

## Comparison of Isolation rate of the Pathogenic Microorganisms According to Stool Culture Methods

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**Background :** In developed countries, food-born diseases have decreased and hospital laboratory have taken more simple method rather than complex enrichment-selective methods. But detection rate of pathogenic bacteria in stool culture was not so high.

**Methods :** We mixed 4 pathogenic bacteria (*S. typhi*, *S. flexneri*, *V. cholerae* and *Y. enterocolitica*) with 3 stool specimens from healthy persons (for *Y. enterocolitica*, 5 specimens) and inoculated directly or after enrichment ( $10^5$  bacteria/plate). After proper incubation, we counted suspected colonies and calculated true positive rate after identification of each colonies.

**Results :** For *S. typhi*, in the case of direct inoculation on the MacConkey, XLD and SS agar, positive rate of selected colonies were below 36.6%. After enrichment in SF broth for 8 hours, the rate were 80.0%, 83.0% and 70.0% respectively. For *S. flexneri*, the rates were 86.7%, 100%, 93.3% in direct inoculation, and were highest after enrichment in GN broth for two hours (93.3% in MacConkey and 100.0% in both XLD and SS agar). For *V. cholerae*, inspite of screening by catalase and oxidase tests, positive rate of selected colonies were 0% (0/7 colonies) in direct inoculation on the MacConkey. After enrichment in APW about 1 day and on TCBS agar, the rate were 100%. For *Y. enterocolitica*, after incubation at room temperature for 2 days, most selected colonies were *Y. enterocolitica* on CIN media.

**Conclusion :** For more efficient detection of pathogenic bacteria in stool culture, combination of direct inoculation on MacConkey agar and on one or two selective media after proper enrichment process, should be considered.

**Key word :** Stool culture, *Salmonella*, *Shigella*, *Vibrio*, *Yersinia*

*V. cholerae* MacConkey thiosulfate-citrate-bile-sucrose (TCBS) agar, alkaline peptone water (APW) 15 23

oxidase, catalase

*Y. enterocolitica* MacConkey cefsulodin-irgasan-novobiocin (CIN) agar 48 TSI

SIM 35 18

*Campylobacter spp.* rotavirus [1]. Vitek GNI card

3.

4

1.5cm × 1.5cm

[2-4]. 가 ( 5 )

가 가

*S. typhi, S. flexneri, V. cholerae, Y. enterocolitica* 1. *S. typhi*

3

MacConkey 35, XLD 69, SS 77 가, 30.0%-36.7%

GN broth 2

XLD 가 가, 6 8

SS 가, 2

MacConkey 40.0% SS 36.7%-46.7% 가 19

0.0-6.7%

SF broth 6, 8

가 3가

3 (*Y. enterocolitica* 5 244 83.3% 19 50.0%)

1g 2ml

McFarand 0.5 268- 484 가

300ul 가 10ul 4

(10<sup>5</sup>/plate) 0.5ml

10ml

2. *S. flexneri*

154-281 GN broth 86.7-100.0% GN broth

2

179- 293 93.3-100.0% 가

2, 6, 8, XLD 93.3-100.0%

TSI (triple sugar iron) SIM (sulfide indole motility) 35 18

Table 1. Detection of *S. typhi* in stool specimen according to selective and enrichment process

Enrichment*	MacConkey			XLD			Salmonella-Shigella			
	No <sup>†</sup>	(+)/scr <sup>‡</sup>	(%)	No	(+)/scr	(%)	No	(+)/scr	(%)	
Control	22	0/15	0.0	33	0/15	0.0	47	0/15	0.0	
Direct	35	10/30	33.3	69	11/30	36.7	77	9/30	30.0	
GN	2h	42	6/15	40.0	105	4/15	26.7	58	7/15	46.7
	6h	49	2/30	6.7	58	8/30	26.7	113	11/30	36.7
	8h	30	2/30	6.7	59	5/30	16.7	128	14/30	46.7
	19h	34	1/15	6.7	50	1/15	6.7	41	0/15	0.0
SF	6h	244	18/30	60.0	336	18/30	60.0	515	15/30	50.0
	8h	342	24/30	80.0	624	25/30	83.3	294	21/30	70.0
	19h	268	0/15	0.0	484	1/15	6.6	351	1/15	6.7

\* Control: stool specimen from healthy persons without pathogenic bacteria.

Direct: direct inoculation on agar plate without enrichment.

GN: gram-negative broth, SF: selenite F broth.

2h, 6h, 8h, 19h: enrichment time of 2 hour, 6 hour, 8 hour and 19 hour.

<sup>†</sup> Sum of total colonies in the rectangular area of 1.5cm x 1.5cm of three specimens.

<sup>‡</sup> Sum of positive colonies/number of screened colonies.

Table 2. Detection of *S. flexneri* in stool specimens according to selective and enrichment process

Enrichment*	MacConkey			XLD			Salmonella-Shigella			
	No <sup>†</sup>	(+)/scr <sup>‡</sup>	(%)	No	(+)/scr	(%)	No	(+)/scr	(%)	
Control	9	0/15	0.0	30	0/15	0.0	5	0/15	0.0	
Direct	154	13/15	86.7	233	15/15	100.0	281	14/15	93.3	
GN	2h	193	14/15	93.3	179	15/15	100.0	293	15/15	100.0
	6h	124	13/15	86.7	167	14/15	93.3	71	13/15	86.7
	8h	94	11/15	73.3	288	14/15	93.3	100	10/15	66.7
	19h	50	7/15	46.7	36	11/15	73.3	87	13/15	86.7
SF	2h	25	0/15	0.0	26	6/15	40.0	5	2/11	18.2
	6h	23	2/15	13.3	18	0/10	0.0	20	0/10	0.0
	8h	45	0/11	0.0	25	0/10	0.0	42	0/10	0.0
	19h	113	0/15	0.0	48	0/15	0.0	148	0/15	0.0

\*. <sup>†</sup>. <sup>‡</sup>: same as the Table 1.

