Fapas® – Food Microbiology Proficiency Test Report 228

November-December 2017

PARTICIPANT LABORATORY NUMBER

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Laboratory numbers are displayed in SecureWeb next to the download link for this report.

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SUMMARY

1. The test material for Fapas® – Food Microbiology distribution 228 was dispatched in November 2017. Test materials for 11 proficiency tests were available in this distribution:

M228e06	Enumeration of *Clostridium perfringens* (equivalent to 10 g of beef)
M228e04	Enumeration of Enterobacteriaceae/coliforms/*Escherichia coli* (equivalent to 10 g of beef)
M228e03	Enumeration of Enterobacteriaceae (equivalent to 10 g of milk powder)
M228e15	Enumeration of Yeasts and Moulds [sum] (equivalent to 10 g of flour)
M225e18	Enumeration of Coliforms (equivalent to 10 g of milk powder)
M228d02	Detection of *Listeria* spp./*L. monocytogenes* (equivalent to 25 g of chicken x 2)
M228d11	Detection of *Escherichia coli* 0157:H7 (equivalent to 25 g of sprouting seeds and lettuce x 2)
M228d07	Detection of *Salmonella* spp. (equivalent to 25 g of ground pepper x 2)

2. For each proficiency test in enumeration, an assigned value (x_a) was determined. This was used in conjunction with the standard deviation for proficiency (σ_p) to calculate a z-score for each result.

3. Qualitative results for the proficiency tests in detection are assessed based on the presence or absence of the target organism in **both** of the test materials issued.

4. Results and assessments for the proficiency tests in enumeration are summarised as follows:

proficiency test	assigned value, x_a $\log_{10}$cfu/g	number of scores, $\|z\| \leq 2$	total number of scores	% $\|z\| \leq 2$
enumeration of *C. perfringens* in beef	3.67	26	28	93
enumeration of enterobacteriaceae in beef	4.21	86	89	97
enumeration of coliforms in beef	4.18	82	86	95
enumeration of *E. coli* in beef	4.17	92	98	94
enumeration of enterobacteriaceae in milk powder	3.98	34	46	74
enumeration of yeasts & moulds [sum] in flour	3.86	62	68	91
enumeration of coliforms in milk powder	3.96	90	103	87

5. Results and assessments for the proficiency tests in detection are summarised as follows:

proficiency test	intended result	number of satisfactory assessments	total number of assessments	satisfactory /agreement with intended result %	false negatives %	false positives %
detection of *Listeria* spp. in chicken	test material A detected test material B not detected	38	41	93	2	7
detection of *L. monocytogenes* in chicken	test material A detected test material B not detected	62	67	93	6	6
detection of *E.coli* O157:H7 in sprouting seeds and lettuce	test material A not detected test material B detected	17	17	100	0	0
detection of *Salmonella* spp. in ground pepper	test material A detected test material B not detected	31	33	94	3	3

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1. INTRODUCTION

1.1. Proficiency Testing

Proficiency testing aims to provide an independent assessment of the competence of participating laboratories. Together with the use of validated methods, proficiency testing is an essential element of laboratory quality assurance.

Further details of the Fapas® – Food Microbiology proficiency testing scheme are available in our protocols [4, 5].

2. TEST MATERIAL

2.1. Preparation

Preparation of the samples for this proficiency test was sub-contracted to a laboratory meeting the quality requirements of the scheme's accreditation [3].

Fapas® – Food Microbiology test materials include background flora to simulate real conditions. Information for these organisms is given in APPENDIX I.

The strain of *Escherichia coli* O157:H7 used in our samples is atoxigenic, i.e. it does not produce a toxin. It has eae genes but the genes for VT1, VT2, (stx_1 and stx_2) are absent.

Samples were stored at +4°C until dispatch.

2.2. Homogeneity and Validation

For the proficiency tests in enumeration randomly selected test materials were analysed in duplicate by a laboratory meeting the quality requirements of the scheme's accreditation [3].

These data showed sufficient homogeneity and were not included in the subsequent calculation of the assigned values.

For the proficiency tests in detection, ten percent of the batch of test materials prepared was analysed to verify the presence/absence of the target organism. In addition, two of each of the test materials positive for the target organism were also analysed by the most probable number technique to verify the level of organisms present. The data obtained is given in APPENDIX II.

2.3. Dispatch

The start date was 27 November 2017. Test materials were sent to 387 participants.

