

PREVALENCE OF *DEMODEX* ECTOPARASITES AMONG HUMANS IN ORDU PROVINCE IN TURKEY

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Abstract. *Demodex folliculorum* and *Demodex brevis* are common ectoparasites in humans. *Demodex* parasite infestations have not been determined in the province of Ordu. We determined the prevalence of *Demodex* species among humans in Ordu Province, Turkey. Seven hundred ninety-nine subjects (438 males and 361 females) aged ≥ 18 years living in the central districts of Ordu Province, Turkey, were selected using the World Health Organization cluster sampling method. A superficial skin biopsy of the face was obtained from each subject. Six hundred sixty-nine subjects (83.7%) had a *Demodex* parasite. Factors significantly associated with the presence of *Demodex* infestation were: female gender, employment in the private sector, people who only occasionally wash their face and district of residence. Since *Demodex* ectoparasites were common in Ordu Province, it is suggested that the diagnosis and treatment of this ectoparasite should be carried out in the hospitals of this region.

Keywords: *Demodex*, ectoparasite, epidemiology, Turkey

INTRODUCTION

Demodex are extremely small mites, 0.1-0.4 mm long; they infest a wide variety of mammalian hosts but are highly host-specific (White, 2003). *Demodex folliculorum* and *Demodex brevis* are *Demodex* species infecting only humans (Özcel *et al*, 2007). These parasites preferentially live on the hair follicles of the face and in the sebaceous glands, although they have also

been reported to reside in other parts of the human body, such as the buttocks, nipples and penis (Nutting, 1976; Bonnar *et al*, 1993). Transmission from person to person can occur through close contact (Nutting, 1976; Bonnar *et al*, 1993; Aycan *et al*, 2007).

Demodex species infecting humans are found worldwide (Andrews, 1982; Aycan *et al*, 2007). The degree of infestation varies by age but can reach 100% in the elderly (Andrews, 1982; Aycan *et al*, 2007). The parasite is associated with poor skin hygiene, overuse of cosmetic products, oily skin, aging and immunodeficiency (Nutting, 1976; Bonnar *et al*, 1993; Baima and Sticherling, 2002).

In this study, we determined the prevalence of *Demodex* species among

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humans in Ordu Province, Turkey and possible factors associated with infestation. According to available information, *Demodex* parasite infestations have not been determined in the province of Ordu. This study was aimed to draw attention of health personnel in hospitals of the related regions in Turkey to be aware of this ectoparasite especially in patients with skin complaints.

MATERIALS AND METHODS

Study site

Ordu is a province of Turkey located on the Black Sea coast with a population in 2013 of 423,295. Ordu Province is divided into 19 districts. Thirteen central districts of Ordu Province were selected for the study of the relationship between prevalence of *Demodex* and the associated factors.

Study subjects

The study subjects were selected using the World Health Organization cluster sampling method (Paul and Bennet, 2004). A minimum of 777 subject was calculated based on the confidence interval of 95%, design effect of 2 and deviation of 5%. Inclusion criteria were men and women aged ≥ 18 years old residing in 13 districts of Ordu Province. Exclusion criteria were those aged < 18 years old and pregnant or lactating women. A total of 799 subjects selected from all health centers in the city center were included in the study which was conducted during April 1, 2013 and October 31, 2013.

Sample collection and examination

Samples were collected using the standard skin surface biopsy (SSSB) method (Rusiecka-Ziółkowska *et al*, 2014; Aycan *et al*, 2007). Each sample was prepared and examined under a light microscope at magnifications of 40x and 100x.

Demodex spp density was evaluated per cm^2 (Rusiecka-Ziółkowska, 2014).

Data collection and analysis

A questionnaire was developed to collect data associated with the presence of *Demodex*. The questionnaire was administered after specimen collection. Data were analyzed by SPSS for windows version 22.0 (IBM, Armonk, NY) and presented as frequencies and percentages. The Pearson chi-square or Fisher's exact tests were used for statistical analysis as appropriate. A p -value < 0.05 was considered statistical significant.

Ethical clearance

The study was approved by the ethics committee of the Faculty of Medicine (2013/130), Inonu University. Written informed consent was obtained from each participant.

RESULTS

Seven hundred ninety-nine subjects were included in the study (438 males and 361 females). Parasites were detected in 669 (83.7%) of 799 subjects (80.1% of males and 86.8% of females) (Table 1). The prevalent difference between genders was statistically significant ($p < 0.05$). The parasite was significantly most common among those in the private sector (92.3%) than those who were workers (74.4%, $p < 0.05$) (Table 1).

Demodex was found on oily skin (82.5%), dry skin (82.4%), and normal skin (82.5%) without significant differences ($p > 0.05$; Table 2). The parasite was significantly more common among those who washed their face occasionally (95.2%) than those who washed their face regularly ($p < 0.05$).

