy individuals (Fig. 3,4).

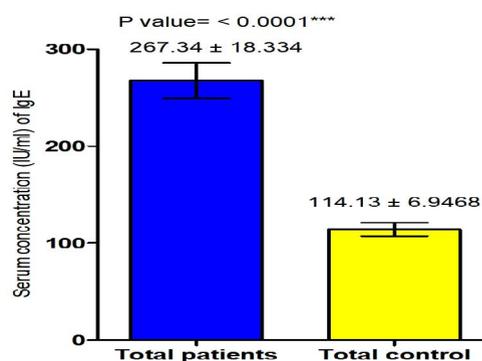


Fig. 4. Comparison between serum level of IgE in total patients and total control

(153.27 ± 21.07 IU/ml), (154.67 ± 22.973 pg/ml) respectively, on the other hand, revealed the significant increase (P (259.29 ± 20.22 pg/ml), (153.97 ± 15.21 pg/ml) respectively in concentration of (MCP-1) in total patients with *S. scabiei* and total healthy individuals (Fig. 5, 6).

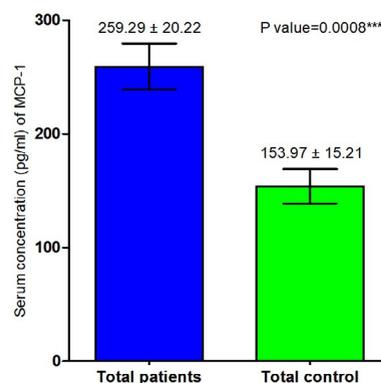


Fig. 6. Comparison between serum level of MCP-1 in total patients and total control with *Sarcoptes scabiei*

Serum concentration of IL-17 (pg/ml)

The current study revealed that concentration of (IL-17) in both male and female patients with *S. scabiei* were significant increase ($P < 0.05$) (16.318 ± 0.71 pg/ml), (16.847 ± 0.58) respectively in compared to the control group

(5.6009 ± 0.45 pg/ml), (5.2023 ± 0.35 pg/ml) respectively, and proved that there was significant increase ($P < 0.05$) (16.583 ± 0.45 pg/ml), (5.4016 ± 0.28 pg/ml) respectively in concentration of (IL-17) in total patients with *S. scabiei* and total healthy individuals (Fig. 7,8).

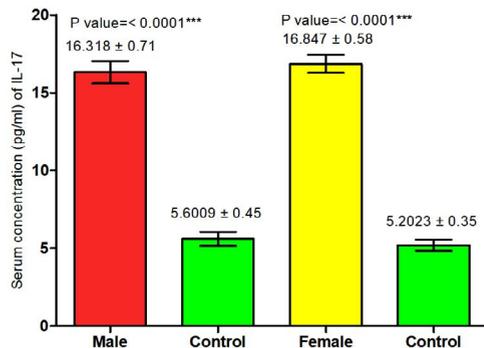


Fig. 7. Comparison between serum level of IL-17 in male and female with *Sarcoptes scabiei* and control group

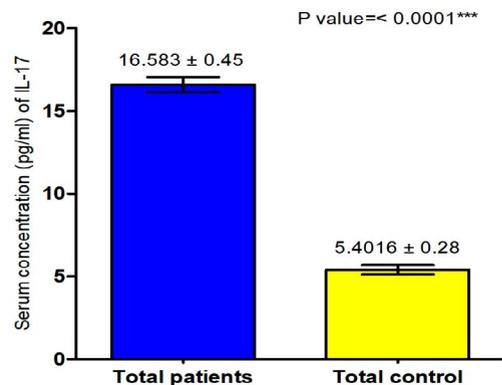


Fig. 8. Comparison between serum level of IL-17 in total patients and total control with *Sarcoptes scabiei* and control group

DISCUSSION

The present study indicate that there was significant increase in the serum level of eosinophilic cationic protein in both male and female patients with *S. scabiei* parasite compared to control group, also in total patients with *S. scabiei* compared to the total control group, this increase may be due to interaction between the human immune response and *S. scabiei* antigens or influences of products from scabies mites that caused activated eosinophils, neutrophils, basophils and others immune cells which produced in high numbers in allergic inflammation and helminthes infections to produce cytokines, the granulocytes of eosinophil appear in large numbers at inflammatory sites and in response to infections caused by parasites, These granular cells have positively charged proteins, the eosinophil cationic protein is one of four essential proteins that enter the surrounding tissue and stimulate the secretion of the amino acid granules, although ECP varies widely from one patient to another, some studies show that the measurement of this protein by serum monitors many inflammatory diseases, ECP is one of the important natural defense against invading parasites, allergic inflammatory disease and gastrointestinal diseases

