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Demodex Mite Infections in Ophthalmic Patients on Indonesian Islands: The ICS Humanitarian Aid Report

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Objective: *Demodex* is the most common external human parasite. It has been suggested that the *Demodex* infection may be associated with malnutrition, nutritional deficiencies, reduced immunity, and poor hygiene. The patients who benefitted from humanitarian aid

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in Indonesia, often demonstrated the abovementioned risk factors. The aim of the present report was to assess the prevalence of *Demodex* infestation in ophthalmic patients in Indonesian.

Patients and methods: A total of 217 individuals (132 women) with ocular discomfort, who presented to the ophthalmologist in mission points in Indonesia (Bali, Java, and Papua, the province of Indonesia in the New Guinea Island) were checked for the presence of *Demodex* on their eyelashes and underwent an anthropometric examination.

Results: The prevalence of ocular demodicosis varies from 71.2% in Bali to 89.2% in Papua. There were no statistically significant differences between the islands, urban or rural areas, or between sexes. A statistically significant difference was found between nutritional status and *Demodex* infestation ($P = 0.0007$). Malnourished and overweight patients had odds of being infested with *Demodex* that were approximately 8 and 3 times higher, respectively, compared with subjects with a normal body mass index.

Conclusions: Ocular demodicosis is very common in medically underserved areas of Bali, Java, and Papua, where it exceeds the frequency observed in countries of the northern hemisphere. An abnormal nutritional status comprising of both malnutrition and being overweight appears to be a risk factor for *Demodex* infection. This issue requires further research.

Key words: Nutritional status – Malnutrition – Obesity – Bali – Java – Papua

Demodex belongs to the family of Demodicidae, class Arachnida, subclass Acarina. *Demodex folliculorum* and *Demodex brevis,* the two species found in humans, are collectively referred to as *Demodex*. They are the most common external human parasites that colonize normal human skin in an adult population in any climatic zone.[1] The primary route of infection is through direct contact with infected skin, such as shaking hands and using the same towels, bed sheets, or utensils. Infection can be also the result of contact with dust containing the mite's eggs.

Demodex is acquired at an early age and remains asymptomatic while it resides on the skin or eyelashes in most people. When the eco-balance of the skin or external eye is disturbed, the parasite begins to penetrate the dermis, grow in number, and can then cause dermatologic (acne rosacea, folliculitis, pityriasis folliculorum)[2–4] and/or ocular diseases (marginal blepharitis, recurrent chalazia, meibomian gland dysfunction, kerato-conjunctivitis, loosing eyelashes).[5–9]

Background

Ocular demodicosis is a common but frequently overlooked eye disease. Recently, increased interest in *Demodex* has been associated with the demonstration that demodicosis is often misdiagnosed as an allergy, inflammation, bacterial, or fungal infection.[9] The alternative cause of symptoms are sought in the absence of improvement after long-time treatment, whereas the diagnosis of *Demodex* infection is easy, inexpensive, and nearly noninvasive.

It has been suggested that the *Demodex* infection may be associated with covert and overt malnutrition, nutritional deficiencies (vitamin D, essential fatty acids, etc.), reduced immunity, and poor hygiene.[10–12] The majority of patients who sought help in the humanitarian aid points in Indonesia demonstrated the abovementioned risk factors.

Aim

Searching through the available literature, we have not found data regarding the prevalence of ocular *Demodex* infection in the inhabitants of Indonesian Islands. Thus, the present report aimed to assess the prevalence of *Demodex* infestation in ophthalmic patients at short-term medical missions in Java and Bali islands, as well as in Papua, the Indonesian's province in the New Guinea Island.

Materials and Methods

All the data presented in the report were obtained as clinical data for the purpose of diagnosis and

Fig. 1 The mission team and geographical localization of the medical services in 2015.

treatment, but they were not collected with the intent of research or publication. They were analyzed retrospectively.

