

## Original papers

# Prevalence of fungi in cases of geographical and fissured tongue<sup>1</sup>

Anna Dudko<sup>1</sup>, Anna J. Kurnatowska<sup>1</sup>, Piotr Kurnatowski<sup>2</sup>

<sup>1</sup>Chair of Dentistry Surgery and Periodontology, Faculty of Medicine, Division of Dentistry, Medical University of Lodz, Pomorska 251, 92-213 Lodz, Poland

<sup>2</sup>Chair of Biology and Medical Parasitology, Faculty of Medicine, Medical University of Lodz, Hallera 1, 90-647 Lodz, Poland

Corresponding author: Anna J. Kurnatowska; e-mail: anna.kurnatowska@umed.lodz.pl

**ABSTRACT.** One of the most common malformations of the tongue is fissured tongue, very often, is accompanied by geographic tongue; the etiopathogenesis of them is not known. The aim of study was to evaluate the prevalence of fungi in cases of fissured and geographic tongue, and to determine their species and susceptibility to selected antifungal drugs. The study included 104 patients with fissured and/or geographical tongue. To determine fungi present in the tongue, the material was collected with a sterile swab for mycological examination. The procedure was conducted according to that used at our Department. The *in vitro* susceptibility of the strains to nystatin and miconazole was evaluated. In 45 (43%) cases fissured tongue, in 28 (27%) geographic tongue, and in 31 (30%) both conditions were diagnosed. Mycological examination revealed fungi on the tongue in 73 (70%) patients, including 31 patients (69%) with fissured tongue, 19 (68%) with geographic tongue, and 23 (74%) with concomitant changes. The most frequently detected was *Candida albicans* (detected in 48–66% of cases); in individual cases, other species of *Candida* species were found. The strains demonstrated greater sensitivity to nystatin than to miconazole. An analysis of reported symptoms based on the presence or absence of fungi on the tongue revealed that idiopathic pain and burning were significantly more frequently reported by patients with fungi on the tongue ( $p=0.034174$ ). Statistically significant differences exist between the presence and absence of fungi with regard to the signs, symptoms of changes on the tongue ( $p=0.026015$ ). Also, statistically significant differences ( $p=0.00000$ ) exist regarding the presence of fungi with regard to brushing a fissured tongue, or a fissured and geographic tongue; fungi are frequently present when brushing is absent. The prevalence of fungi is greatest in patients with geographic tongue, especially those who do not brush the surface of the tongue.

**Key words:** fissured tongue, geographic tongue, fungi

## Introduction

Variations in tongue morphology can be caused by developmental defects or inflammation, and can also occur in the course of systemic diseases [1].

One of the most common malformations of the tongue is fissured tongue, which occurs in 2–30.5% of the population, more frequently in men. Various factors can play a role in the etiology of fissured tongue. To some degree, the condition has a genetic basis: it is common in successive generations and in siblings of the same family. It is often accompanied by developmental defects, such as cleft lip or syndactylia. Pathological changes concern the surface of the tongue, due to changes in the mucous

membrane and the muscular tissue, and are manifested by numerous fissures, slots and grooves of irregular shape and varying depths (up to 6 mm), extending along the back of tongue and the side surfaces, sometimes giving the impression that the tongue is divided into separate parts. Patients do not typically display other symptoms and diagnosis often occurs randomly, during a visit to the doctor. However, fissured tongue favors the development of a variety of infections caused by viruses, bacteria, and fungi [2–4].

Very often, fissured tongue is accompanied by geographic tongue, which is reported in 1.8–12.7% of the population, mainly in adults, more often in women [5–7]. The precise etiopathogenesis of

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geographic tongue is not known; it has been associated with psychosomatic diseases, endocrine disorders, avitaminosis, as well as genetic factors, particularly the antigens HLA-DR5, HLA-DRW6 and HLA-Cw6 [8–11].

Typically, patients do not complain of symptoms, although they may experience a burning sensation and irritation in the case of eating hot and spicy food. These symptoms occur mainly in the tongue, but also in the buccal mucosa and the floor of the mouth, and the condition presents as erythema with loss of filiform papilla, surrounded by a crawling, white, hyperkeratotic border. Very often, patients report a spontaneous resolution of the lesion, with a return to normal in one area, while another lesion appears in a different location of the tongue [10,12]. Both fissures and geographic tongue are often accompanied by psoriasis [12,13].

The aim of study was to evaluate the prevalence of fungi in cases of fissured and geographic tongue, and to determine their species and susceptibility to antifungal drugs used in local treatment.

