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Original article

Comparison Between the Efficiency of Dermatoscope and The Light Microscope for The Diagnosis of Scabies in Tripoli, 2018-2019

Naema Shibani[1]*, Hamida Al Dwibe[2], Maha Iskandarani[3], Bashir Zandah[4]

[1]*Department of Life Sciences, School Basic Sciences, Libyan Academy of Postgraduate Studies, Janzour, Libya*
[2]*Department of Dermatology, Faculty of Medicine, University of Tripoli, Tripoli, Libya*
[3]*Department of Zoology, Faculty of Science, University of Tripoli, Tripoli, Libya*
[4]*Department of Dermatology, Tripoli University Hospital, Tripoli, Libya*

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ABSTRACT

Background and aims*. Scabies is a common contagious skin infestation caused by a fertilized female mite Sarcoptes scabiei var. hominis and usually manifested with severe night itching and burrows that are visible to the naked eye. Early diagnosis and treatment of cases are essential, as misdiagnosis may result in outbreaks and significantly increase economic burden. The best ways to diagnose scabies in Tripoli have not been investigated yet. Thus, the study was aimed to compare the diagnostic properties and efficiency of using the dermatoscope (DS) by placing it directly on the affected skin, and a light microscope (LM) to view infested mite in the skin scrapings (SS) on diagnosing scabies.* ***Methods****. This study was conducted on 1037 patients with scabies who were randomly selected from dermatology department out of patients' clinics of three Hospitals in Tripoli and underwent examination by using LM on skin scraping, and DS technique during the period January 2018 to June 2019. The validity of the clinical diagnosis using the two methods DS technique and LM technique provided that each one was used separately.* ***Results****. The study showed that there were no significant differences between the three hospitals in terms of diagnosing the disease by LM and DS, with a value of (p = 0.683) and (p = 0.847) respectively, however high significant differences (p value = 0.000) between the two techniques in terms of severity of infection revealed. Both techniques reached an accurate rate of 92%, that is, they are completely identical to the diagnosis of scabies, and accordingly, the infection rate (FR) of scabies with the DS technique reaches 32%, nearly similar to the LM technique by 31%. The degree of compatibility between the two devices was very high (0.832 using the Kappa scale), and it was statistically significant, with a high generalization (P-value = 0.000), meaning that the agreement between the two techniques reached 92.4%.* ***Conclusion****. The current finding suggested that the two techniques are complementary to each other.*

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INTRODUCTION

Scabies or Norwegian “itch” is a contagious, common parasitic skin disease caused by infection with a microscopic female mite Sarcoptes scabiei var hominies living in the upper stratum of the epidermis; in animals, known as itch mite [1]. It was identified in 1687 by the scientists Bonomo and Cestoni by using light microscope [2-4]. Scabies is a major public health problem worldwide particularly in tropical humid regions, with reported prevalence up to 25%.

In developing countries, children have the highest disease burden, with an average prevalence (5–10%) [5,6]. Usually occurred sporadically or as outbreaks in institutions in elderly and immune-suppressed patients in developed countries, however is endemic in many third-world countries such as Africa [7-9]. It affects both males and females of all race and socioeconomic classes [1,10].

Recently the World Health Organization (WHO) added it to its list of neglected tropical diseases in 2017, and annually, more than 300 million cases of scabies are reported worldwide [5,11,12]. The main risk factors in contracting scabies are poverty, poor hygiene, overcrowding, and homelessness. Outbreaks commonly reported in schools, hospitals (including intensive care units), institutions and refugee camps [13-17]. Transmission is mainly by direct close personal contact, sexually, or indirectly by fomites such as on clothing or bed sheets, within institutional settings and the risk of infection increases among family members [3,8,18-20]. The hallmark of scabies in humans is severe itching mostly at night which affects sleep, quality of patients' life and also causes social stigma [21-23].