(Wardlaw 1994; Sajad et al., 2017; Majeed and Aljanaby, 2019). The present study similar to study of Czech et al.) 1992) who revealed that serum concentrations of ECP have been related with atopic dermatitis activity and correlated with erythema, papules, pruritus and skin score. The results of study corresponding to study of Charlotte et al.) 2009) who recorded that concentration of serum ECP was elevated in patients with allergic disease as compared with the healthy controls groups due to elevated blood eosinophil counts, basophils, neutrophils and others immune cells. The results of study showed a significant increase in the serum level of IgE in male and female patients infected with *S. scabiei* parasite compared to control group, also in total patients with *S. scabiei* compared to the total control group, this increase may be due to allergenic protein which secretion from *S. scabiei* in host skin lead to type1 hypersensitivity reaction in patients infested with scabies which is responsible for expelling the parasite and products from the borrows by the intense itching and scratching, which in turn leads to sudden reduction in parasite density at time when itching started (Al-Rawi, 2000; Adam et al., 2019). The sensitization of the host to the mites and its products may be

has an important role in pathogenesis of scabies (Van Nest, 1986). The current study agreed with study of (Elmaraghy and Elmeghawry, 2011; Al-Hadraawy and Hessen, 2017) were showed a significant increase in the serum level of IgE in male and female patients infected with *S. scabiei* parasite compared to control group. But not agreed with study of Ibrahim *et al.* (2012) who revealed that concentration of IgE was lower than its cut off concentration in 50% of patients with scabies, whereas the rest patients with scabies had elevated concentration of IgE. Also agreed with study of Jayaraj *et al.* (2011) who revealed that levels of IgE immunoglobulin was elevated in patients with scabies in compared to control group. The current study agreed with study of Maizels *et al.* (2005) that showed a significant increase in the serum level of total IgE in patients infected with helminthes parasite infections and allergic diseases in compared to control group. The results of study showed a significant increase in the serum level of MCP-1 in male and female patients infected with *Sarcoptes scabiei* parasite compared to control group, also in total patients with *S. scabiei* compared to the total control group, this increase may be due to interaction between the human immune response and *S. scabiei* antigens (Sajad *et al.*, 2017; Hayder and Aljanaby, 2019), or may be due to essential role of *S. scabiei* in demonstrate chemotaxis of neutrophils, eosinophils, macrophages, and Th2- lymphocytes into the skin have shown increased expression levels of keratinocyte-derived chemokines including IL-8, MCP-1, Eotaxin, and Eotaxin-2 (Shiraki *et al.*, 2006; Aljanaby 2013). The results of study agreed with study of Cheng *et al.* (2010) who reported that the concentration of MCP-1 elevated in patients with scabies as compared to the total control group due to action of macrophage migration inhibitory factor which can induce secretion of TNF α Tumor Necrosis Factor- γ (TNF- γ), INF γ Interferon gamma (IFN γ), IL-1b, IL-12, IL-6, IL-8 (CXCLD), MCP-1 and others from mammalian cells and expression of the cell adhesion molecules ICAM-1 and VCAM-1.

The results of study showed a significant increase in the serum level of IL-17 in male and female patients infected with *Sarcoptes scabiei* parasite compared to control group, also in total patients with *S. scabiei* compared to the

total control group, this increase may be due to hypersensitivity reactions in patients infested with scabies caused by the secretion of different materials by *S. scabiei* in the host skin (McCarthy *et al.*, 2004; Hengge *et al.*, 2006; Liu *et al.*, 2016; Aljanaby and Medhat 2017). During 4 weeks from infestation of scabies the immunity developed and appears of first symptom (Walton *et al.*, 2008). The human body is facing numerous pathogens every day, but only few of them causing diseases that because we have natural defense system that called innate immune system. It is the first line of host defense (Judith *et al.*, 2013; Mohy *et al.*, 2018). Also may by digging the adult female mite in the host skins and stimulated the immune response of host through the life cycle of *Sarcoptes scabiei* (Currie *et al.*, 2010; Al-Hadraawy and Hessen, 2017). The current results may be due to stimulating many cells of the innate immune system; in particular, they recruit to and activate neutrophils, eosinophils and other immune cells at sites of inflammation, and stimulate endothelial and epithelial cells to synthesize the different inflammatory cytokines particularly the interleukin-17 which is associated with hyper-IgE syndrome, also associated with the skin inflammation and producing CD4+ (T-helper) (Weaver *et al.*, 2007; Kai *et al.*, 2013; Hahn *et al.*, 2016; Aljanaby *et al.*, 2018). The results of current study agreed with study of Luo (2016) who recorded that higher concentration of interleukin-17 and interleukin -23 in crusted scabies are the first to indicate a contribution of Th17 associated cytokines to a dysregulated immune response in crusted scabies pathology (Arlian and Morgan, 2006; Gonzalez-Lombana *et al.*, 2013; Martin *et al.*, 2014).

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CONFLICT OF INTEREST

The authors declares that there is no conflict of interest.

ETHICS STATEMENT

The ethics of statement in this study according to College of Medicine, University of Kufa, Iraq.

DATA AVAILABILITY

All datasets generated or analyzed during this study are included in the manuscript and are also available in the University of Kufa, Faculty of Science, Iraq and authors.

FUNDING

None.

AUTHORS' CONTRIBUTION

AAM collected samples and did the measurement of immune biomarkers. AAJ and SKA wrote the manuscript. AAJ did the statistical analysis. All authors read and approved the final manuscript.

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