## Materials and Methods

The study included 104 patients of the Department of Periodontology and Diseases of Oral Mucosa, Medical University of Lodz, were admitted for changes in the tongue. The group comprised 78 women, aged from 22 to 82 years ( $x=50$ ) and 26 males aged 26 to 73 years ( $x=55$ ). None of the included patients had been previously treated in the Department, none had taken any antifungal drugs in the previous 12 months, and none had smoked cigarettes. Patients with symptoms of the tongue which could be attributed to general diseases, such as diabetes, or concomitant medications were also eliminated from the study.

A special questionnaire was designed and completed by all patients covering personal details, medical history, results of a dental examination (a

detailed assessment of the tongue and oral mucosa) and mycological investigations. Case histories considered such factors as patient complaints, the sequence, intensity, duration and relapse of disease signs/symptoms and the presence of any predisposing agents.

To determine the genera and species of fungi present in the tongue, the material was collected with a sterile swab for mycological examination. The material was seeded directly on liquid Sabouraud's medium incubated at 37°C for 24 hours, and the culture was left at room temperature for a further 48 hours. Direct preparations were then made of all the resulting colonies, in 0.9% NaCl solution, and examined under the microscope (100×, 400× or 800×) for fungal structures. If such structures were detected, the culture was placed on Sabouraud's agar.

Subsequent control preparations were performed in the same manner after 5–10 days and then after a further 10 days, and left for observation for up to 8 weeks. The transfer of the colonies to fresh media enabled the isolation of pure bacteria-free strains (axenic cultures). In the event that fungi forming fluffy, coat-like colonies were detected, which signalled possible laboratory contamination, a culture from the same patient was repeated.

Morphological and biochemical methods were used to differentiate the fungal strains. The macroscopic features of the colonies (colour, shape, lustre, edges, surface, relation to agar surface, changes in colour) as well as the microscopic aspects of the microcultures were evaluated on special media. On the basis of these characteristics, strains forming fluffy colonies were separated from those forming smooth colonies, and were differentiated between Aspergillaceae or Cryptococcaceae.

Auxanograms and zymograms were used to type individual Cryptococcaceae strains, using API 20C and API 20C AUX (bioMérieux) tests; the strains

Table 1. The occurrence of changes in the tongue in a group of men and women

Tongue	Gender					
	Women		Men		Total	
	N	%	N	%	N	%
Fissured	33	42	12	46	45	43
Geographic	20	26	8	31	28	27
Fissured and geographic	25	32	6	23	31	30
Total	78	100	26	100	104	100

Table 2. Brushing the tongue in different groups of patients

Tongue	Brushing			
	Yes		No	
	n	%	n	%
Fissured	9	20.0	36	80.0
Geographic	14	50.0	14	50.0
Fissured and geographic	11	35.5	20	64.5
Total	34	32.7	70	67.3

were classified into appropriate species and genera using numerical identification (Analytical Profile Index, bioMérieux, Lyon, 1990). The procedure was conducted according to that used at the Department of Biology and Parasitology, Medical University of Lodz, and has been described previously [14].

Subsequently, the *in vitro* susceptibility of the strains to nystatin and miconazole, two drugs applied topically in oral fungal infections, was evaluated. The fungal suspension was distributed evenly on NBY medium, paper discs impregnated with the drugs were placed on the surface of the

medium, and the culture was incubated at 37°C for 24 h. After this time, the degree of sensitivity was determined based on the size of the inhibition zones around the discs (Nystatin 100 IU, Miconazole – 10 mcg) according to the manufacturer's instructions (DHN). Strains whose growth was inhibited further than 18 mm from the disc were recorded as being susceptible, those inhibited between 14–18 mm as medium sensitive, and those with a diameter of less than 14 mm were recorded as resistant.

To assess the significance of the differences, the chi-square test of independence was used, as well as the chi-square test with Yates' correction and Fisher's exact test.

## Results

Of 104 patients with lesions on the tongue, 45 (43%) were diagnosed with fissured tongue, 28 (27%) with geographic tongue, and 31 (30%) with both conditions together. The frequency of both changes existing at the same time was more commonly seen among women. Data on the

Table 3. The occurrence of symptoms in each group

Tongue	Idiopathic pain and burning		Pain and burning invoked by food		Dryness		No symptoms	
	n	%	n	%	n	%	n	%
Fissured	7	15.6	1	2.22	7	15.6	28	62.2
Geographic	7	25.0	12	42.9	1	3.57	6	21.4
Fissured and geographic	20	64.5	5	17.3	3	9.7	3	9.7
Total	34	32.7	18	17.3	12	11.5	37	35.6