Clinically, human scabies is characterized by intense nocturnal itching, papules, vesicles, nodules and burrows which are mediated through host immune response to mite products followed by the invasion of mites to the upper layers of skin [1,19,24]. Secondary Bacterial infection with *Streptococci* and *Staphylococci* is commonly reported among scabietic patients due to disruption of the skin's protective barrier function as a result of intense itching [12]. This can lead to serious complications including, invasive skin infections, glomerulonephritis and possibly rheumatic heart disease [14,25-27]. Diagnosis of scabies is based mainly on the patient's history of the night itching, a positive family history of itching and on clinical examination by the presence of lesions on at least two typical skin sites [8]. However, in certain situations it can be presented with unusual clinical patterns especially in patients using steroid therapy, or immunocompromised. Scabies in infants and elderly can be also challenging due to different clinical presentation [8,24,28]. In addition; scabies can easily be misdiagnosed, because clinically it can mimic other dermatological diseases such as papular urticaria, atopic dermatitis, psoriasis, diaper rash, and contact eczema [15,29]. To confirm diagnosis of scabies, the traditional light microscopic (LM) examination tests are useful tools used to detect the presence of mites or their fecal pellets or eggs in skin scrapings of the stratum corneum of the epidermis. Disadvantages of these tests are a large margin of error and are time consuming [28,30]. Although the LM of skin scrapings has a 100% positive predictive value and a short turnaround time, it has a limited sensitivity, which further varies according to the quality and quantity of the skin scrapings collected [3,10].

Dermoscopy (DS) is another useful tool used to diagnose skin diseases, including parasitic infestations Dermoscopy confirm scabies by seeing a structure resembling an airplane, leaving behind a white trail that represents the tunnel or in the form of a dark-brown triangle or V-shaped structure representing the pigmented parts of the mouth and front legs of the mite [28,32]. Dermoscopy (DS) technique is characterized by a high sensitivity (SN), and is considered to be one of the effective, simple, easy, painless, quick techniques in diagnosing tunnels and mites, and isn't time consuming [33-37].

Due to the lack of studies to diagnose scabies by confirmatory methods, the current study was conducted to compare the diagnostic properties and efficiency of the DS and LM in diagnosis of scabies in Tripoli.

METHODS

Study design and setting

This cross-sectional study was conducted from January 2018 to June 2019 at the outpatient dermatological clinics in TCH, UHC, and BAMH in Tripoli city on 1037 patients who showed clinical signs of scabies.

Data collection procedure

For each patient demographic data, family history, past history and clinical findings were noted in predesigned preform. All patients were examined clinically in a well-lighted room and the diagnoses of scabies were ensured by the presence or absence of *S. scabiei* mite by using the two techniques; DS and LM. DermLite DL100 handheld dermatoscope (Gen3, San Juan Capistrano, CA, USA) (Figure 1), was used to identify *S. scabiei* mite by seeing the distinctive sign ("delta wing sign), the dark brown triangle, which represents the mite *S. scabiei* (the anterior front of the proterosoma, which includes the oral region and the front pair of legs of mite) (Figure-1) and the end of the white line that represents the tunnel (Figure-2). An application of a liquid interface was not required. The dermatoscope plastic plate (found posterior around lens) were thoroughly cleaned with antiseptic alcohol cleansing wipes to prevent any cross-contamination among patients. After the dermatoscope, the skin scrapings were obtained with sharp edge of sterile scalpel from clinical suspected burrows and were transferred to a glass slide. A cover slip was placed over the slide and examined under LM in the dermatology laboratory. The entire slide was examined under low-power lens (×10), mite, eggs, larvae or feces were suspected ×40 magnification (Figures 4-8). The diagnosis was evaluated by DS and LM in terms of sensitivity (SN), specificity (SP), and accuracy (AC) by percentage and known as predictive value theory.

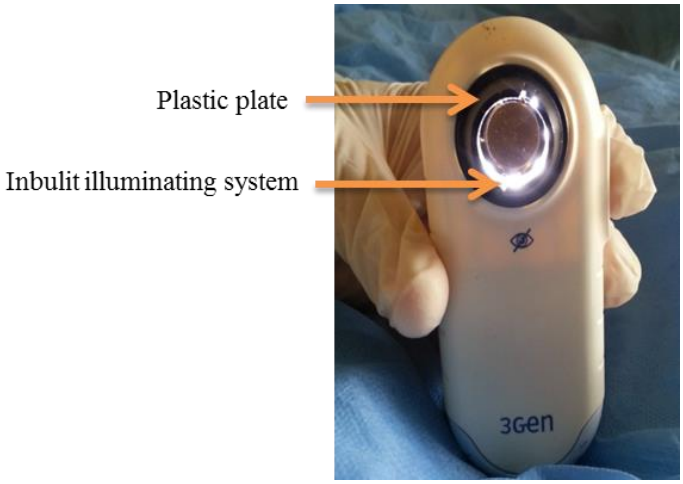

Figure 1. Dermlite DL 100 (DS)