The study was conducted between July 31 and August 18 2015, during the fourth annual short-term medical mission named "Indonesia Medical Volunteer Service 2015" (Fig. 1). The humanitarian aid has been organized annually since 2012 by the International College of Surgeons (ICS) with the help of Kaohsiung Medical University and the Poznań University of Medical Sciences.

Study group

A total of 217 individuals (132 women, 85 men) who presented to ophthalmologists at mission points in Bali, Java, and Papua were examined for the presence of *Demodex* on their eyelashes. One hundred thirty subjects were native Javanese people from the east part of Java, 51 were native Balinese people recruited from the suburbs of Denpasar and surrounding villages, and 37 were Papuans from the Komoro tribe in the Timika region of Papua (Indonesian's province in the New Guinea Island). All of the examined patients complained of symptoms that could potentially be caused by mites from the *Demodex* family: burning of their eyelids, a sense of "heaviness" of their eyelids, ocular discomfort, conjunctiva reddening, itching of eyes, chalazia, foreign body feeling in eyes, blurry vision, or flaking and crusting of the eyelids. None of the subjects wore glasses or contact lenses. Because all patients wanted to see specialists besides ophthalmologists (internists or surgeons), they underwent a physical examination that included the evaluation of anthropometric measurements (weight, height, and body mass index [BMI]), as well as other measures.

Methods

The confirmation of *Demodex* infestation was completed via collection of 3 eyelashes from the right and left eyes with disposable tweezers. Eyelashes were taken from the upper and lower eyelids (12 altogether) and immediately immersed on a microscopic slide in 10% fluorescein (Alcon Laboratories, Inc, Fort Worth, Texas), covered with a cover slip, and verified under light microscope (magnification 10×10) by an experienced microbiologist (IC-S) for the presence of larvae, nymphs, or images of *Demodex*. The diagnosis was then confirmed by a second researcher (IJM). A sample was considered positive if at least 2 adult forms of the parasite were found. Noteworthy is the fact that, although the