Table 4. The character of tongue mucosa in each group

Tongue	Tongue mucosa											
	pale		pink		wet		dry		smooth		atrophic	
	N	%	N	%	N	%	N	%	N	%	N	%
Fissured	18	40.0	27	60.0	39	86.7	6	13.3	34	75.6	11	24.4
Geographic	7	25.0	21	75.0	28	100.0	0	0	26	92.9	2	7.1
Fissured and geographic	11	35.5	20	64.5	28	90.3	3	9.7	24	77.4	7	22.6
Total	36	34.6	68	65.4	95	91.3	9	8.7	84	80.8	20	19.2

Table 5. The prevalence of fungi in each group

Tongue	Fungi			
	Present		Absent	
	n	%	n	%
Fissured	31	68.9	14	31.1
Geographic	19	67.9	9	32.1
Fissured and geographic	23	74.2	8	25.8
Total	73	70	31	30

occurrence of specific changes to the tongue in a group of men and women are shown in Table 1.

Data from the interview reveals that only 34 of the subjects regularly brushed their tongue everyday and for a long time; these results are summarized in Table 2.

In general, patients rarely complained of idiopathic pain and burning tongue associated with foods; a feeling of dryness in the mouth was also

Table 6. The prevalence of fungal species in each group

Species	Tongue			Total
	Fissured	Geographic	Fissured and geographic	
<i>C. albicans</i>	21 (67.7%)	11 (57.9%)	16 (69.6%)	48 (65.7%)
<i>C. tropicalis</i>	6 (9.4%)	2 (10.5%)	3 (13.0%)	11 (15.1%)
<i>C. guilliermondii</i>	2 (6.45%)	0	1 (4.35%)	3 (4.11%)
<i>S. cerevisiae</i>	0	2 (10.5%)	1 (4.35%)	3 (4.11%)
<i>C. kefyr</i>	0	1 (5.26%)	1 (4.35%)	2 (2.74%)
<i>C. glabrata</i>	0	1 (5.26%)	0	1 (1.37%)
<i>C. parapsylosis</i>	0	0	1 (4.35%)	1 (1.37%)
<i>C. famata</i>	0	1 (5.26%)	0	1 (1.37%)
<i>C. inconspicua</i>	0	1 (5.26%)	0	1 (1.37%)
<i>C. lusitaniae</i>	1 (3.2%)	0	0	1 (1.37%)
<i>C. humicola</i>	1 (3.23%)	0	0	1 (1.37%)
Total	31 (42.5%)	19 (26.0%)	23 (31.5%)	73 (100.0%)

Table 7. The occurrence of symptoms among patients with and without fungi on the tongue

Fungi	Idiopathic pain and burning		Pain and burning invoked by food		Dryness		No symptoms	
	n	%	n	%	n	%	n	%
Present	29	39.7	12	16.4	8	10.9	24	33.0
Absent	5	16.1	6	19.3	4	12.9	16	51.6
Total	34	32.7	18	17.3	12	11.5	40	38.5

Table 8. Character of tongue mucosa among patients with and without fungi on tongue

Fungi	Tongue mucosa											
	Pale		Pink		Wet		Dry		Smooth		Atrophic	
	N	%	N	%	N	%	N	%	N	%	N	%
Present	24	32.9	49	67.1	69	94.5	4	5.5	59	80.8	14	19.2
Absent	12	38.7	19	61.3	26	83.9	5	16.1	25	80.6	6	19.4
Total	36	34.6	68	65.4	95	91.3	9	8.7	84	80.8	20	19.2

Table 9. The sensitivity of selected species to tested antifungals

Species/Drug	Resistant	Medium sensitive	Susceptible
<b><i>C. albicans</i></b>			
Nystatin	0	4.2	95.8
Miconazole	14.6	27.0	58.4
<b><i>C. tropicalis</i></b>			
Nystatin	0	9.1	90.9
Miconazole	0	45.5	54.5
<b><i>C. famata</i></b>			
Nystatin	0	0	100.0
Miconazole	100.0	0	0
<b><i>C. inconspicua</i></b>			
Nystatin	0	0	100.0
Miconazole	100.0	0	0

noted. The occurrence of symptoms in each group is shown in Table 3. It can be seen that nearly two-

fifths of the examined subjects did not report any problems associated with the tongue.

It was found that in most cases, the mucous of tongue was pink, wet and smooth. Detailed information on this topic is summarized in Table 4.

Mycological examination revealed the presence of fungi on the tongue in 73 (70%) patients, including 31 patients (69%) with fissured tongue, 19 (68%) with geographic tongue, and 23 (74%) with concomitant changes. Detailed information on this topic is presented in Table 5.

