



ISSN: 0067-2904

Estimating Scabies Severity by Epidemiological and Clinical Survey of Baghdad Governorate Patients and Assessing Blood Immune Antibody Levels

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Received: 24/12/2024

Accepted: 31/8/2025

Published: 30/ 8/2026

Abstract

Scabies is a parasitic infestation caused by tiny mites *Sarcoptes scabiei*. Scabies can lead to skin ulcers and serious complications such as septicemia (bloodstream infection), heart disease and kidney problems. Therefore, scabies is considered a dangerous infectious disease that must be treated when diagnosed. The current study aimed to conduct a survey of scabies patients of both genders, examining the role of humoral immunity by estimating certain immunoglobulins (IgM and IgG) and their effect on the patients. However, this study involved the collection of blood specimens from a group of 67 patients with scabies and a control. The results showed infected male more than female with a non-significant difference, the values were 20 (57.14%) and 15 (42.86%) respectively, and the largest age group affected of <30 was 17 (48.57%) while the lowest age group of >40 was 5 (14.29%), the majority of those infected were primary school students (12, 34.4%), while the lowest percentage were university graduates (6, 17.1%). Regarding the patient's job, the most affected group was freelancers, at 15 (42.8%), while the lowest percentage was among housewives, at 3 (8.7%). Additionally, the results showed a high significance between patients from agricultural cities and those from civilian towns, with percentages of 23 (65.7%) and 12 (34.3%), respectively. Although most cases of infection were of the mild and papular type 22 (62.8%) and 23 (65.7%), respectively, more than severe and nodular type 13(37.2%) and 12 (34.3%), respectively, the affected area of patients was the entire body (more than three affected organs) in high percentage (15, 42.8%), whereas the lowest value of slight area was 4 (11.5%). Finally, the immunological results showed an increase in the IgM levels in the scabies patients (3.809 ± 0.23) compared to the healthy group (1.269 ± 0.06), and the results also showed an increase in the IgG levels in the patients (12.51 ± 0.53) compared to the healthy group (7.61 ± 0.28).

Keywords: Scabies, IgM, IgG, Immune responses, Parasite.

تقدير شدة الجرب من خلال المسح الوبائي والسرييري لمرضى محافظة بغداد وتقييم مستويات الاجسام
المضادة المناعية في الدم

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الخلاصة

الجرب مرض طفيلي يسببه الحلم الصغير يُدعى "ساركوبتس سكابي". يمكن أن يؤدي الجرب إلى تقرحات جلدية ومضاعفات خطيرة، مثل تسمم الدم (عدوى مجرى الدم)، وأمراض القلب، ومشاكل الكلى. لذلك، يُعتبر الجرب مرضاً معدياً خطيراً يجب علاجه عند تشخيصه. هدفت الدراسة الحالية إلى إجراء مسح لمرضى الجرب من كلا الجنسين ودراسة دور المناعة الخلطية من خلال تقدير بعض الكلوبولينات المناعية (IgM و IgG) وتأثيرها على المرضى. وقد شملت الدراسة جمع عينات الدم من 67 مريضاً يعانون من الجرب والاصحاء . أظهرت النتائج أن الذكور المصابين أكثر من الإناث مع عدم وجود فروق ذات دلالة إحصائية . وكانت القيم 20 (57.14%) و 15 (42.86%) على التوالي، وكانت أكبر فئة عمرية متأثرة هي الأقل من 30 عاماً 17 (48.57%) بينما كانت أقل فئة عمرية أكبر من 40 عاماً 5 (14.29%)، وكانت غالبية المصابين من طلاب المدارس الابتدائية 12 (34.4%)، بينما كانت أقل نسبة من خريجي الجامعات 6 (17.1%). وفيما يتعلق بعمل المريض، كانت الفئة الأكثر تضرراً هم اصحاب المهن الحرة 15 (42.8%)، بينما كانت أقل نسبة 3 (8.7%) بين ربات البيوت. بالإضافة إلى ذلك، أظهرت النتائج وجود دلالة إحصائية معنوية بين المرضى من المدن الزراعية والمدن المدنية بنسبة 23 (65.7%) و 12 (34.3%) على التوالي. على الرغم من أن معظم حالات الإصابة كانت من النوع الخفيف والحطاطي 22 (62.8%)، 23 (65.7%) أكثر من النوع الشديد والعقدي 13 (37.2%)، 12 (34.3%) على التوالي، كانت المنطقة المصابة من المرضى هي لجميع الجسم (أكثر من ثلاث أعضاء مصابة) بنسبة عالية 15 (42.8%)، في حين أن أقل قيمة للمناطق الطفيفة 4 (11.5%). وأخيراً ، أظهرت النتائج المناعية ارتفاعاً في نسب IgM لدى مرضى الجرب (3.809 ± 0.23) مقارنة مع مجموعة الاصحاء (1.269 ± 0.06)، كما أظهرت النتائج زيادة بنسب IgG للمرضى (12.51 ± 0.53) اما الاصحاء فقد كانت النسبة (7.61 ± 0.28).