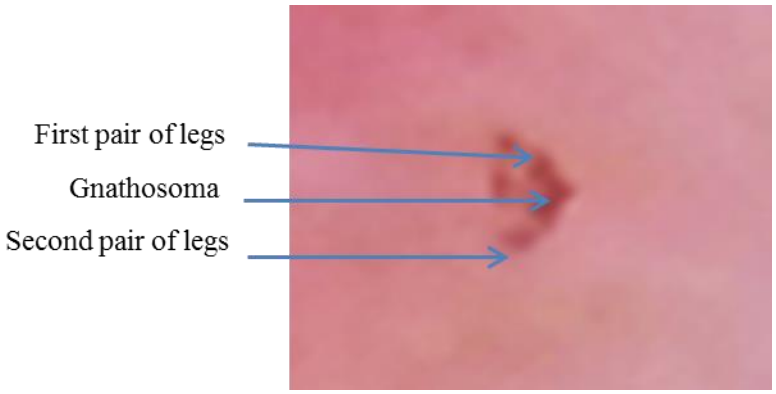

Figure 2. Sarcoptes scabiei without burrow by (DS) Dermlite DL 100

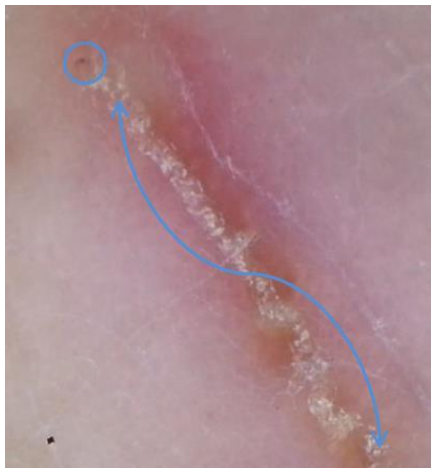

Figure 3. Sarcoptes scabiei with burrow by (DS) Dermlite DL 100. Blue circle indicates proterosoma, and blue arrow indicates burrow.

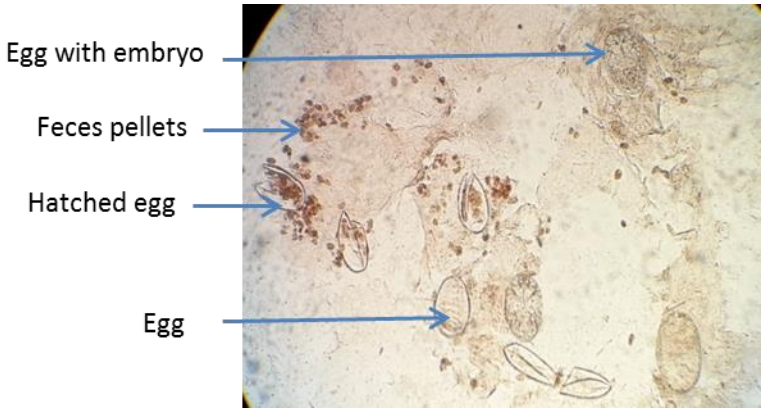

Figure 4. Identifying S. scabiei by seeing eggs and feces pellets using magnification 10X.

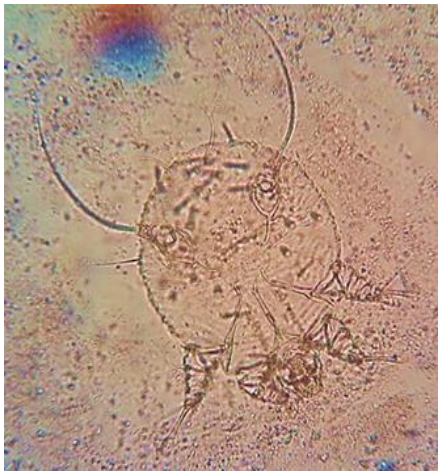

Figure 5. Identifying S. scabiei by seeing the larva using magnification 40X.