2.4. Storage and Preparation Instructions

Instructions for the safe handling [6], sample storage and for the preparation of Fapas® Food Microbiology samples before analysis [7] were available to download from the relevant links at fapas.com/technical-documentation

3. RESULTS

The instructions for reporting results were as follows:

- Start the analysis between 27 November 2017 and 6 December 2017.
- The results for enumeration tests must be reported as cfu/g.
- The results for detection tests must be reported as detected/not detected in 25 g (in English).

Results were submitted by 366 participants (95%) before the closing date for this test, 18 December 2017.

Each participant was given a laboratory number, assigned in order of receipt of results. The reported results are given in Table 1 to Table 10.

The analytical methods used by each participant are summarised in APPENDIX III.

4. STATISTICAL EVALUATION OF RESULTS

The results submitted by participants for the proficiency tests in enumeration were statistically analysed in order to derive assigned values. The assigned values were then used in combination with the standard deviation for proficiency, σ_p, to calculate a z-score [8] for each result. The procedure is detailed in the relevant protocols [4, 5].

Further background on the procedure followed can be found in the IUPAC International Harmonised Protocol for the Proficiency Testing of Analytical Chemistry Laboratories [9].

4.1. Calculation of the Assigned Value, x_a

The assigned value, x_a, for each enumeration test was derived from the consensus of the results submitted by participants. The procedure used to derive this consensus involved:

- transformation of participants results to $\log_{10}$cfu/g, to obtain a normal distribution,
- removal of non-numerical results i.e. qualitative or semi-quantitative results.

For the C. perfringens, Enterobacteriaceae, E. coli and coliforms in beef and Yeasts and Moulds [sum] in flour enumerations this procedure was straight-forward and the robust mean was chosen as the assigned value.

For the enumerations of enterobacteriaceae in milk powder and coliforms in milk powder the distribution of results was skewed by a small number of low results and the mode was considered the best estimate of the true value. The kernel density plots of the distribution of results are presented as an insert to Figure 5 and Figure 7.

The assigned values for the proficiency tests in enumeration are shown in Table 11.

4.2. Standard Deviation for Proficiency, σ_p

The standard deviation for proficiency, σ_p, was set at a value that reflects best practice for the analyses in question. The Fapas® Advisory Committee has agreed that this value corresponds to 0.25 $\log_{10}$ cfu/g.

The value for σ_p used to calculate z-scores from the results reported for the enumeration tests is given Table 11.

4.3. Individual z-Scores and Assessments

Participants' z-scores were calculated as:

$$z = \frac{(\log x - \log x_a)}{\sigma_p}$$

where x = the participant's reported result,
x_a = the assigned value
and σ_p = the standard deviation for proficiency.

Participants' z-scores for the proficiency tests in enumeration are given in Table 1 to Table 7 and shown as histograms in Figure 1 to Figure 7. The number and percentage of z-scores in the range $-2 \leq z \leq 2$ for the enumeration tests are given in Table 12.

It is possible for the z-scores published in this report to differ slightly from the z-score that can be calculated using the formula given above. These differences arise from the necessary rounding of the actual assigned values and standard deviations for proficiency prior to their publication in Table 11.

Participants' results for the proficiency tests in detection are assessed based on the presence or absence of the target organism in **both** of the test materials issued. Assessments are given in Table 8 to Table 10.

Intended results for these detection tests are shown in Table 13.

The number and percentage of satisfactory assessments are given in Table 14.

5. INTERPRETATION OF SCORES AND ASSESSMENTS

In normal circumstances, over time, about 95% of z-scores will lie in the range $-2 \leq z \leq 2$. Occasional scores in the range $2 < |z| < 3$ are to be expected, at a rate of 1 in 20. Whether or not such scores are of importance can only be decided by considering them in the context of the other scores obtained by that laboratory.

Scores where $|z| > 3$ are to be expected at a rate of about 1 in 300. Given this rarity, such z-scores very strongly indicate that the result is not fit-for-purpose and almost certainly requires investigation.

The consideration of a set or sequence of z-scores over time provides more useful information than a single z-score. Examples of suitable methods of comparison are provided in the IUPAC International Harmonised Protocol for the Proficiency Testing of Analytical Chemistry Laboratories [9].

Results submitted by participants for detections tests are assessed as either satisfactory (S) or not satisfactory (NS) as compared to the intended result.