1. Introduction

Scabies is a serious parasitic disease that infects the skin and continues to persist all over the world despite the availability of abundant acaricides and curative tools, one of the most important kinds of parasitic illnesses, especially in underdeveloped and developing countries [1]. This disease is caused by the mite *Sarcoptes scabiei*, which resides in the skin of humans, and is an infectious skin disease that impacts millions of people worldwide. The yearly prevalence of scabies is estimated to be 300 million worldwide [2]. These mites spread through direct close contact, or occasionally indirectly by defiled objects such as clothes or quilts [3]. It primarily affects areas with a fine layer of corneum and a few hair follicles, such as exemplary skin areas like the digits, joints, elbows, wrists, female breasts, shoulders, and male scrotum, among others [4]. The head, neck, and face are seldom influenced in adults; there are many types of the disease, including nodular scabies (NS), which is a known clinical appearance of scabies [5]. More mutual among babies. It exists as pruritic, enduring nodules for months, even after particular treatment for scabies [6]. While another type, crusted (Norwegian) scabies, predominantly occurs in persons with defective immune systems, it results in the formation of crusted areas covering major areas of the skin and has a large number of mites, with 10 to 15 mites being common in classic scabies [7]. The pathogenesis of this disease may affect the patient's health, leading to damage to many body organs [8]. Human with scabies parasite respond to at most by produce a cell-mediated immune reactions through the immunoglobulins such as (IgG) and IgM, which perhaps implicated to eliminate of mites from the skin surface, but topical the reactions may block the multiplication of scabies, in this infection participation in innate immune system as well as affect on adaptive immunity of vertebrate [9]. The current study aims to evaluate antibody responses and determine the types of scabies most prevalent in Iraq.

2. Materials and methods

The current study included sixty-seven samples divided into two groups. The first consisted of 35 patients (20 males and 15 females) suffering from scabies illness in different organs of the body, with ages between 6 and 45 years, by a consultant specialist of the dermatology department in Baghdad Teaching Hospital / Medical City. The second group consists of 32 healthy individuals (17 males and 15 females) as controls with ages ranging from 12 to 48 years. During the period from December 2022 to April 2023. A questionnaire was conducted for both groups, which included the name, gender, age and date of sample collection for both groups (patients and controls). As for the duration, the number of organs affected by the disease, the type of lesion, the severity of the illness, the infection of other family members, and the treatment used, these were specific to the patient group only.

The blood sample (6 ml) was collected in a plain test tube, then left to stand for (45 minutes) at room temperature for clot formation for serum aggregate, the tubes were centrifuged at (3500 rpm) for (12 minutes) for serum experience for Eliza technique and ELISA Kit as provided, then aspirated the serum by a Pasteur pipette and divided in sterile Eppendorf tubes and stocked at (-20C°) until used.