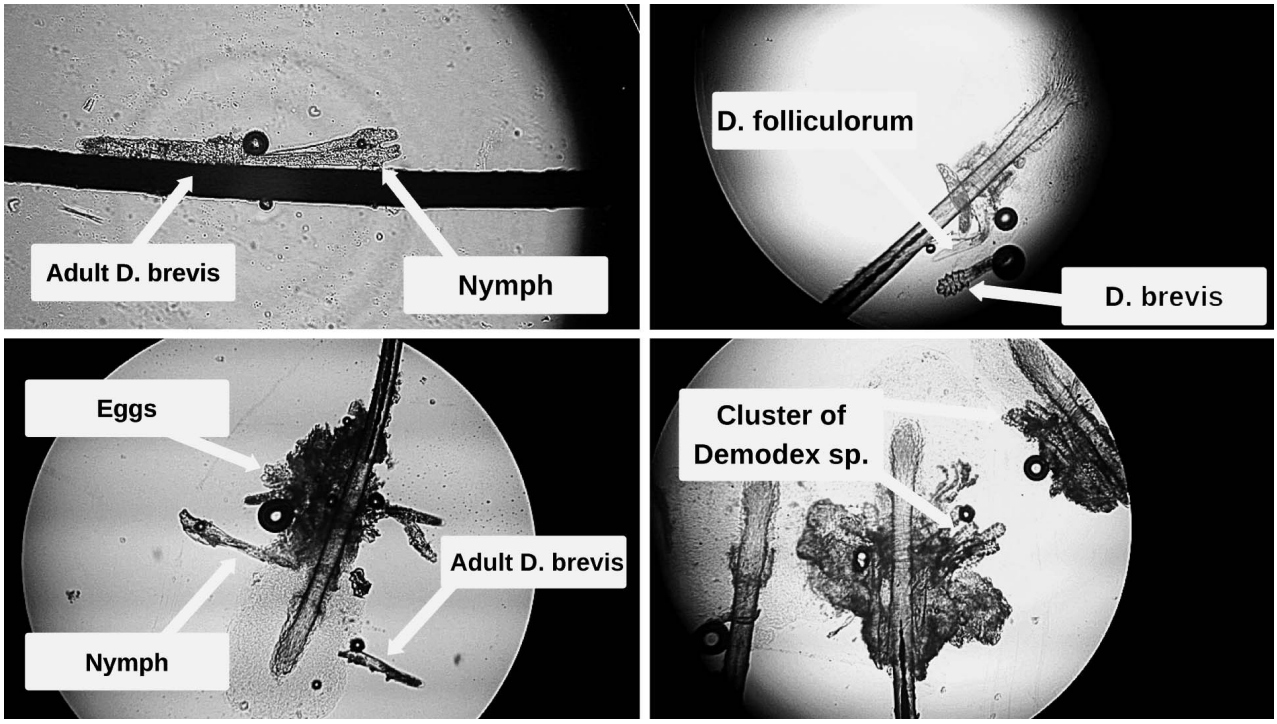

Fig. 2 *Demodex*: two different mites species at various life stages.

number of pathogens was not enumerated (due to the need to work at a swift pace), there was not even a single *Demodex*-positive subject with only a single pathogen on the eyelashes. The clustered pathogens were usually found at different developmental stages (Fig. 2).

All subjects diagnosed with the ocular demodicosis received free treatment. Because there are no standardized therapeutic recommendations for the treatment of demodicosis and there are several published treatment options available, we used the protocol found to be effective in Poland.[13] Therapy consisted of 250 mg metronidazole (Polpharma, Starogard Gdański, Poland) 2 times a day for 2 weeks in tablet form and Demoxoft, lipogel form or Demoxoft clean wipes, which are used for wiping the eyes (Ofta LLC, Warsaw, Poland). Patients were informed to ingest the metronidazole after meals. They were also presented with instructional posters that had illustrated descriptions written in Indonesian of methods to maintain personal hygiene with emphasis on their eyelids.

Demoxoft is a combination drug consisting of aloes, D-panthenol, Fucocert with hyaluronic acid, and the natural emollient Olivem 1000. It relieves the itching and burning associated with inflammation, accelerates regeneration of the epidermis, forms a protective layer, provides hydration, and strengthens the natural protective barrier of the skin. All patients received Demoxoft for a 1-month course of treatment.

The present report was approved by the Bioethical Committee of Poznan University of Medical Sciences.

Statistical analyses were performed using the data analysis software system STATISTICA (version 10; StatSoft, Krakow, Poland). The Kruskal-Wallis test with post hoc analysis was used for comparison of numeric data between the groups. Chi-square and Fisher-Freeman-Halton tests were used to compare frequency data between the groups. In addition, the odds ratios (ORs) were calculated. Differences were considered significant when $P < 0.05$.

Results

Detailed characteristics of the analyzed group are summarized in Table 1. The age of patients and nutritional status, expressed as BMI, differed between the islands. Patients from Java were older than those of Papua and Bali ($P < 0.0001$ for both). There was no statistically significant difference in the age of Papuans and Balinese people. Patients from Papua had lower BMIs than those on Java and

Table 1 Characteristic of the studied group (n = 217)

Characteristics	Place of Residence			*P*
	Java	Bali	Papua	
Age (years)				0.0007
Median	54	45	35	
1q-3q	(45.00–65.00)	(36.25–51.75)	(28.00–58.00)	
Mean ± SD	54.97 ± 4.44	44.60 ± 13.95	41.68 ± 17.15	
Sex, n (%)				0.5509
Female	83 (63.8)	28 (56.0)	21 (56.8)	
Male	47 (36.2)	22 (44.0)	16 (43.2)	
Region n (%)				0.0001
Urban	44 (33.8)	36 (72.0)	0 (0.0)	
Rural	86 (66.2)	14 (28.0)	37 (100.0)	
BMI (kg/m^2)				0.0001
Median	21.28	23.77	19.92	
1q-3q	(19.13–24.54)	(22.41–28.25)	(18.90–21.19)	
Mean ± SD	21.86 ± 4.26	25.63 ± 5.49	20.04 ± 2.22	

Bali ($P < 0.05$ and $P < 0.0001$, respectively), whereas subjects from Java had lower BMIs compared with Balinese people ($P < 0.0001$). We did not study any Papuan subjects coming from an urban region.