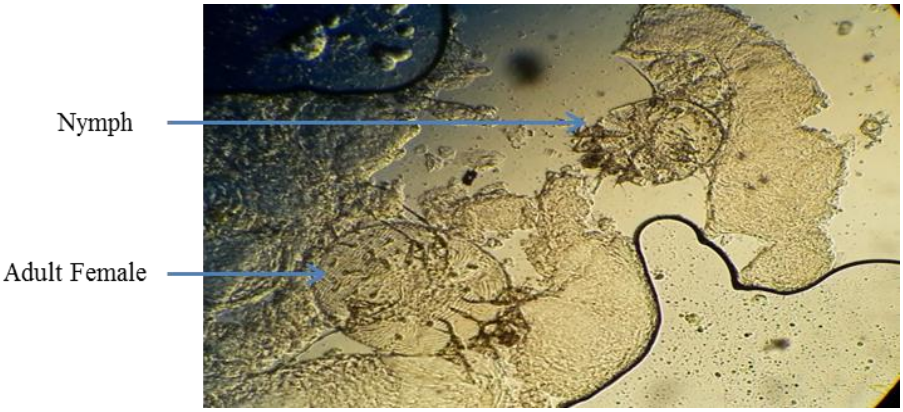

Figure 6. Identifying S. scabiei by seeing the larva and adult female using magnification 10X.

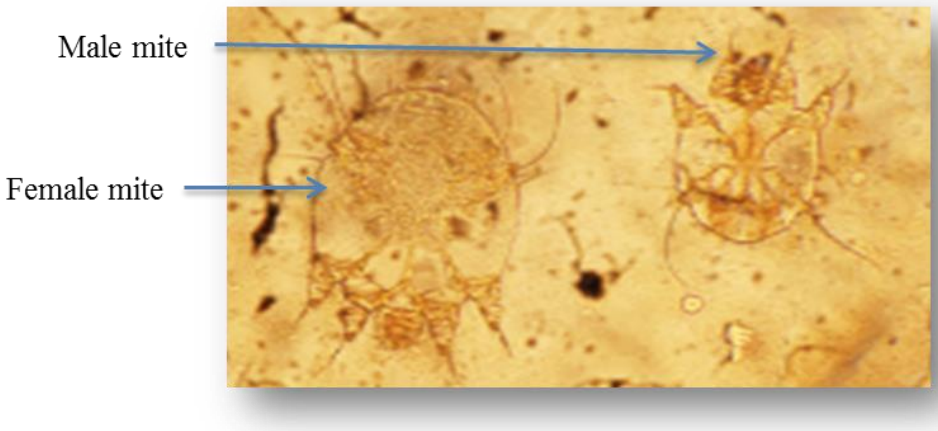

Figure 7. Identifying S scabiei by seeing male and female mites using magnification 10X.

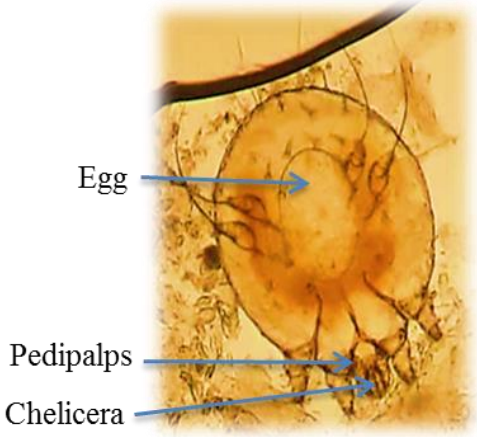

Figure 8. Identifying S. scabiei by seeing adult female mite using magnification 10X.

Statistical analysis

The SPSS soft wear program 25 was used in the statistical analysis to find out whether the data followed a normal distribution, the Kolmogorov-Smirnov and the Chi Square tests were also used in the study to conduct the different relationships and to find the odds of disease in the presence of its influences. As we used the Kappa scale and predictive values, which include sensitivity (SN), specificity (SP), accuracy (AC) and frequencies (FR) that were studied to determine the degree compatibility between DS and LM and to evaluate the diagnostic value of both techniques. The test significance was measured at the level of significance with P-value 0.05.