Assay Procedure of Immunoglobulin M (IgM) LISA Kit

The levels of IgM were estimated according to the manufacturer's instructions (MyBioSource, United States), Catalogue No. MBS564051, of (Immunoglobulin M), based on sandwich ELISA format (enzyme-linked immunosorbent assay) technology.

Assay Procedure of Immunoglobulin G (IgG) ELISA Kit

The levels of IgG were estimated according to manufacturers' instructions (ELK Biotechnology, China), Catalogue No. ELK1252, of (Immunoglobulin G) by a solid phase sandwich ELISA format technique.

Statistical Analysis

The Statistical Analysis System/ SAS program (2018) was applied to reveal the effect of different agents on study parameters. The Chi-square test was used to determine significant differences between percentages ($p < 0.05$ and $p < 0.01$) in all study results.

3. Results and discussion

The presented study included sixty-seven individuals, divided into two main groups: Thirty-five patients with scabies disease and thirty-two healthy individuals as a control. According to sex, the patient group consisted of 20 (57.14%) males and 15 (42.86%) females, whereas the control group consisted of 17 (53.12%) males and 15 (46.88%) females; therefore, there was no significant variation between males and females in the two groups, as shown in Table 1.

Table 1: The percentage of study groups (patients and controls) according to gender

Group	Gender	No. (%)	Chi-Square (Pvalue)
Patients	Male	20 (57.14%)	0.714 NS (0.169)
	Female	15 (42.86%)	
	Total	35	
Control	Male	17 (53.12%)	0.125 NS (0.674)
	Female	15 (46.88%)	
	Total	32	

NS: Non-Significant.

This result is consistent with other studies from Egypt, Denmark, Brazil and Poland [10]. But, studies from the UK have recorded a higher prevalence among females [11]. This unpredictability cannot be described and may be attributed to various factors related to the country's total number, community systems, and climate environment, among others. Regarding scabies patients ages, the results of this study showed that there were a significant difference ($P < 0.01$) between almost age groups, it was the highest percentage age group was in (<30) years in proportion 17 (48.57%), while the lowest level was in (>40) years in proportion 2 (14.29 %) as in Table 2.

Table 2: The percentage of scabies patients according to age

Age group (year)		No	Percentage (%)	
<30		17	48.57	
30-40		13	37.14	
>40		5	14.29	
Total		35	100 %	
Chi-Square value)	(P-	---	7.468 **	(0.0057)

** ($P \leq 0.01$).

Although scabies affects people of all ages, it is more common in younger age groups, as shown in the study results. This may be due to a lack of awareness among these age groups regarding personal hygiene or the avoidance of infection from infected individuals, or perhaps as a result of continuous contact with infected people in educational institutions, for example. This result agrees with the study by Singh *et al.*, [12].

As for scabies patients connected with educational level, the results of this study showed that there were a significant difference ($P < 0.05$) between educational stage groups, it was the highest percentage in student group in proportion 12 (34.4%), while the lowest level was in university degree 6 (17.1%), as demonstrated in Table 3.

Table 3: Distribution of the sample study according to educational level

Educational level		No	Percentage (%)	
Stage				
Primary degree <11 years		10	28.5	
Middle School degree 11-14 years		7	20	
Secondary student <18 years		12	34.4	
University degree		6	17.1	
Total		35	100%	
Chi-Square value)	(P-	---	4.600 *	(0.0277)

* ($P \leq 0.05$).

The results of this study showed that the educational level of those infected with scabies was higher among primary and secondary school students than in other groups. This may be due to these students' lack of basic knowledge about scabies, as they display high-risk behaviors for transmission of the disease among them, which requires isolation and early

diagnosis of the infected person. The results of the study are consistent with those reported by Ibekwe *et al.*, [13].

Results showed highly significant differences ($p < 0.01$) for the patient's job. The highest value among freelancers was 15 (42.8%), and the lowest value among housewives was 3 (8.7%). However, the other categories had close values, with employees and graduates observed at 9 (25.7%) and 8 (22.8%), respectively, as shown in Table 4.