The incidence of ocular demodicosis among the medical mission's patients with ocular discomfort varied from 71.2% in Bali to 89.2% in Papua (Table 2). The prevalence of *Demodex* was 17%–18% higher in Papua than in Bali and Java. However, only patients from Papua had significantly higher odds of being infested with *Demodex* compared with subjects from Java (OR, 3.1560; 95% confidence interval [CI], 1.0449–9.5540; $P = 0.0416$), which was not the case when comparing the Papuan with Balinese (OR, 2.8906; 95% CI, 0.89061–9.76900; $P = 0.0860$) or Javanese with Balinese subjects (OR, 0.9174; 95% CI, 0.4379–1.9220; $P = 0.8193$).

There were no statistically significant differences ($P = 0.4203$ and $P = 0.9382$, respectively) of *Demodex* infestation between patients from urban and rural areas (OR, 1.2970; 95% CI, 0.6885–2.4432) or between females and males (OR, 1.0254; 95% CI, 0.5442–1.9322; Table 2).

The last part of Table 2 presents the association between *Demodex* infection and nutritional status. The incidence of demodicosis in patients was categorized into 3 groups according to their BMI: normal (BMI, 18.5–25.0 kg/m^2; n = 132), malnourished (BMI < 18.5 kg/m^2; n = 36), and overweight (BMI > 25.0 kg/m^2; n = 49)], which were significantly different ($P = 0.0007$). The malnourished and overweight patients had 8.2135 (95% CI, 1.8850–35.7879; $P = 0.0050$) and 2.4761 (95% CI, 1.0685–5.7383; $P = 0.0345$) times higher odds of being infested with *Demodex* compared with subjects with a normal BMI. When comparing malnourished to overweight subjects, there were no statistically significant differences seen (OR, 3.3171; 95% CI, 0.6598–16.6751; $P = 0.1456$).

Discussion

According to a review of the literature related to the topic, this is the first report evaluating the impact of ocular *Demodex* infestation in the medically underserved areas of Indonesia. The mission points were organized in the impoverished regions of Bali, Java, and Papua. For most patients, this was their first contact with modern medical care. In the context of

Table 2 Prevalence of Demodex*-positive and* Demodex*-negative patients with ocular discomfort: dependence on the place of residence, sex, and nutritional status*

Variables	*Demodex*		*P*
	Positive	Negative	
Place of residence			0.0924
Java, n (%)	94 (72.3)	36 (27.7)	
Bali, n (%)	37 (71.2)	13 (28.8)	
Papua, n (%)	33 (89.2)	4 (10.8)	
Region			0.4203
Urban, n (%)	58 (72.5)	22 (27.5)	
Rural, n (%)	106 (77.4)	31 (22.6)	
Sex			0.9382
Female, n (%)	100 (75.8)	32 (24.2)	
Male, n (%)	64 (75.3)	21 (24.7)	
BMI (kg/m^2)			0.0007
<18.5, n (%)	34 (94.4)	2 (5.6)	
18.5–25, n (%)	89 (67.4)	43 (32.6)	
>25, n (%)	41 (83.7)	8 (16.3)	

medical problems, many of them have benefited from nonprofessional help in the past.

Because there are large ethnic and geographical divergences among the islands, we will focus on emphasizing the similarities and differences observed between the examined groups. In that regard, it must be stressed that the entire studied group can be taken as representative for the poor, medically underserved areas of similar latitude.

Our analysis showed that the prevalence of *Demodex* infestation in ophthalmic patients varied from 71.2% in Bali to 89.2% in Papua. It was higher compared with the literature data reported by other authors, especially when considering the age of the examined subjects. The meta-analysis published by Zhao *et al* demonstrated that 44% of blepharitis patients were infected by *Demodex* with the prevalence increasing dramatically as they aged.[14] The explanation for the almost twofold increase in *Demodex* prevalence in our report may be due to poor sanitary conditions, as well as the bad nutritional status of the examined patients.