A significant relationship was found between the prevalence of *D. folliculorum*

Table 1
Distribution of the parasite for selected variables.

Variables		<i>Demodex</i> spp		Total	<i>p</i> -value
		Negative No. (%)	Positive No. (%)		
Age (years)	15-19	22 (27.8)	57 (72.2)	79	0.07
	20-24	28 (18.4)	124 (81.6)	152	
	25-29	12 (11.2)	95 (88.8)	107	
	30-34	14 (13.1)	93 (86.9)	107	
	35-39	14 (17.1)	68 (82.9)	82	
	40-50	23 (14.2)	132 (85.8)	155	
	>50	17 (14.5)	100 (85.5)	117	
Sex	Women	72 (19.9)	289 (80.1)	361	0.011
	Men	58 (13.2)	380 (86.8)	438	
Marital status	Single	52 (18.0)	237 (82.0)	289	0.41
	Married	73 (15.0)	415 (85.0)	488	
	Widowed	5 (22.7)	17 (77.3)	22	
Educational status	Illiterate	4 (26.7)	11 (73.3)	15	0.212
	Literate	4 (23.5)	13 (76.5)	17	
	Primary	46 (15.8)	246 (84.2)	292	
	High school	50 (19.0)	213 (81.0)	263	
	Senior high school	10 (15.4)	55 (84.6)	65	
	University	16 (12.4)	113 (87.6)	129	
	Master's degree	0 (0)	18 (100.0)	18	
Profession	Housewife	41 (24.0)	130 (76.0)	171	0.001
	Worker	32 (25.6)	93 (74.4)	125	
	Officer	12 (21.1)	45 (78.9)	57	
	Private sector	12 (7.7)	143 (92.3)	155	
	Other	33 (11.7)	258 (88.3)	291	
Living situation	Alone	5 (20.8)	19 (79.2)	24	0.052
	With friends	7 (10.3)	61 (89.7)	68	
	Nuclear family	110 (18.2)	494 (81.8)	604	
	Extended family	8 (8)	92 (92.0)	100	
	Other	0 (0)	3 (100.0)	3	
Knowledge of <i>Demodex</i>	Good	0 (0)	5 (100.0)	5	0.66
	Medium	3 (25.0)	9 (75.0)	12	
	Low	2 (14.3)	12 (85.7)	14	
	None	125 (16.3)	643 (83.7)	768	

and certain factors such as the sex, employment status, and the frequency with which the subject washed their face ($p<0.05$). The presence of *Demodex* is not associated with marital status, diseases, medication and pet care.

Distribution of the parasite based on districts is summarized in Table 3. *Demodex* was identified in 100% of samples taken from subjects residing in the following neighborhoods of Ordu: Akyazı, Bucak, Cumhuriyet, Denizciler, Durugöl, Sahincili, Sirinevler, and Uzunisa.

Table 2
 Distrubition of *Demodex folliculorum* for the selected variable.

Variable based on survey questions		<i>Demodex folliculorum</i>		Total	p-value
		Negative No. (%)	Positive No. (%)		
Skin type	Oily	54 (14.4)	321 (85.6)	375	0.57
	Dry	35 (17.6)	164 (82.4)	199	
	Mixed	41 (17.5)	193 (82.5)	234	
Use of sunscreen lotion	Yes	18 (14.4)	107 (85.6)	125	0.62
	No	112 (16.6)	562 (83.4)	674	
Use of epilator	Yes	10 (24.4)	31 (75.6)	41	0.21
	No	120 (15.8)	638 (84.2)	758	
Use of laser	Yes	6 (23.1)	20 (76.9)	26	0.41
	No	124 (16.0)	649 (84.0)	773	
Use of wax	Yes	14 (17.9)	64 (82.1)	78	0.78
	No	116 (16.0)	605 (84.0)	721	
Use of face wash	Once a day	9 (13.2)	59 (86.8)	68	<0.001
	Morning and evening	107 (22.5)	368 (77.5)	478	
	Sometimes	3 (4.8)	60 (95.2)	63	
	Never	1 (20.0)	4 (80.0)	5	
	Often	10 (5.0)	178 (95.0)	188	
Use of moisturizing cream	Yes	58 (19.1)	239 (80.9)	297	
	No	72 (14.0)	430 (86.0)	502	
Use of foundation	Yes	29 (22.5)	100 (77.5)	129	
	No	101 (15.1)	569 (84.9)	670	
Use of makeup	Yes	37 (20.0)	144 (80.0)	181	
	No	93 (15.0)	525 (85.0)	618	
Face itching	Yes	18 (13.0)	119 (87.0)	137	
	No	112 (16.5)	550 (83.5)	662	
Face erythema	Yes	31 (15.0)	172 (85.0)	203	
	No	99 (17.1)	479 (82.9)	578	
Eye itching	Yes	33 (13.3)	216 (86.7)	249	
	No	97 (17.6)	453 (82.4)	550	
Ear itching	Yes	28 (16.6)	141 (83.4)	169	
	No	102 (16.3)	523 (83.7)	625	
Have a cat	Yes	3 (14.0)	19 (86.0)	22	
	No	127 (16.3)	650 (83.7)	777	
Have a dog	Yes	9 (26.0)	26 (74.0)	35	
	No	121 (15.8)	643 (84.2)	764	
Disease	Yes	25 (16.0)	131 (84.0)	156	
	No	105 (16.3)	538 (83.7)	643	
Skin disease	Yes	121 (15.8)	643 (84.2)	764	
	No	9 (9.9)	82 (90.1)	91	
Medication	Yes	22 (16.2)	112 (83.8)	134	
	No	108 (15.8)	577 (84.2)	685	
Type of towel	Paper	16 (21.0)	61 (79.0)	77	
	Cotton	114 (15.8)	608 (84.2)	722	