The most frequently detected fungus was *Candida albicans*, detected in 48 (66%) cases, while *Candida tropicalis* was found in 11 (15%) patients. In individual cases, other species of *Candida* species, such as *C. glabrata*, *C. kefyr*, *C. guilliermondii*, *C. parapsylosis*, *C. famata*, *C. inconspicua*, *C. lusitaniae* and *C. humicola* were found. In three cases,

fungi of the genus *Saccharomyces* – *S. cerevisiae* were detected. Detailed data on the prevalence of different species in the groups of patients is given in Table 6.

An analysis of reported symptoms based on the presence or absence of fungi on the tongue revealed that idiopathic pain and burning were significantly more frequently reported by patients with fungi on the tongue ( $\chi^2=4.486$ ;  $p=0.034174$ ). Data on the symptoms is given in Table 7.

An analysis of tongue mucosa character, based on the presence or absence of fungi on the tongue, reveals no statistically significant differences between the mucosal pictures ( $p>0.05$ ). Detailed data is presented in Table 8.

It should be emphasized that statistically significant differences exist between the presence and absence of fungi with regard to the signs, symptoms of changes on the tongue ( $\chi^2=4.955$ ;  $p=0.026015$ ). Also, statistically significant differences ( $\chi^2=29.404$ ;  $p=0.00000$ ) exist regarding the presence of fungi with regard to brushing a fissured tongue, or a fissured and geographic tongue; fungi are frequently present when brushing is absent.

The strains demonstrated greater sensitivity to nystatin than to miconazole. For both drugs, all strains of *S. cerevisiae*, *C. guilliermondii*, *C. kefir*, *C. glabrata*, *C. parapsylosis*, *C. lusitaniae*, and *C. humicola* were susceptible. The sensitivities of other species are summarized in Table 9. All strains of *C. famata* and *C. inconspicua* were sensitive to nystatin. Over 90% of the strains of *C. albicans* and *C. tropicalis* were sensitive to nystatin, and slightly more than 50% to miconazole.

Unfortunately, a lack of similar studies makes any comparison with existing literature impossible.

## Conclusions

1. The prevalence of fungi is greatest in patients with geographic tongue, especially those who do not brush the surface of the tongue.

2. The strains are more sensitive to nystatin than to miconazole.

## References

- [1] Rogers S., Bruce A.J. 2004. The tongue in clinical diagnosis. *JEADV* 18: 254-259.
- [2] Kelsch R.D., James W.D. Fissured tongue. <http://emedicine.medscape.com/article/10784536>.
- [3] Kovac-Kovacic M., Skaleric U. 2000. The prevalence of oral mucosal lesions in a population in Ljubljana, Slovenia. *Journal of Oral Pathology and Medicine* 29: 331-335.
- [4] Reamy B.V., Derby R., Bunt C.W. 2010. Common tongue conditions in primary care. *American Family Physician* 81: 627-634.
- [5] Knychalska-Karwan Z. 2000. The tongue: physiology and pathology. UJ Press, Kraków. (In Polish)
- [6] Shulman J.D. 2005. Prevalence of oral mucosal lesions in children and youths in the USA. *International Journal of Paediatric Dentistry* 15: 89-97.
- [7] Yarom N., Cantony U., Gorsky M. 2004. Prevalence of fissured tongue, geographic tongue and median rhomboid glossitis among Israeli adults of different ethnic origins. *Dermatology* 209: 88-94.
- [8] Fenerli A., Papanicolaou S., Papanicolaou L., Lasakris H. 1993. Histocompatibility antigens and geographic tongue. *Oral Surgery, Oral Medicine, Oral Pathology* 76: 476-479.
- [9] Shulman J.D., Carpenter W.M. 2006. Prevalence and risk factors associated with geographic tongue among US adults. *Oral Diseases* 12: 381-386.
- [10] Kelsch R.D., James W.D. Geographic tongue. <http://emedicine.medscape.com/article/1078465>
- [11] Zduniak A., Zanio A., Regulska K., Regulski P., Androsz-Kowalska O. 2007. Evaluation of the frequency of changes on the tongue in various age groups. *Nowa Stomatologia* 4: 150-154 (In Polish).
- [12] Costa S.C., Sirota S.K., Takahashi M.D., Andrade H., Migliari D.A. 2009. Oral lesions in 166 patients with cutaneous psoriasis: a controlled study. *Medicina Oral Patologia Oral y Cirugia Bucal* 14: e371-375.
- [13] Zargari O. 2006. The prevalence and significance of fissured tongue and geographical tongue in psoriatic patients. *Clinical and Experimental Dermatology* 31:192-195.
- [14] Kurnatowska A., Kurnatowski P. (ed). 2006. Medical mycology. Promedi, Lodz (In Polish).

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