RESEARCH NOTE

Comparison of three differential media for the presumptive identification of yeasts

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ABSTRACT

This study evaluated three differential media, CHROMagar Candida, BiGGY agar and Albicans ID2 agar, for the presumptive identification of yeast species. In total, 215 yeast isolates were included in the study. The sensitivity and specificity of CHROMagar Candida, BiGGY agar and Albicans ID2 agar for the detection of *Candida albicans* were 100% and 100%, 91% and 92.7%, and 99.2% and 92.7%, respectively. CHROMagar Candida was a reliable tool for the presumptive identification of *C. albicans*, *Candida tropicalis*, *Candida krusei* and *Candida glabrata*. Albicans ID2 agar was useful for the detection of *C. albicans*.

Keywords Albicans ID2 agar, BiGGY agar, *Candida* spp., CHROMagar Candida, media, yeasts

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Yeast infections have become more common in recent years because of AIDS and the rising number of immunocompromised patients [1,2]. These infections, some of which are life-threatening, require rapid diagnosis and early antifungal therapy [3]. While infections involving *Candida albicans* are still the most common, the significance of other *Candida* spp. is increasing as they are more resistant to antifungal agents [4,5]. Several chromogenic media have been developed to improve the rapid identification of yeasts, based on the formation of colonies with different colours and morphologies following cleavage of chromogenic substrates [6].

The present study examined the growth of 215 yeast isolates (133 *C. albicans*, 23 *Candida tropicalis*, 20 *Candida glabrata*, 18 *Candida parapsilosis*, eight *Candida krusei*, four *Candida kefyr*, one *Candida guilliermondii*, seven *Trichosporon* spp. and one *Geotrichum candidum*) from various clinical specimens on three different media, namely CHROMagar Candida (CH; CHROMagar, Paris, France), bismuth sulphite glucose glycine yeast (BiGGY) agar (BA; Oxoid, Basingstoke, UK) and Albicans ID2 agar (AID; bioMérieux, Marcy l'Etoile, France). *C. albicans* ATCC 90028, *C. parapsilosis* ATCC 90018, and *C. krusei* ATCC 6258 were used as quality control strains.

The isolates were identified first by germ tube test, morphology on cornmeal Tween 80 agar, and reactions in the API 20C AUX system (bioMérieux). The isolates were grown on Sabouraud dextrose agar and then streaked on to chromogenic culture media. The results were scored independently by three individuals, according to the colour and morphology of the colonies and the existence of a halo around the colonies, after incubation for 24, 48 and 72 h at 37°C in the dark. The isolates were identified according to the manufacturers' instructions and as described by Odds and Bernaerts [7]. All isolates grew well on CA and AID, but a few isolates of *C. parapsilosis* and *C. kefyr*, and all isolates of *C. glabrata*, grew weakly on BA. Table 1 shows the colours of the colonies growing on the three media after incubation for 24 and 48 h.

On CA, all 133 *C. albicans* isolates produced green smooth-type colonies after incubation for 24, 48 and 72 h. On BA, 132 (99.2%), 121 (91%) and 119 (89.5%) of these isolates were identified as *C. albicans* after 24, 48 and 72 h, respectively. AID detected 130 (97.7%), 132 (99.2%) and 133 (100%) of *C. albicans* isolates after 24, 48 and 72 h, respectively.

CA identified 22 (95.7%) of 23 *C. tropicalis* isolates correctly after 24 h, and all 23 isolates on subsequent readings. BA identified four (17.4%), 20 (87%) and 21 (91.3%) of the *C. tropicalis* isolates after incubation for 24, 48 and 72 h, respectively. All eight *C. krusei* isolates were identified correctly by CA after each incubation period, while BA identified none at

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Table 1. Colony colours for each yeast species after incubation on three differential chromogenic agar for 24 and 48 h at 37°C

		No. of isolates after incubation for 24/48 h												
		CHROMagar						BiGGY agar				Albicans ID2 agar		
Species	*n*	Light green	Dark green	Blue-violet	Pink	Dark-pink	Off-white/cream	Light brown	Dark brown	Yellowish-mustard	Grey	Turquoise	White	Off-white/cream
Candida albicans	133	133/133	0/0	0/0	0/0	0/0	0/0	132/121	1/12	0/0	0/0	130/132	3/1	0/0
Candida tropicalis	23	0/0	0/0	22/23[a]	0/0	1/0	0/0	19/3	4/20	0/0	0/0	0/0	23/23	0/0
Candida glabrata	20	0/0	0/0	0/0	17(3[b])/18(17[b])	1/1[b]	2/0	20[c]/20[c]	0/0	0/0	0/0	2/2	5/5	13/13
Candida parapsilosis	18	0/0	0/0	0/0	3/3	0/0	15/15	18(3[c])/9	0/1	0/0	0/8	0/0	3/7	15/11
Candida krusei	8	0/0	0/0	0/0	8[d]/8[d]	0/0	0/0	8/0	0/8[d,e]	0/0	0/0	0/0	8(4[d])/8(4[d])	0/0
Candida kefyr	4	0/0	0/0	0/0	1/0	0/0	3/4	3[c]/2(1[c])	1[c]/2	0/0	0/0	0/0	3/3	1/1
Candida guilliermondii	1	0/0	0/0	0/0	1/1	0/0	0/0	1/0	0/1	0/0	0/0	0/0	1/1	0/0
Trichosporon spp.	7	0/0	7[a,d]/7[a,d]	0/0	0/0	0/0	0/0	4/6[d]	0/1[d]	3[d]/0	0/0	6[d]/7[d]	0/0	1/0
Geotrichum candidum	1	0/0	0/0	0/0	1[d]/1[d]	0/0	0/0	1/0	0/1[d]	0/0	0/0	0/0	1/1	0/0