Table 3
Distribution of *Demodex* by neighborhood.

District	<i>Demodex</i>		Total	p-value
	Negative No. (%)	Positive No. (%)		
Akyazı	0 (0.0)	72 (100.0)	72	0.001
Bucak	0 (0.0)	60 (100.0)	60	
Cumhuriyet	0 (0.0)	59 (100.0)	59	
Denizciler	0 (0.0)	49 (100.0)	49	
Durugöl	0 (0.0)	69 (100.0)	69	
Düz	11 (25.0)	33 (75.0)	44	
Karşıyaka	52 (76.5)	16 (23.5)	68	
Selimiye	47 (77.0)	14 (23.0)	61	
Subaşı	16 (26.7)	44 (73.3)	60	
Şahincili	0 (0.0)	58 (100.0)	58	
Şirinevler	0 (0.0)	58 (100.0)	58	
Uzunisa	0 (0.0)	62 (100.0)	62	
Yeni Mahalle	4 (5.1)	75 (74.9)	79	

DISCUSSION

Infestation with *D. folliculorum* can lead to allergic reactions caused by increased mite counts and displacement of other skin microorganisms, which facilitates infection by this parasite (Budak *et al*, 1995; Aycan *et al*, 2007). The allergic reactions result from parasite antigen exposure in the skin (Budak *et al*, 1995; Aycan *et al*, 2007).

The prevalence of *D. folliculorum* has been investigated in various populations. *D. folliculorum* was detected in 80% of subjects in a study of 88 subjects from New Zealand (Andrews, 1982) and in 51% of subjects in a study of 100 subjects from Brazil (Madeira and Sogayar, 1993). In a study from Australia, *D. folliculorum* was detected in 80% of subjects aged 51-80 years, and in 90-100% of subjects aged 60-89 years (Nutting and Green, 1974). In a study from Egypt of patients diagnosed with rosacea, 44% of females aged 11-50

years had *Demodex* infestation (el-Shazly *et al*, 2001). A report from Greece of 92 patients diagnosed with papulo-pustular rosacea showed that 90% had *Demodex* infestation (Georgala *et al*, 2001). In a study from England of 25 patients with rosacea, 80% had *Demodex* infestation (Sibenge and Gawkrödger, 1992). In a study from Poland of 568 patients with chronic blepharitis, 67% had *D. folliculorum* infestation (Humiczewska, 1991). In a study by Norm in 1982 *Demodex* was identified in 4% of subjects aged <20 years, 30% of subjects aged 20-80 years and 47% subjects aged >80 years.

In Turkey, *D. folliculorum* infestation has been reported by various studies. Dereli *et al* (1997) found *D. folliculorum* infestation using skin biopsies of lesions in a patient diagnosed with granulomatous rosacea. Koc *et al* (1996) found *D. folliculorum* infestation in 40% of facial skin biopsy samples among 30 patients aged 14-42 years, 27 were women and 3 were men (29

had acne vulgaris and 1 had acne rosacea). Yazar *et al* (2008) found *D. folliculorum* infestation in 2.9% of 171 college students. Cengiz *et al* (2014) found *Demodex* spp in 18 of 38 women (47%) and 14 of 29 men (48%) at the Department of Parasitology, Faculty of Medicine, Yüzüncü Yıl University, Van, Turkey. In this study conducted in Ordu, 669 of 799 subjects (80.1% of males and 86.8% of females) tested had the *Demodex* parasites.

Base on our findings, which were confined to Ordu Province, studies on the epidemiology of the ectoparasites are recommended to be conducted in other regions of Turkey. Patients with skin complaints should be investigated for *Demodex* ectoparasites, especially in those with oily skin type, women, older age group, those with low socioeconomic status or with poor hygienic conditions.

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