Table 4: Distribution of the sample study according to the patient's Job

Patient's Job				
Job	No.2	Percentage (%)		
Graduate	8	22.8		
Freelancer	15	42.8		
Housewife	3	8.7		
Employee	9	25.7		
Total	35	100%		
Chi-Square value)	(P-	---	8.835 **	(0.0097)

** ($P \leq 0.01$).

The results in Table 4 show that most people at risk of contracting scabies are people who are poor in education and do not have adequate opportunities to complete their studies, suggesting that the reason for this is that they lack the adequate comprehension and application of the correct instructions when they come into contact with scabies patients, which is transmitted directly through contact between people.

The present data revealed a significant increase ($P < 0.05$) in scabies patients in agricultural areas, higher than in civilian areas, where the percentages were 23 (65.7%) and 12 (34.3%), respectively, as shown in Table 5.

Table 5: Distribution of the sample study according to the patient's place

Patient's Job				
Location	No.2	Percentage (%)		
Agricultural cities	23	65.7		
Civilian cities	12	34.3		
Total	35	100%		
Chi-Square value)	(P-	---	3.574 *	(0.049)

* ($P \leq 0.05$).

Scabies spreads worldwide, yet is most common in very warm, tropical cities and in areas of high population density, which include agricultural and urban areas. However, it also increases the disease in resource-poor regions, with an estimated 5–50% of children affected by scabies in these areas [14]. In addition, the availability of chemicals, physical, and nutrients in various zones may be assessed for endemic mites in specific agricultural areas. Therefore, the infection rate was higher in agricultural areas than in civilian areas, as indicated in Table 5.

The results regarding the number of patients in the family infected with scabies disease displayed a highly significant difference ($P \leq 0.01$). The highest percentage was 22 (62.8%) for the number greater than 4, while the lowest percentage in the family, with the first infection, was 6 (17.2%), as shown in Table 6.

Table 6: Distribution of the sample study according to the number of infected individuals in the family

Patient's number in the family			
Patients Number	Number	Percentage (%)	
None	6	17.2	
<4	22	62.8	
>4	7	20.00	
Total	35	100%	
Chi-Square value)	(P-	13.914 **	(0.0002)
** ($P \leq 0.01$).			

Although scabies mites do not live further than 2-3 days in the absence of human skin [14]. However, the disease is communicable and can spread rapidly from person to person, especially within the same family. Therefore, medical supervision is frequently recommended for the entire family or anyone in close proximity immediately [15]. Consequently, when one family member is infected, the rest are likely to be infected, as confirmed by the results of the current study.

The current results regarding the severity of disease for scabies patients show that there are no significant differences between the two types of dangerousness. However, the highest value was for mild, at 22 (62.8%), while the lowest value was for severe, at 13 (37.2%), as shown in Table 7.

Table 7: Distribution of the sample study according to disease severity

Disease Severity			
Case	No.	Percentage (%)	
Mild	22	62.8	
Sever	13	37.2	
Total	35	100%	
Chi-Square value)	(P-	2.600 NS	(0.128)
NS: Non-Significant.			

Despite, the severe kind of scabies disease called crusted scabies, that have many millions of mite, which this type may influence many individuals such as children or young but increase in people with debilitate immune systems or patients suffer from medical condition, organ transplantation and the elderly [13], therefore, most of the patients in this case of the mild type have about 10 to 17 mites, may be because the study samples did not contain the above-mentioned cases in addition to the age did not exceed 45 years for the study samples.

The study results showed a significant increase ($P < 0.05$) in the contusion or lesion type, with popular being the most common, at 23 (65.7%), followed by nodular at 12 (34.3%), as shown in Table 8.

Table 8: Comparison of the sample study according to lesion type

Lesion type				
Type	No.	Percentage (%)		
Popular	23	65.7		
Nodular	12	34.3		
Total	35	100%		
Chi-Square (P-value)	--	3.574 *	(0.049)	

* ($P \leq 0.05$).