RESULTS

About 1037 patients suffering from scabies were randomly selected from dermatology outpatient clinics from three Hospitals in Tripoli during the period January 2018 to June 2019. This study showed that 531 (51%) of patients were reported from UMH, 267 (26%) of patients from BAMH and 239 (23%) of patients from TCH. Males were 488 (47%), and females were 549 (53%) with M/F 1: 1.13 ratio. The current study showed that the DS technique was able to detect that 327 of patients (32%) out of 1037 were diagnosed with scabies, with a significant difference of ($p = 0.000$). The LM technique was able to diagnose 324 (31%) of patients with a similar significant difference ($p = 0.000$) to DS.

The study revealed that there were no significant differences between the three Hospitals in terms of diagnosing the disease by LM and DS, with a value of (p = 0.683) and (p = 0.847) respectively. As the DS technique was able to diagnose 327 (32%) of infected people, and 710 (68%) were negative. This technique being nearly similar to the LM technique, where it was able to diagnose 324(31%) of people with scabies and 713 (69%) of patients were negative (Figure 9).

Figure 9. Comparison between (DS) and (LM) diagnosis of infected and non-infected patients with scabies

The study revealed that there were no significant differences between the DS and LM in terms of their detection of the disease with p-value (0.887). The two techniques DS and LM identified patients with scabies in 286 (%) cases. The DS technique was able to identify 41 cases of scabies, while the LM technique failed to identify them, while the LM technique was able to identify 38 cases of scabies, while the DS technique failed. In their identification, that is, 79 of the patients were diagnosed differently by the two techniques (Figure 10).

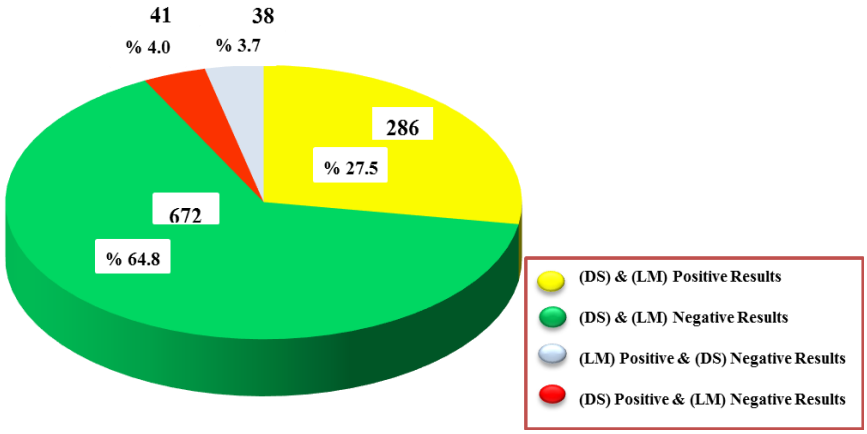

Figure 10. Shared and unshared positive cases using both techniques (DS) and (LM)

The study revealed that the area between the fingers plays a major role in influencing the outcome of both techniques DS and LM, where the DS technique showed its superiority over the LM technique by recognizing *S. scabiei* mite in the area between the fingers, because it is considered one of the most important areas in which the two techniques differed. Whereas, the DS technique was able to identify 35 patients out of 41 infected, which correspond to an 85% rate by watching the *S. scabiei* in the area between the fingers, while the LM technique was able to identify only 4 cases out of 38 infected, i.e., by 11% (Figure 11).

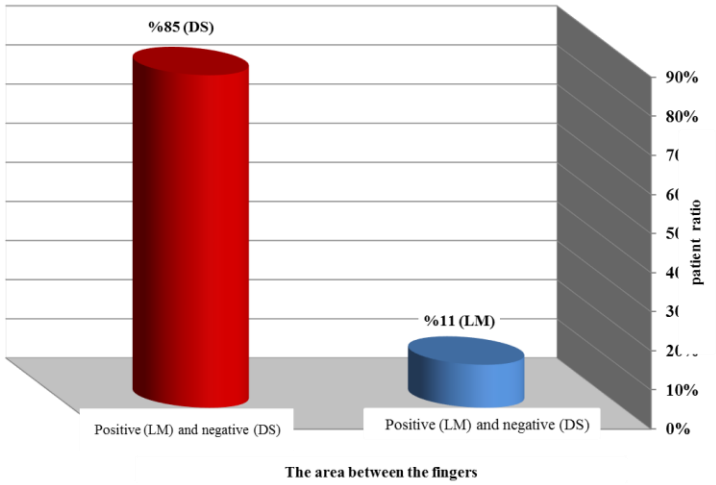

Figure 11. The effect of the injury area between the fingers in the diagnosis of scabies Using (DS) and (LM) technology