The researchers concur that the likelihood of *Demodex* infection increases with age.[1,15,16] However, the percentage of people infected with *Demodex* in different age groups varies between studies. Post and Juhlin[1] have shown that, in 1963, about 84% of people over 60 years of age and almost 100% of people over 70 were infected with *Demodex*. More recent data obtained in 2005 indicated that 34% of the people aged 19 to 25 years, 69% of the people aged 31 to 50 years, and 87% of the people aged 51 to 70 years were *Demodex* positive.[15] In 2012, Wesołowska *et al* estimated the *Demodex* prevalence in different populations (290 subjects, age 19–79 years) as being 41%. They did not observe higher *Demodex* prevalence in subjects with ocular discomfort than in the rest of asymptomatic individuals.[16] This is in concordance with the results of Kemel *et al*.[17] Studying 500 subjects, 170 with ocular discomfort and 330 without ocular symptoms, they did not find differences between the groups in prevalence of *Demodex* infestation.

We examined for *Demodex* infection only in patients complaining of different forms of ocular discomfort. However, based on the findings of Wesołowska and Kemal, we may suppose that the prevalence of *Demodex* infestation in asymptomatic individuals in medically underserved areas of Bali, Java, and Papua is similar to that which we showed for patients with ocular discomfort.[16,17]

In line with the findings of other authors,[16–18] we stated no sex-related difference in *Demodex* infestation. When comparing inhabitants of rural and urban areas, there was no distinction in *Demodex* prevalence. This fact can be linked to the specificity of places in which the medical services were organized. The suburbs of the cities, which were counted as urban areas, were just as medically and hygienically neglected as the villages.

When analyzing the whole group, we revealed that that malnourished and overweight subjects had higher odds of ocular demodicosis compared with patients with normal BMIs. The literature data concerning *Demodex* infection and nutritional state are scarce. Kaya *et al* showed that in 100 pediatric patients, malnutrition increased the risk of *Demodex* infestation more than 17 times.[19] Our findings are the second report in the literature concerning the adult population and are in line with the results of Dokuyucu *et al*.[20]

Comparing *Demodex* prevalence depending on the place of residence, we showed that the highest rate (89.2%) of *Demodex*-positive patients was in Papua, the youngest examined population (with a median age of 35 years). Their odds were 3.1560 and 2.8906 higher of being infested with *Demodex* than subjects from Java and Bali, respectively. This is in contrast to the findings of other authors,[1,14,15] who claimed that *Demodex* prevalence increases with age. There may be several explanations for this finding. Papuans were the most poorly nourished patients among the 3 analyzed groups, with a median BMI of 19.92 kg/m^2. On the other hand, we suggest that (based on the assumptions of Lacey *et al*[21]) Papuans have sunken eyes, whereas Javanese and Balinese people have protruding eyes. Unlike the eyes of Papuans, the eyes of Javanese and Balinese people may not be protected by bony protrusion (brows, nose, and cheeks). Also, the eyelashes of Papuans are longer and thicker than those of Javanese and Balinese people.[22] The differences in the eyelashes of Javanese and Balinese people can be easily overcome by washing the face without having to cleanse the eyes separately.

The limitations of the present report are also worth noting. It should be emphasized that due to the specificity of working conditions (including language problems), the medical histories might not be thorough. Hence, the different comorbidities might result in the various risk of *Demodex* infection in the patients.

The age range of patients aided by the mission differed between the islands. The number of pathogens on the eyelashes was not counted. This is because the priority of our action was humani-

tarian help, so it was imperative that we work at a very fast pace to help the greatest number of patients. It should also be stressed that we were not able to verify the effects of the treatment because the mission points were organized in different places every day.

Conclusions

Ocular demodicosis is very common in medically underserved areas of Bali, Java, and Papua and exceeds the frequency observed in countries of the northern hemisphere. Abnormal nutritional status, comprising both malnutrition and being overweight, seems to be a risk factor of *Demodex* infection. This issue requires further research.

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