The type popular, which is characterized itchy like popular, which is the reason for its name, that also called (pruritic or non-crusted or classic type) [15], demonstrated high incidence in this results rather than the another type called nodular which is less prevalent manifestation of classic scabies because the latter type occur in chronic cases when the disease worsens and intractable it from being treated that distinguish by erythematous, persistent, hard and very pruritic nodules, frequently involving the genitals [16].

The results concerning the affected organs showed highly significant differences ($P \leq 0.01$) in all body areas at 15 (42.8%) cases, which was the most prevalent among scabies patients; it was followed by the genital area and abdomen at 9 (25.7%); then, the genital area, wrist, between the fingers, forearms, and thighs were 7 (20.0%), and the lowest in slight areas was 4 (11.5%), as shown in Table 9.

Table 9: Comparison of the study sample according to affected organs

Lesion type				
Organ	No.	Percentage (%)		
Genital area, abdomen	9	25.7		
Genital area , wrist , between the fingers, forearms , thighs	7	20.0		
Slight area	4	11.5		
All body	15	42.8		
Total	35	100%		
Chi-Square (P-value)	---	14.073 **	(0.0001)	

** ($P \leq 0.01$).

It typically affects the skin around the wrists, fingers, waist, and lower arms and groin of many elderly people and adolescent children, causing a rash on their upper and lower body, including the head, neck, and other areas. [17]. The current results showed that the highest values were observed in all body parts, while the lowest values were found in minor areas or small organs of the body. The reason may be that the entire body is affected due to complications with bacterial inflammation or a failure to diagnose and treat rapidly, which can lead to the aggravation of the disease and injury to most organs of the body [18].

Measurement of immune parameters

Scabies infection triggers a specialized immune response, as evidenced by the results of this study, which measured antibodies, including IgM and IgG.

The results related to immunological tests showed an increased level of immunoglobulin percentages in the patients, specifically IgM and IgG, at 3.809 ± 0.23 and 12.51 ± 0.53 , compared with the control, which was 1.269 ± 0.06 and 7.61 ± 0.28 , respectively ($P \leq 0.01$), as shown in Tables 10 and 11. The modification in IgM and IgG may be a specific response to the parasite or a nonspecific reaction to the dead parasite, its waste, or even the debris [19]. Therefore, the mite infestation provokes strong immune responses mediated by antibodies [1], including IgM and IgG; consequently, their percentages in the patients increased more than in controls. These results are consistent with those of Gazi et al. . The results also showed that the values of IgG were higher than those of IgM in the patients' serum, which may be due to the fact that IgG persists in chronic parasitic infections or in cases where most of the body organs of scabies patients are affected.

Table 10: Comparison between patients and control groups in IgM

Group	Mean $\pm$ SE of IgM
Patients (No.= 35)	3.809 ± 0.23
Control (No. =32)	1.269 ± 0.06
T-test	0.481 **
(P-value)	(0.0001)

** ($P \leq 0.01$).

Table 11: Comparison between patients and control groups in IgG

Group	Mean $\pm$ SE of IgG
Patients (No.= 35)	12.51 ± 0.53
Control (No. =32)	7.61 ± 0.28
T-test	1.209 **
(P-value)	(0.0001)

** ($P \leq 0.01$).

4. Conclusion

Based on the results of the current study, it can be concluded that both genders are equally exposed to scabies at all ages, across all occupations, and in both rural and urban areas. It is widespread in families where more than one person may be infected, with varying degrees of severity. It occurs in all types of scabies (mild, moderate and severe), most commonly affecting most parts of the body. The role of humoral immunity was evident in the results, as patients with scabies had significantly higher levels of IgM and IgG antibodies compared to the control group.

5. Disclosure and conflict of interest

Conflict of Interest: The author declares that there are no conflicts of interest.

Ethical approval

Ethical approval for sample collection was obtained from the Medical City Department administration, affiliated with the Ministry of Health, Republic of Iraq, with number 1329 on August 22, 2022.

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