6. REFERENCES

1 Adobe Approved Trust List, https://helpx.adobe.com/acrobat/kb/approved-trust-list2.html#Whatisit accessed 01/06/2017.

2 GlobalSign PDF Signing Tool, https://www.globalsign.com/en/pdf-signing/ accessed 01/06/2017.

3 ISO/IEC 17043:2010, Conformity assessment – General requirements for proficiency testing.

4 Fapas®, 2017, Protocol for Proficiency Testing Schemes, Version 6, April 2017, Part 1 – Common Principles.

5 Fapas®, 2017, Protocol for Proficiency Testing Schemes, Version 5, April 2017, Part 3 – Fapas® Food Microbiology scheme (FEPAS).

6 Fapas® – Food Microbiology safety data sheet, Version 6, April 2016 https://fapas.com/sites/default/files/2017-03/Food-Microbiology-safetydata_0.pdf. accessed 6/12/2017.

7 Fapas® – Food Microbiology Instructions for the Preparation of Samples, Version 21, September 2017, https://fapas.com/sites/default/files/2017-09/Food-Microbiology-prep.pdf. accessed 6/12/2017.

8 AMC Tech Brief No. 74, z-Scores and other scores in chemical proficiency testing – their meanings, and some common misconceptions, Anal. Methods, 2016, 8, 5553.

9 Thompson, M., Ellison, S.L.R. and Wood, R., 2006, The International Harmonised Protocol for the Proficiency Testing of Analytical Chemistry Laboratories, *Pure Appl. Chem.*, **78**, No. 1, 145–196.

Table 1: Results and z-Scores for *C. perfringens* in Beef

laboratory number		*C. perfringens*		
		assigned value 3.67 log_{10}cfu/g		
		result, cfu/g	result, log_{10}cfu/g	z-score
022		7.5E+3	3.875	0.8
030		6.8E+3	3.833	0.7
033		2.6E3	3.415	-1.0
049		6500	3.813	0.6
056		2.5E+03	3.398	-1.1
058		7.5E+3	3.875	0.8
061		39E+2	3.591	-0.3
082		6.5E+3	3.813	0.6
092		3.0E+3	3.477	-0.8
110		6.1E+3	3.785	0.5
114		6.0E+3	3.778	0.4
125		2.4E+3	3.380	-1.2
146		3800	3.580	-0.4
159		7.1E3	3.851	0.7
183		5.5E+3	3.740	0.3
188		6.82E+3	3.834	0.7
197	*	5.6E+3	3.748	0.3
209		2.0E+3	3.301	-1.5
214		7.9E+3	3.898	0.9
275		5.3E+3	3.724	0.2
285		5.6E+3	3.748	0.3
286	*	6.2E+3	3.792	0.5
315		6.6E+3	3.820	0.6
334		4.2E+2	2.623	**-4.2**
339		9.0E+3	3.954	1.1
347	*	6.1E+3	3.785	0.5
354		1.3E+3	3.114	**-2.2**
359		1900	3.279	-1.6

z-scores outside |z| >2 are shown in **bold,** see Section 5
* tested outside of the time frame recommended for analysis

Table 2: Results and z-Scores for Enterobacteriaceae in Beef

laboratory number	enterobacteriaceae			
	assigned value 4.21 log_{10}cfu/g			
	result, cfu/g	result, log_{10}cfu/g	z-score	MPN
010	1.3E+4	4.114	-0.4	
015	2.1E+4	4.322	0.4	No
022	1.8E+4	4.255	0.2	no
023	1.94E+4	4.288	0.3	YES
024	1.8E+4	4.255	0.2	
025	19000	4.279	0.3	no
026	3.2E+4	4.505	1.2	NO
027	13000	4.114	-0.4	NO
034	1.4E+4	4.146	-0.3	NO
040	14E+3	4.146	-0.3	NO
044	1.24E+4	4.093	-0.5	no
045	1.4E+4	4.146	-0.3	no
053	1.4E+4	4.146	-0.3	no
057	<10			no
058	2.4E+4	4.380	0.7	no
060	2E+4	4.301	0.4	no
064	1.1E+4	4.041	-0.7	no
065	26000	4.415	0.8	no
066	18181	4.260	0.2	no
067	2.0E+4	4.301	0.4	
081	1.0E+4	4.000	-0.8	no
082	2.3E+4	4.362	0.6	NO
083	2.0E+4	4.301	0.4	no
084	2.0E+4	4.301	0.4	yes