The level of severity of infection (Figure 12) has an effective and strong role in identifying patients with scabies, the DS technique was able to detect people with scabies who had minor infection at a rate of (11%), while the LM technique was able to detect only (2%). The LM technique was also able to detect those with scabies who had severe infections by (10%), while the DS technique was able to detect only (0.3%) (Figure - 36). These results confirmed statistically that there are high significant differences (p value = 0.000) between the two techniques in terms of severity of infection, the total cases were 79 and 38 of them showed a negative result by DS and positive by LM, and on the contrary 41 cases were positive by DS and negative by LM.

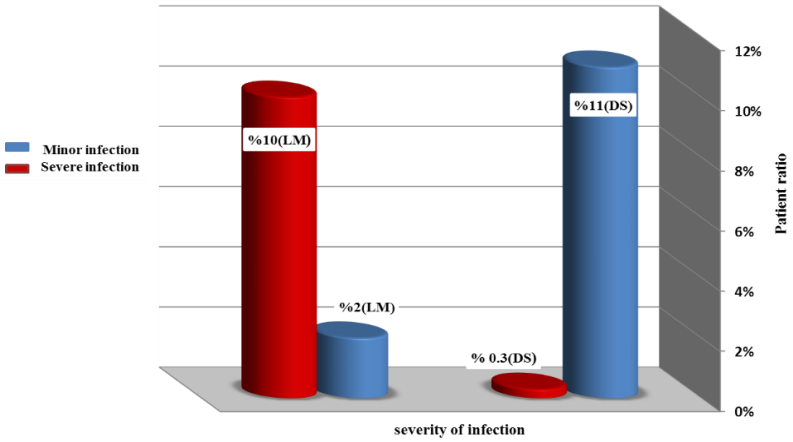

Figure 12. The effect of infection severity level on the diagnosis of scabies using (DS) and (LM) technology

The study showed that the sensitivity of LM technology reaches 88%, which is nearly similar to DS technology, which reaches 87%, and the specificity of DS technology reaches 95%, which is also nearly similar to the specificity of LM technology of 94%, and both two techniques reached an accuracy rate of 92%, that is, they are completely identical to the diagnosis of scabies, and accordingly, the infection rate (FR) of scabies with the DS technique reaches 32%, nearly similar to the LM technique by 31% (Figure 13).

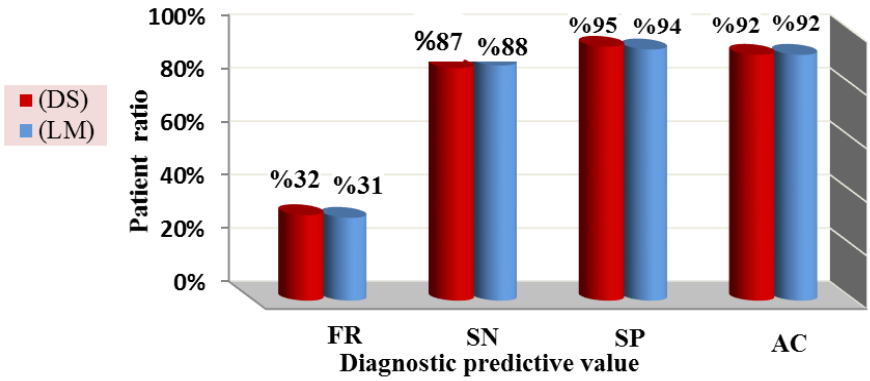

Figure 13. Diagnostic evaluation between (DS) and (LM) technology

The two techniques DS and LM matched, so the degree of compatibility between the two devices was very high (0.832 using the Kappa scale), and it was statistically significant, with a high generalization (P-value = 0.000), meaning that the agreement between the two techniques reached 294%.