[a]Halo diffusing into surrounding agar; [b]Pale edges; [c]Weak growth; [d]Rough, fuzzy colonies; [e]Yellow zone.

24 h, but all eight after 48 and 72 h. Three (15%) of the 20 *C. glabrata* isolates were identified correctly on CA after incubation for 24 h. At the second and third readings, the number of *C. glabrata* isolates identified correctly increased to 18. This species was easy to recognise on BA because of its weak growth and small light-brown colonies.

The sensitivity, specificity, positive and negative predictive values for different *Candida* spp., calculated by Epi Info v.6.0 [8], growing on these media are shown in Table 2. Odds and Bernaerts [7] found 100% sensitivity and specificity for *C. albicans* with CA after incubation for 48 h. This agreed with the finding in the present study, although other studies have reported a slightly lower sensitivity [9–11]. In agreement with other reports [7,9,12], the present study found CA to be useful for the presumptive identification of non-*C. albicans* species, although the sensitivities and specificities varied. Two studies [12,13] have reported that CA identified *C. glabrata*, but other reports have concluded that many other yeast species produced similar colonies [7,14,15]. The latter observation was also made in the present report, but it is recommended that special attention should be given to the existence of pale colony edges.

The observed sensitivity of BA for *C. albicans* was higher than that reported (60%) by Kalkanci *et al.* [16], and BA was also useful for the identification of *C. krusei*, which produced dark-brown rough colonies with 100% sensitivity.

The observed sensitivity and specificity of AID for *C. albicans* agreed with the observations of Cárdenes *et al.* [17], although Fricke-Hidalgo *et al.* [18] found a lower specificity, which might have arisen from the different incubation temperature used. Although both *C. albicans* and *Trichosporon* produce turquoise colonies, the morphological

Table 2. Sensitivity, specificity, positive (PPV) and negative (NPV) predictive values for the identification of *Candida* spp. obtained with three differential chromogenic media

		CHROMagar Candida				BiGGY agar				Albicans ID2 agar			
Species	Hour	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)
Candida albicans	24 h	100	100	100	100	99.2	32.9	70.6	96.4	97.7	93.9	96.3	96.3
	48 h	100	100	100	100	91.0	92.7	95.3	86.4	99.2	96.3	97.8	98.8
	72 h	100	100	100	100	89.5	92.7	95.2	84.4	100	93.8	96.4	100
Candida tropicalis	24 h	95.7	100	100	99.5	17.4	99.0	66.7	90.9				
	48 h	100	100	100	100	87.0	91.7	55.6	98.3				
	72 h	100	100	100	100	91.3	90.1	52.5	98.9				
Candida glabrata	24 h	15.0	100	100	92.0								
	48 h	90.0	100	100	99.0								
	72 h	90.0	100	100	99.0								
Candida krusei	24 h	100	99.5	88.9	100	–[a]	–[a]	–[a]	–[a]				
	48 h	100	99.5	88.9	100	100	99.5	88.9	100				
	72 h	100	99.5	88.9	100	100	99.0	80.0	100				

[a]Could not be calculated as no description is provided by the manufacturer.

appearance of the colonies may be helpful in identification, as they produce smooth and rough colonies, respectively.

As identification of *Candida* spp. by a germ-tube test followed by biochemical tests has been reported to be time-consuming and expensive [19], chromogenic media are of great interest to microbiologists. In order to determine the most appropriate medium, each individual laboratory will take local costs into consideration; thus, in Turkey, a BA plate costs 1 arbitrary unit, while CA and AID cost 11 and 5 units, respectively.

It was concluded that the use of CA and AID is reliable for the presumptive identification of *C. albicans*, *C. tropicalis*, *C. krusei*, *C. glabrata* and *C. albicans*. The lower sensitivity and specificity of BA for the identification of commonly isolated *Candida* spp. limits its clinical usefulness.

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