MPN - most probable number technique used

Table 2 (continued): Results and z-Scores for Enterobacteriaceae in Beef

laboratory number		enterobacteriaceae			
		assigned value 4.21 log_{10}cfu/g			
		result, cfu/g	result, log_{10}cfu/g	z-score	MPN
088		7000	3.845	-1.5	no
110		2.5E+4	4.398	0.7	Yes
111	*	8.6E+3	3.934	-1.1	NO
112		2.2E+4	4.342	0.5	NO
114		2.0E+4	4.301	0.4	No
118		2.1E4	4.322	0.4	no
120		9.31E+3	3.969	-1.0	no
121		1.1E+4	4.041	-0.7	no
125		1.8E+4	4.255	0.2	yes
132		2.0E+4	4.301	0.4	
135		14100	4.149	-0.2	no
141		6.1E+3	3.785	-1.7	no
142		3.0E+4	4.477	1.1	No
149		1.6E+4	4.204	0.0	no
155		2.04E+4	4.310	0.4	yes
156		15000	4.176	-0.1	no
161		3.5E+4	4.544	1.3	NO
170		2.0E+4	4.301	0.4	no
174		1.0E+4	4.000	-0.8	no
175		1.5E+4	4.176	-0.1	
178		1.8E+4	4.255	0.2	yes
188		1.75E+4	4.243	0.1	Yes

* tested outside of the time frame recommended for analysis
MPN - most probable number technique used

Table 2 (continued): Results and z-Scores for Enterobacteriaceae in Beef

laboratory number		enterobacteriaceae			
		assigned value 4.21 log_{10}cfu/g			
		result, cfu/g	result, log_{10}cfu/g	z-score	MPN
190	*	2.2E+4	4.342	0.5	No
194		15.5E+3	4.190	-0.1	
195		1.1E+4	4.041	-0.7	no
196	*	1.5E+4	4.176	-0.1	no
203		1.2E+4	4.079	-0.5	No
208		2.4E+4	4.380	0.7	No
209		1.3E+4	4.114	-0.4	NO
224		1.8E+4	4.255	0.2	no
229		2.1E+4	4.322	0.4	
230		1.6E+4	4.204	0.0	
233		2.2E+4	4.342	0.5	no
235		7300	3.863	-1.4	No
244		7.8E+3	3.892	-1.3	no
250		1.7E+4	4.230	0.1	No
262		1.5E+4	4.176	-0.1	no
266		1.25E+4	4.097	-0.5	no
274		7.8E+3	3.892	-1.3	
277		1.0E+4	4.000	-0.8	No
279	*	13909	4.143	-0.3	No
280		1.6E+04	4.204	0.0	NO
282		3.0E+5	5.477	**5.1**	no
283		1.5E+4	4.176	-0.1	NO
284		1.1E+4	4.041	-0.7	no

z-scores outside |z| >2 are shown in **bold,** see Section 5
* tested outside of the time frame recommended for analysis
MPN - most probable number technique used

Table 2 (continued): Results and z-Scores for Enterobacteriaceae in Beef

laboratory number		enterobacteriaceae			
		assigned value 4.21 log_{10}cfu/g			
		result, cfu/g	result, log_{10}cfu/g	z-score	MPN
286		2.0E+4	4.301	0.4	no
288		2.5E+4	4.398	0.7	no
291		1.0E+4	4.000	-0.8	no
293		26000	4.415	0.8	NO
298	#	3.2E+6	6.505	***9.2***	no
300		1.7E+4	4.230	0.1	NO
304		2.6E+4	4.415	0.8	No
306		16600	4.220	0.0	NO
328	*	1.5E+4	4.176	-0.1	no
329		17000	4.230	0.1	NO
331		2.8E+4	4.447	0.9	no
335	*	2.5E+4	4.398	0.7	yes
351		9400	3.973	-1.0	no
352		13500	4.130	-0.3	no
357		2.0E+4	4.301	0.4	
358		9.1E+3	3.959	-1.0	NO
359		10000	4.000	-0.8	no
360		11000	4.041	-0.7	no
362		2.6E+4	4.415	0.8	no
364	*	8E+4	4.903	**2.8**	no
366	*	6.3E+3	3.799	-1.6	no

z-scores outside |z| >2 are shown in **bold,** see Section 5
samples received outside of recommended timeframe for analysis
* tested outside of the time frame recommended for analysis
MPN - most probable number technique used
italic text indicates for information only