DISCUSSION

Scabies is a common contagious skin disease caused by the female mite (SC), and is considered by the WHO as a neglected health problem worldwide [5,31,38-40]. The diagnosis of scabies is challenging and can be difficult in certain situations. Diagnosis is based mainly on the presence of suspicious clinical signs such as itchy papules, vesicles or nodules in certain sites of the body especially in countries with low socioeconomic status [6,28]. However; the clinical diagnostic findings are less efficient due to the diagnostic sensitivity (SN) less than 50% [41,42]. In addition; to the similarity of scabies with other skin disease conditions, the polymorphic manifestations, hided the clinical picture by superinfection and the lack of clinical awareness by the clinicians [6,28,40]. The low specificity of clinical diagnosis, and its sensitivity depend on the experience of the clinician [6]. This may lead to misdiagnosis, wrong treatment, and the patient to become a source of infection [42]. Thus, it is impossible to depend mainly on clinical diagnosis according to the previous studies, and diagnosis must be supported by using one of the confirmatory diagnostic methods, including DS, LM or using both techniques [28,36,43]. A definitive diagnose of scabies can only be made through identification of mites, eggs, or mite pellets by using LM or epiluminescence microscopy or dermoscopy [2,28]. The burrow of the mite is the only pathognomonic sign, which usually isn't readily visible especially on pigmented skin, frequently destroyed by scratching and may require dermoscopy to be detected [2,40]. Not seeing a mite cannot exclude the presence of scabies and can lead to wrong diagnosis [28].

This study showed that the DS was able to detect scabies in 327 patients (32%) and the LM was able to diagnose 324 (31%). It was found through results that there were no significant differences between the two microscopes in terms of diagnostic disease in general, with value ($p = 0.887$). Thus, the DS was able to diagnose positive infected cases of 32%, as it corresponds with the previous studies which confirmed that the white trace represent the tunnel were seen and the distinctive sign of the mite was identified as a dark brown triangle at the end of this tunnel [28,37]. S. scabiei without a tunnel was a rare case found in three patients and this is also consistent with the results of other study which revealed that it is not necessary for S. scabiei to exist in the tunnel [44]. The LM was able to diagnose scabies patients of 31%, and this finding was lower than the results of Abdel-Latif et al. 2018 by (10%), our study may be higher due to large sample size. The larva, nymph, and male mite were observed corresponding to the previous studies where the mites, eggs, and feces pellets were only seen [8,16,28].

The study showed that the two techniques DS and LM were involved in diagnosing 286 (27.6%) infected cases while they differed in 79 (7.62%) cases, and this indicated that the factors that contributed the difference in the positive cases were not shared between the two techniques. The most important affecting factor is the area of infection, where the results clearly showed that the area between the fingers is the most infected area, as the DS was able to identify 35 patients out of 41 infected, approximately 85%, while the LM was able to identify only 4 cases out of 38 infected, approximately 11%. This result is consistent with the results of two previous studies [36,37]. The second factor that affects the result is the extent of

the infection, as the current study confirmed that when the LM was able to detect 10% of scabies with severe infections, the DS detected only 0.3%. However; when the DS identified and detected minor infections of 11%, the LM detected only 2% of them, and this is consistent also with Micali et al., 2000 study [45]. These could be explained by directly placing the DS on the infected site, which helps to preserve the body of the mite, in contrast to the LM technique in which scraping may be done by using a surgical scalpel causing the sample and its products to be destructed and lost. Also, previous studies were shown that minor and severe infections had major roles in influencing the vision of the dark brown triangular sign, and thus, it was hardly seen or difficult to identify it in minor infection, or it may be undistinguishable in severe infection [2,28]. Usage of skin scrapings in LM technique sometimes helps in the success of detecting scabies in patients but fails with mild infections, which leads to a false negative result or due to the low number of mites as in patients with classic scabies or due to sampling error and thus, it is necessary to take samples from several affected sites of the skin as done in this study [34,45-48].

The study revealed that when comparing the assessment of diagnostic characteristics between the two techniques DS and LM using predictive values, where there is none fundamental difference between them, and are similar to another study, which found 90% by LM, and 91% by DS, while SP was 86% by DS technique, and 100% by LM technique [34]. It also gave similar results to another previous study using the DS, with a sensitivity ratio 79.65% [37]. The study showed that the sensitivity of the (DS) technique of a dermatologist diagnostic accuracy increased exponentially during the study, as it reduced the number of false positive (FP) and false negative (FN) results. Also showed that the SP for LM reached 94%, which was lower than Dupuy et al., 2007 study (100%), and the reason for that is the DS was used as a guide tool for LM technique, while this study did not use DS as a guide tool as a guiding tool for (LM). Their study revealed that, 41 cases were diagnosed by DS, and 23 cases by skin scraping (SS) only out of the total number of 49 patients, while it showed a negative result for diagnosing 8 cases by both techniques as a result of other skin diseases diagnosed Clinically [34,49]. Our study confirmed that the DS added a diagnostic value for the use of LM.

