Diagnostic Microbiology and Infectious Disease 86 (2016) 128–130

Contents lists available at ScienceDirect

Diagnostic Microbiology and Infectious Disease

journal homepage: www.elsevier.com/locate/diagmicrobio

Bacteriology

Performance of the chromID *Salmonella* Elite chromogenic agar in comparison with CHROMagar™ *Salmonella*, Oxoid™ Brilliance™ *Salmonella* and Hektoen agars for the isolation of *Salmonella* from stool specimens

Delphine Martiny [a,*], Anne Dediste [a], Claire Anglade [b], Linda Vlaes [a], Catherine Moens [a], Souad Mohamed [a], Olivier Vandenberg [a,c]

[a] Department of Microbiology, iris-Lab, Iris-Brussels Public Hospital Network, Brussels, Belgium
[b] Department of Clinical Affairs, bioMérieux, Craponne, France
[c] Infectious Diseases Epidemiological Unit, Public Health School, Université Libre de Bruxelles, Brussels, Belgium

ARTICLE INFO

Article history:
Received 24 May 2016
Received in revised form 13 July 2016
Accepted 21 July 2016
Available online 27 July 2016

Keywords:
Chromogenic medium
Salmonella
Screening
Stool samples

ABSTRACT

chromID™ *Salmonella* Elite is compared with 3 culture media commonly used for *Salmonella* isolation from stool specimens. As results were equivalent to other chromogenic media (100% sensitivity, 98% specificity), only financial arguments should guide the choice for a medium with respect to another.

Salmonella infection constitutes a major public health burden worldwide (Crump and Mintz, 2010). Typhoid fever mostly appears in developing countries, whereas nontyphoidal salmonellosis are ubiquitous and induce a wide panel of clinical manifestations ranging from common gastroenteritis to bacteremia and systemic infections in up to 5% of cases (Gal-Mor et al., 2014). In Europe, *Salmonella* is the second cause of bacterial gastroenteritis after *Campylobacter* and this microorganism is responsible for more than 6 million human infections in the 27 EU Member States annually (Havelaar et al., 2013). In low-income and middle-income countries, the number of typhoid fever episodes was estimated to be of 12 million with 129,000 fatal outcomes (Crump, 2014; Mogasale et al., 2014). Salmonellosis is mainly a foodborne infection with more than 85% of cases related to contaminated food consumption (Majowicz et al., 2010). The increasing number of strains that develop resistance mechanisms against frequently used antimicrobials highlights the need for *Salmonella* isolation and routine antimicrobial susceptibility testing, which can direct appropriate therapy (Rahman et al., 2014). Bacterial culture should therefore be considered as the gold standard (Parry et al., 2011). The aim of the present study is to evaluate the performance of the chromID™ *Salmonella* Elite chromogenic agar in comparison with other frequently used agars for the isolation of *Salmonella* from stool specimens.

During a 3-monthperiod, all stool specimens submitted to the iris-Lab, Brussels, Belgium, for bacterial analysis were included in the evaluation. In addition, frozen stool specimens were also retrospectively included. One gram or 1 mL of stool was suspended in 2 mL of physiological saline 0.85% and then 10 μL of each suspension were aseptically streaked for isolation, without enrichment, onto each of the following 3 chromogenic agars: chromID™ *Salmonella* Elite (bioMérieux; Marcy l'Etoile, France), BBL™ CHROMagar™ *Salmonella* (Becton Dickinson; Erembodegem, Belgium) and Oxoid™ Brilliance™ *Salmonella* (ThermoFisher Scientific; Erembodegem, Belgium); and onto a conventional Hektoen selective medium (bioMérieux). In parallel, 100 μL of each suspension were inoculated on a Selenite F broth (ThermoFisher Scientific). Agar plates and broths were incubated at 35–37 °C in aerobic atmosphere and growth was evaluated after 18–24 h incubation.

Salmonella was suspected when typically colored colonies (as specified in the manufacturer's instructions) were observed on the agar (reading level) and confirmed by conventional identification techniques including MALDI-TOF mass spectrometry using a Microflex LT (Bruker Daltonics; Bremen, Germany), VITEK® 2 ID GN card (bioMérieux) and agglutination tests (confirmatory level). Antimicrobial susceptibility patterns were evaluated using VITEK® 2 AST N236 card

* Corresponding author. Tel.: +32-24352032; fax: +32-24352039.
E-mail address: delphine_martiny@stpierre-bru.be (D. Martiny).

http://dx.doi.org/10.1016/j.diagmicrobio.2016.07.021
0732-8893/

Table 1
Serovars isolated from the stool samples examined by using the 4 media.

Salmonella serovar	Number of stool samples per serovar	Number of stool samples per serovar detected with:							
		chromID *Salmonella* ELITE		CHROMagar		Brilliance		Hektoen	
		Without enrichment	With enrichment	Without enrichment	With enrichment	Without enrichment	With enrichment	Without enrichment	With enrichment
Braenderup	1	1	1	1	1	1	1	1	1
Durban	1	0	1	0	1	0	1	0	1
Enterica subsp. Enterica (9:eh:e,n,x)	1	1	1	0	1	0	1	1	1
Enteritidis	13	7	13	6	13	5	13	7	13
Infantis	1	0	1	0	1	0	1	0	1
Johannesburg	1	1	1	0	1	1	1	1	1
Kentucky	1	1	1	1	1	0	1	1	1
Montevideo	1	1	1	1	1	1	1	1	1
Newport	1	1	1	1	1	1	1	1	1
Toronto	1	1	1	1	1	1	1	1	1
Typhi	1	0	1	0	1	0	0	1	1
Typhimurium	14	7	14	8	14	6	14	7	14
Typhimurium var. Copenhagen	1	1	1	1	1	1	1	1	1
Total	38	22	38	20	38	17	37	23	38

(bioMérieux) and all *Salmonella* strains were referred to the Belgian National Reference Center for confirmation.