Table 3: Results and z-Scores for Coliforms in Beef

laboratory number	coliforms			
	assigned value 4.18 log_{10}cfu/g			
	result, cfu/g	result, log_{10}cfu/g	z-score	MPN
002	9.2E+3	3.964	-0.9	No
010	1.0E+4	4.000	-0.7	
015	2.1E+4	4.322	0.6	No
022	1.8E+4	4.255	0.3	no
023	2.22E+4	4.346	0.7	YES
024	1.9E+4	4.279	0.4	
025	20000	4.301	0.5	no
026	3.0E+4	4.477	1.2	NO
027	11000	4.041	-0.6	NO
034	1.8E+4	4.255	0.3	NO
040	13.5E+3	4.130	-0.2	NO
044	9.3E+3	3.968	-0.8	no
045	1.0E+4	4.000	-0.7	no
053	1.6E+4	4.204	0.1	no
060	2.1E+4	4.322	0.6	no
064	1.0E+4	4.000	-0.7	no
065	14000	4.146	-0.1	no
066	18181	4.260	0.3	no
073	1.5E+4	4.176	0.0	NO
079	1.31E+4	4.117	-0.3	no
080	1.14E+4	4.057	-0.5	no
081	2.4E+4	4.380	0.8	yes
082	2.0E+4	4.301	0.5	NO
084	2.1E+4	4.322	0.6	yes

MPN - most probable number technique used

Table 3 (continued): Results and z-Scores for Coliforms in Beef

laboratory number		coliforms			
		assigned value 4.18 log_{10}cfu/g			
		result, cfu/g	result, log_{10}cfu/g	z-score	MPN
088		8400	3.924	-1.0	no
091		9.6E+2	2.982	**-4.8**	No
110		2.5E+4	4.398	0.9	Yes
111	*	11.38E+3	4.056	-0.5	NO
114		2.0E+4	4.301	0.5	No
116		1.6E+4	4.204	0.1	yes
118		2.0E4	4.301	0.5	no
121		1.1E+4	4.041	-0.6	no
125		1.7E+4	4.230	0.2	yes
132		1.8E+4	4.255	0.3	
135		12300	4.090	-0.4	no
141		1.6E+4	4.204	0.1	no
142		3.0E+4	4.477	1.2	No
155		2.25E+4	4.352	0.7	yes
156		12000	4.079	-0.4	no
161		3.0E+4	4.477	1.2	NO
170		2.0E+4	4.301	0.5	no
174		1.0E+4	4.000	-0.7	no
175		1.5E+4	4.176	0.0	
177		9.0E+3	3.954	-0.9	no
178		1.2E+4	4.079	-0.4	yes

z-scores outside |z| >2 are shown in **bold,** see Section 5
* tested outside of the time frame recommended for analysis
MPN - most probable number technique used

Table 3 (continued): Results and z-Scores for Coliforms in Beef

laboratory number		coliforms			
		assigned value 4.18 log_{10}cfu/g			
		result, cfu/g	result, log_{10}cfu/g	z-score	MPN
190	*	1.7E+4	4.230	0.2	No
195		1.3E+4	4.114	-0.3	no
196	*	1.1E+4	4.041	-0.6	no
203		1.7E+4	4.230	0.2	Yes
205		1.5E+4	4.176	0.0	No
208		2.3E+4	4.362	0.7	Yes
209		2.4E+4	4.380	0.8	YES
224		2.0E+4	4.301	0.5	no
229		1.9E+4	4.279	0.4	
233		2.2E+4	4.342	0.6	no
235		9000	3.954	-0.9	No
244		9.3E+3	3.968	-0.8	no
250		1.7E+4	4.230	0.2	No
262		1.4E+4	4.146	-0.1	no
266		0			no
274		8.7E+3	3.940	-1.0	
277		1.0E+4	4.000	-0.7	No
279	*	13727	4.138	-0.2	No
280		1.3E+04	4.114	-0.3	NO
282		2.4E+4	4.380	0.8	no

* tested outside of the time frame recommended for analysis
MPN - most probable number technique used