It was revealed that both techniques were similar, and there was no difference between them in terms of numbers or percentages that have been identified. The DS was able to diagnose 327 people with scabies, and the LM was able to diagnose 324 infected cases. A study was carried out by Park et al., 2012, from Korea on scabies, which compared the method of skin scraping with the help of a DS and the method of skin scraping without the use of LM [49].The sensitivity of DS was (87%), which agreed with that of Walter et al. (83%) and was lower than Dupuy et al. (91.0%), and the high sensitivity results can be explained by the good experience of DS users and the ability to diagnose infected cases by recognizing the distinctive sign (dark brown triangle) and artefacts, such as crusts, bleeding or dirt particles induced by scratching can be confound with a mite [2,34].

In addition; we examined all affected areas in patients to reduce false negatives, while Walter study DS examined only 3 areas of infection for a period of 5 minutes [2]. Also, our results were much higher than Abdel-Latief et al., 2018 (43.5%), possibly because of pigmented skin type of patients, which could interfere with visualizing the triangle mark (the winged delta sign) [28]. Study results showed the sensitivity of LM (88%) was higher and disagreed with Walter et al, 2011 (46%), and Abdel-Latif et al, 2018 (43.5%) studies [2,28]. Due to the use of 10% KOH, in order to preserve the mite and prevent it from moving on the glass slide, while Walter et al study used oil, but it did not prevent the mite of *S. scabiei* from moving, to reach the edges of the slide cover and was therefore, not seen [2]. It was also higher than Abdel-Latif et al., 2018 study (43.5%) [28]. The specificity (SP) of DS reached 95%, which was much higher than Walter et al, 2011 study (46%), as this study was distinguished by the fact that users of DS had good experience in diagnosing patients [2]. Compared to Walter et al., 2011, patients had pigmented skin and DS users did not have the experience in using this technique, but were rather trained to use the DS during the study period only [2]. Thus; a good training on using DS is required to avoid confusion of artifacts [28]. It is also higher than Abdel-Latif et al., 2018 (84.4%) and Dupuy et al., (86.0%) in spite of a small sample size of (100 cases) in comparison to this large sample size study [28, 34]. Thus, to overcome the problem of the study sample size, the number of patients diagnosed with scabies reached 1037, and also to stay away as much as possible from false negatives and false positives in order to be able to accurately diagnose scabies.

The specificity (SP) of LM reached 94%, being slightly less than Walter et al., 2011 and Abdel-Latief et al., 2018, whose results for the diagnostic evaluation of the specificity of LM technology to 100% for both. As there is no false positive, because the technique was managed by a good experience the researcher, and the medical analysis technician, as the other reason is the large sample size confirmed the validity of the sensitivity of LM [2,28]. Through the results of this study, when comparing the two techniques DS and LM to confirm the clinical diagnosis of scabies and to know the optimal technique

that will be taken as a standard, we found that both techniques were able to identify *S. scabiei* and by comparing them in terms of evaluating the diagnostic features SN, SP, FR and AC. It turns out that there is no difference between them, and the study confirmed that the DS was able to diagnose scabies disease by watching the mite or its effect, and also confirmed that the LM was able to identify the adult female mite, male, egg, larva, nymph, and excrement. It was concluded from this study that both techniques DS and LM are similar, and there was no difference between them in terms of the number or percentages that have been identified.

CONCLUSION

The study showed the need to support the clinical diagnosis of scabies using the two confirmatory methods, the DS and LM, and by comparing them, we concluded that one of the two techniques could not be considered as having the standard for diagnosing scabies as the LM was able to diagnose scabies in minor and highly sever infections, while the DS was able to diagnose mild infections, meaning that the two techniques were complementary to each other. Thus, necessity for dermatologists to do both techniques to confirm and support the clinical diagnosis of scabies.

Disclaimer

The article has not been previously presented or published.

Conflict of Interest

There are no financial, personal, or professional conflicts of interest to declare.

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