Irrespective of the medium used, specimens were considered positive as soon as suspected colonies were confirmed to be *Salmonella* by confirmatory tests.

S. typhimurium ATCC 14028 and *Escherichia coli* ATCC 25922 were used as quality control strains for the 3 chromogenic media.

In parallel, fresh stool specimens were tested for the presence of other enteropathogenic bacteria including *Yersinia*, *Campylobacter* and *Shigella*, according to standard laboratory procedures.

A total of 311 fresh specimens were included in this evaluation, 5 of which were positive for *Salmonella*. The prevalence of *Salmonella* ranged from 0.5% to 1.5% depending on the study period considered. *Campylobacter* sp. and *Clostridium difficile* were isolated in 4.2% ($n = 13$) and 3.5% ($n = 11$) of cases, respectively. Three other enteropathogenic microorganisms were isolated (1.0%), namely 1 *Aeromonas*, 1 *Yersinia enterocolitica*, and 1 *EPEC*. This distribution is in agreement with our local epidemiology.

To enhance the proportion of positive samples, 81 frozen specimens were added, 33 of which were positive for *Salmonella*. A total of 38 of 392 specimens were thus positive for *Salmonella* isolates (9.7%) from 14 different serotypes.

The performance characteristics of each medium, without and with preenrichment using Selenite brothwas compared using combined data, both before and after confirmatory tests, and is presented in Tables 1 and 2. The results presented in Table 1 firstly highlight the need for an enrichment procedure that considerably improves the sensitivity of the bacterial isolation; without enrichment, the best sensitivity was 60.5% when using the Hektoen medium, whereas the lowest sensitivity observed with an enrichment step was 97.4% using the

Table 2
Growth results at the reading level and after confirmatory tests, with and without the use of enrichment broth.

		Reading level							After confirmatory tests						
	Medium	N°				Sensitivity % (2-sided 95% CI)	Specificity % (2-sided 95% CI)	PPV	NPV	N°				Sensitivity % (2-sided 95% CI)	Specificity % (2-sided 95% CI)	PPV	NPV
		TP	FP	TN	FN					TP	FP	TN	FN				
Without enrichment	chromID ELITE	22	3	351	16	22/38 57.9% (42.2–72.1%)	351/354 99.2% (97.5–99.8%)	88.0%	95.6%	22	0	354	16	22/38 57.9% (42.2–72.1%)	354/354 100.0% (99.0–100.0%)	100.0%	95.7%
	CHROMagar	21	4	350	17	21/38 55.3% (39.7–69.9%)	350/354 98.9% (97.1–99.7%)	84.0%	95.4%	20	0	354	18	20/38 52.6% (37.3–67.5%)	354/354 100.0% (99.0–100.0%)	100.0%	95.2%
	Brilliance	17	1	353	21	17/38 44.7% (30.1–60.3%)	353/354 99.7% (98.4–100.0%)	94.4%	94.4%	17	0	354	21	17/38 44.7% (30.1–60.3%)	354/354 100.0% (99.0–100.0%)	100.0%	94.4%
	Hektoen	23	43	311	15	23/38 60.5% (44.7–74.4%)	311/354 87.9% (84.0–90.9%)	34.8%	95.4%	23	0	354	15	23/38 60.5% (44.7–74.4%)	354/354 100.0% (99.0–100.0%)	100.0%	95.9%
With enrichment	chromID ELITE	38	7	347	0	38/38 100.0% (90.7–100.0%)	347/354 98.0% (96.0–99.2%)	84.4%	100.0%	38	0	354	0	38/38 100.0% (90.7–100.0%)	354/354 100.0% (99.0–100.0%)	100.0%	100.0%
	CHROMagar	38	6	348	0	38/38 100.0% (90.7–100.0%)	348/354 98.3% (96.3–99.4%)	86.4%	100.0%	38	0	354	0	38/38 100.0% (90.7–100.0%)	354/354 100.0% (99.0–100.0%)	100.0%	100.0%
	Brilliance	37	2	352	1	37/38 97.4% (86.2–99.9%)	352/354 99.4% (98.0–99.9%)	94.9%	99.7%	37	0	354	1	37/38 97.4% (86.2–99.9%)	354/354 100.0% (99.0–100.0%)	100.0%	99.7%
	Hektoen	38	69	285	0	38/38 100.0% (90.7–100.0%)	285/354 80.5% (76.1–84.3%)	35.5%	100.0%	38	0	354	0	38/38 100.0% (90.7–100.0%)	354/354 100.0% (99.0–100.0%)	100.0%	100.0%

TP = true-positive result; FP = false-positive result; TN = true-negative result; FN = false-negative result; PPV = positive-predictive value; NPV = negative-predictive value.