Table 3 (continued): Results and z-Scores for Coliforms in Beef

laboratory number		coliforms			
		assigned value 4.18 log_{10}cfu/g			
		result, cfu/g	result, log_{10}cfu/g	z-score	MPN
286		1.7E+4	4.230	0.2	no
288		2.2E+4	4.342	0.6	no
291		1.3E+4	4.114	-0.3	no
293		24000	4.380	0.8	NO
298	#	3.2E+6	6.505	***9.3***	no
300		1E+4	4.000	-0.7	NO
301		4.3E+3	3.633	**-2.2**	No
304		2.0E+4	4.301	0.5	No
305		5.2E+3	3.716	-1.9	No
306		20200	4.305	0.5	NO
328	*	1.3E+4	4.114	-0.3	no
329		17000	4.230	0.2	NO
335	*	2.5E+4	4.398	0.9	yes
351		9400	3.973	-0.8	no
352		13500	4.130	-0.2	no
357		1.8E+4	4.255	0.3	
358		8.9E+3	3.949	-0.9	NO
359		10000	4.000	-0.7	no
360		9200	3.964	-0.9	yes
361		12000	4.079	-0.4	no
362		2.4E+4	4.380	0.8	yes
364	*	7.75E+4	4.889	**2.8**	no

z-scores outside |z| >2 are shown in **bold,** see Section 5
samples received outside of recommended timeframe for analysis
* tested outside of the time frame recommended for analysis
MPN - most probable number technique used
italic text indicates for information only

Table 4: Results and z-Scores for *E. coli* in Beef

laboratory number	*E. coli*			
	assigned value 4.17 log_{10}cfu/g			
	result, cfu/g	result, log_{10}cfu/g	z-score	
002	8.8E+3	3.944	-0.9	No
010	1.0E+4	4.000	-0.7	
015	3.7E+4	4.568	1.6	No
022	1.8E+4	4.255	0.3	no
023	2.19E+4	4.340	0.7	YES
024	1.9E+4	4.279	0.4	
025	20000	4.301	0.5	no
026	2.2E+4	4.342	0.7	NO
027	11000	4.041	-0.5	NO
034	1.3E+4	4.114	-0.2	NO
040	9E+3	3.954	-0.9	NO
044	9.3E+3	3.968	-0.8	no
045	1.4E+4	4.146	-0.1	no
053	1.6E+4	4.204	0.1	no
057	19545.45	4.291	0.5	no
060	2E+4	4.301	0.5	no
064	1.2E+4	4.079	-0.4	no
065	14000	4.146	-0.1	no
066	14545	4.163	0.0	no
067	2.0E+4	4.301	0.5	
073	1.3E+4	4.114	-0.2	NO
079	1.28E+4	4.107	-0.3	no
080	1.42E+4	4.152	-0.1	no
081	2.4E+4	4.380	0.8	yes
082	2.1E+4	4.322	0.6	NO
083	2.0E+4	4.301	0.5	no
084	1.9E+4	4.279	0.4	yes

MPN - most probable number technique used

Table 4 (continued): Results and z-Scores for *E. coli* in Beef

laboratory number		*E. coli*			
		assigned value 4.17 log_{10}cfu/g			
		result, cfu/g	result, log_{10}cfu/g	z-score	MPN
088		5100	3.708	-1.9	no
110		2.5E+4	4.398	0.9	Yes
111	*	11.38E+3	4.056	-0.5	NO
112		3.2E+4	4.505	1.3	NO
114		2.0E+4	4.301	0.5	No
116		1.6E+4	4.204	0.1	yes
118		2.3E4	4.362	0.8	no
120		1.08E+4	4.033	-0.6	no
121		1.1E+4	4.041	-0.5	no
125		1.5E+4	4.176	0.0	yes
132		1.8E+4	4.255	0.3	
135		10900	4.037	-0.5	no
141		1.5E+4	4.176	0.0	no
142		2.9E+4	4.462	1.2	No
149		2.5E+4	4.398	0.9	no
155		2.17E+4	4.336	0.7	yes
156		11000	4.041	-0.5	no
161		3.0E+4	4.477	1.2	NO
170		2.0E+4	4.301	0.5	no
174		1.0E+4	4.000	-0.7	no
175		1.5E+4	4.176	0.0	
177		9.0E+3	3.954	-0.9	no
178		1.8E+4	4.255	0.3	yes
188		3.65E+4	4.562	1.6	Yes

* tested outside of the time frame recommended for analysis
MPN - most probable number technique used