MacConkey SS 34 , APW 15 23  
 , 19 MacConkey 42 가  
 46.7-86.7% , oxidase catalase  
 SF broth 2 , 6 , 8 28.0%, 40.0%, 55.0% 가 ,  
 0.0%  
 2 XLD 40.0% 가 , 6 15 23 100.0%  
 MacConkey 13.3% , MacConkey TCBS  
 81 , oxidase  
 19 catalase 80.0%(20/25)  
 가 (Table 2). 100.0% , APW TCBS

3. *V. cholerae* , oxidase catalase  
 100.0%  
 MacConkey MacConkey oxidase catalase

Table 3. Detection of *V. cholerae* in stool specimens according to selective and enrichment process

Enrichment*	MacConkey							TCBS						
	No <sup>†</sup>	oxidase/catalase				Ab <sup>‡</sup>	(%)	No <sup>†</sup>	oxidase/catalase				Ab <sup>‡</sup>	(%)
		-/-	-/+	+/-	+/+(%)				-/-	-/+	+/-	+/+(%)		
Control	19	0	16	5	4(16.0)	0	(0.0)	6	14	0	0	1(6.7)	0	(0.0)
Direct	34	2	14	2	7(28.0)	0	(0.0)	81	5	0	0	20(80.0)	20	(100.0)
APW 15h	42	1	10	1	8(40.0)	8	(100.0)	760	0	0	0	20(100.0)	20	(100.0)
23h	42	0	9	0	11(55.0)	11	(100.0)	784	0	0	0	20(100.0)	20	(100.0)

\* , † same as the Table 1, APW: alkaline peptone water.

‡ number of colonies that agglutinated with polyvalent O1 antiserum to *V. cholerae*

Table 4. Detection rate of *Y. enterocolitica* in room temperature for 48 hours incubation in MacConkey and CIN agar

Enrichment*	MacConkey			CIN		
	No <sup>†</sup>	(+)/scr <sup>‡</sup>	(%)	No <sup>†</sup>	(+)/scr <sup>‡</sup>	(%)
Control	16	0/15	0.0	2	0/15	0.0
Direct	184	15/15	100.0	196	15/15	100.0

\* , † , ‡ : same as the Table 1. except No<sup>†</sup> calculated from five stool specimens.

11 TCBS  
oxidase catalase , DNA  
5  
(Table 3).

4. *Y. enterocolitica*

가 5  
. *Y. enterocolitica* 5  
48 MacConkey  
yersinia 16  
CIN 2 [5].  
TSI SIM  
yersinia , yersinia  
MacConkey CIN , *E. coli* 10<sup>9</sup>/g  
184 196 ,  
100.0% (Table 4). (200 /g 가 )  
[6].  
10uL 10<sup>5</sup>  
selenite broth GN broth가 , selenite broth  
가  
15% , GN broth 가 selenite  
broth  
[1]. [4] [6,7].  
2.6% 가 , GN broth  
4-6 , selenite broth 8-12  
XLD HE SS  
, *E. coli* *C. difficile*

SS TCBS 가  
가 가 *V. cholerae*

Desoxycholate 가 , XLD HE TCBS 가 TCBS oxidase  
[8-12].  
Rohner [7] selenite broth 가 [14].  
34 GN broth *Y. enterocolitica* 'cold  
59% enrichment' 3  
SS XLD [8,9]. MacConkey CIN  
*S. typhi* 8 48  
selenite broth 50.0- 83.3% [15,16]. 5  
GN broth 6.7-46.7% , selenite MacConkey 48  
broth 8 XLD , GN broth 2 1mm , 1  
8 SS 가  
*S. flexneri* 8 *Y. enterocolitica*  
, GN broth 66.7- 100.0% . *Y. enterocolitica*  
selenite broth 0.0-40.0% , 35  
SS(86.7-100.0%) XLD(93.3-100.0%) TSI(A/A, 가 ) SIM  
( eosine-methylene blue) MacConkey EMB ( ) 24  
urease 가 [16]. , CIN  
, XLD HE(Hektoen enteric) [16]  
SS , selenite  
broth GN broth XLD HE SS 'bull's eye'  
[6].  
selenite broth SS TSI  
가 , *Y. enterocolitica* CIN

GN broth가 ,  
가 , MacConkey  
, XLD SS  
.  
*V.*  
*cholerae* ,  
[13],  
[6]. 가

MacConkey oxidase  
catalase , : 가 (*S. typhi*, *S.*  
TCBS *flexneri*, *V. cholerae*, *Y. enterocolitica*) 3  
가 (Yersinia 5 )  
10<sup>5</sup>

MacConkey TCBS  
, : *S. typhi* MacConkey, XLD and SS agar  
37가 36.6% ,  
MacConkey , APW SF 8 80.0%,

83.0% and 70.0% 가 . *S. flexneri*  
 86.7%, 100%, 93.3%  
 GN 2  
 MacConkey 93.3%, XLD SS 100%  
*V. cholerae* MacConkey  
 catalase oxidase 7  
 , APW  
 TCBS 가  
 . *Y. enterocolitica* 48  
 CIN 가 Y.  
*enterocolitica*  
 :  
 MacConkey ,

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