Table 4 (continued): Results and z-Scores for *E. coli* in Beef

laboratory number		*E. coli*			
		assigned value 4.17 log_{10}cfu/g			
		result, cfu/g	result, log_{10}cfu/g	z-score	MPN
190	*	2.0E+4	4.301	0.5	No
194		17.0E+3	4.230	0.2	
195		1.2E+4	4.079	-0.4	no
196	*	>1.1E+3			yes
203		1.6E+4	4.204	0.1	Yes
205		1.5E+4	4.176	0.0	No
208		2.3E+4	4.362	0.8	Yes
209		2.4E+4	4.380	0.8	YES
224		1.1E+4	4.041	-0.5	no
229		2.0E+4	4.301	0.5	
230		1.4E+4	4.146	-0.1	
233		2.1E+4	4.322	0.6	no
234		1.1E+4	4.041	-0.5	No
235		9000	3.954	-0.9	No
244		9.3E+3	3.968	-0.8	no
250		1.7E+4	4.230	0.2	No
262		1.4E+4	4.146	-0.1	no
266		1.05E+4	4.021	-0.6	no
274		6.8E+3	3.833	-1.4	
277		1.0E+4	4.000	-0.7	No
279	*	13000	4.114	-0.2	No
280		1.3E+04	4.114	-0.2	NO
282		1.5E+4	4.176	0.0	no
283		3.0E+3	3.477	**-2.8**	NO
284		7.2E+3	3.857	-1.3	no

z-scores outside |z| >2 are shown in **bold,** see Section 5
* tested outside of the time frame recommended for analysis
MPN - most probable number technique used

Table 4 (continued): Results and z-Scores for *E. coli* in Beef

laboratory number		*E. coli*			
		assigned value 4.17 log_{10}cfu/g			
		result, cfu/g	result, log_{10}cfu/g	z-score	MPN
286		6.3E+3	3.799	-1.5	no
288		1.8E+4	4.255	0.3	no
291		2.1E+3	3.322	**-3.4**	no
293		23000	4.362	0.8	NO
298	#	3.2E+6	6.505	***9.3***	no
300		1.4E+4	4.146	-0.1	NO
301		5.0E+2	2.699	**-5.9**	No
304		1.8E+4	4.255	0.3	No
305		1.4E+3	3.146	**-4.1**	No
306		20200	4.305	0.5	NO
328	*	1.3E+4	4.114	-0.2	no
329		16000	4.204	0.1	NO
331		2.0E+4	4.301	0.5	no
335	*	2.5E+4	4.398	0.9	yes
336		12000	4.079	-0.4	No
351		11000	4.041	-0.5	no
352		14000	4.146	-0.1	no
357		1.3E+4	4.114	-0.2	
358		8.4E+3	3.924	-1.0	NO
359		10000	4.000	-0.7	no
360		9200	3.964	-0.8	yes
362		2.4E+4	4.380	0.8	yes
364	*	7.75E+4	4.889	**2.9**	no

z-scores outside |z| >2 are shown in **bold,** see Section 5
samples received outside of recommended timeframe for analysis
* tested outside of the time frame recommended for analysis
MPN - most probable number technique used
italic text indicates for information only

Table 5: Results and z-Scores for Enterobacteriaceae in Milk Powder

laboratory number	enterobacteriaceae			
		assigned value 3.98 log_{10}cfu/g		
	result, cfu/g	result, log_{10}cfu/g	z-score	MPN
005	3970	3.599	-1.5	No
007	1.06E+4	4.025	0.2	No
008	5.7E+3	3.756	-0.9	no
009	1.5E+3	3.176	**-3.2**	no
016	7.8E+3	3.892	-0.3	No
017	4.4E+3	3.643	-1.3	NO
021	>2.4E+3			yes
047	6.7E+3	3.826	-0.6	no
068	1.1E+3	3.041	**-3.7**	no
072	11.500	1.061	**-11.7**	YES
075	11000	4.041	0.3	no
076	6.1E+3	3.785	-0.8	yes
077	9.0E+3	3.954	-0.1	No
078	1.1E+4	4.041	0.3	no
087	1.7E+3	3.230	**-3.0**	no
092	8.9E+3	3.949	-0.1	no
093	9.5E+2	2.978	**-4.0**	no
094	1.145E+4	4.059	0.3	no
101	1.3E+4	4.114	0.6	no
115	12000	4.079	0.4	no
124	2.4E+4	4.380	1.6	NO
129	3.0E+2	2.477	**-6.0**	no
147	1.5E+4	4.176	0.8	no
153	1.1E+4	4.041	0.3	no

z-scores outside |z| >2 are shown in **bold,** see Section 5
MPN - most probable number technique used

Table 5 (continued): Results and z-Scores for Enterobacteriaceae in Milk Powder

laboratory number		enterobacteriaceae			
		assigned value 3.98 log_{10}cfu/g			
		result, cfu/g	result, log_{10}cfu/g	z-score	MPN
154		1.7E+4	4.230	1.0	NO
157		1.6E+4	4.204	0.9	no
158		4.5E+3	3.653	-1.3	no
172		2.5E+3	3.398	**-2.3**	NO
179	*	1.0E+2	2.000	**-7.9**	no
181		6.4E+3	3.806	-0.7	yes
191		7.6E+3	3.881	-0.4	No
192		1505	3.178	**-3.2**	No
216		7.2E+3	3.857	-0.5	NO
219		1.3E+4	4.114	0.6	NO
220		1.2E+4	4.079	0.4	no
240		4.0E+3	3.602	-1.5	no
250		8.7E+3	3.940	-0.1	No
254	*	20	1.301	**-10.7**	no
269		34000	4.531	**2.2**	no
294		8.5E+3	3.929	-0.2	non
318		9700	3.987	0.0	no
324		1.2E+4	4.079	0.4	No
333		8.7E+3	3.940	-0.1	no
347	*	1.0E+4	4.000	0.1	yes
349	*	9.2E+3	3.964	0.0	NO
356	*	5.5E+2	2.740	**-4.9**	no
365	*	9.4E+3	3.973	0.0	yes

z-scores outside |z| >2 are shown in **bold,** see Section 5
* tested outside of the time frame recommended for analysis
MPN - most probable number technique used

Table 6: Results and z-Scores for Yeasts and Moulds in Flour

laboratory number	yeast & moulds [sum]		
	assigned value 3.86 log_{10}cfu/g		
	result, cfu/g	result, log_{10}cfu/g	z-score
005	6790	3.832	-0.1
013	6.41E+03	3.807	-0.2
019	5.7E+03	3.756	-0.4
023	6.95E+3	3.842	-0.1
026	6.6E+3	3.820	-0.2
028	8.5E+3	3.929	0.3
062	9.6E+3	3.982	0.5
079	5.2E+3	3.716	-0.6
080	5.8E+3	3.763	-0.4
084	5.3E+3	3.724	-0.6
090	9500	3.978	0.5
092	7.9E+3	3.898	0.1
093	7.7E+3	3.886	0.1
094	6.05E+3	3.782	-0.3
102	2.0E+1	1.301	**-10.2**
108	8.7E+3	3.940	0.3
110	1.2E+4	4.079	0.9
114	1.2E+4	4.079	0.9
119	6.6E+3	3.820	-0.2
122	6.6E+3	3.820	-0.2
125	7.8E+3	3.892	0.1
130	7.3E+3	3.863	0.0
132	7.1E+3	3.851	0.0
133	6.0E+3	3.778	-0.3
139	8.5E+3	3.929	0.3

z-scores outside |z| >2 are shown in **bold,** see Section 5

Table 6 (continued): Results and z-Scores for Yeasts and Moulds in Flour

laboratory number		yeast & moulds [sum]		
		assigned value 3.86 log_{10}cfu/g		
		result, cfu/g	result, log_{10}cfu/g	z-score
147		8.9E+3	3.949	0.3
148		7.2E+3	3.857	0.0
155		8E+3	3.903	0.2
171		3.6E+4	4.556	**2.8**
179	*	6.2E+3	3.792	-0.3
180		1.2E+6	6.079	**8.9**
183		8.6E+3	3.934	0.3
184		6.5E+3	3.813	-0.2
188		4.36E+3	3.639	-0.9
192		7700	3.886	0.1
195		7.9E+3	3.898	0.1
197	*	5.5E+3	3.740	-0.5
204		7.9E+3	3.898	0.1
210		6800	3.833	-0.1
216		6.2E+3	3.792	-0.3
217		9.8E+3	3.991	0.5
227		4.1E+3	3.613	-1.0
238	*	7.4E+3	3.869	0.0
248		6.9E+3	3.839	-0.1
252		7.44E+3	3.872	0.0
256	*	1.0E+4	4.000	0.6
261		6.5E+3	3.813	-0.2
263		1.1E+4	4.041	0.7
271		8066	3.907	0.2
275		7.5E+3	3.875	0.1

z-scores outside |z| >2 are shown in **bold,** see Section 5
* tested outside of the time frame recommended for analysis

Table 6 (continued): Results and z-Scores for Yeasts and Moulds in Flour

laboratory number		yeast & moulds [sum]		
		assigned value 3.86 log_{10}cfu/g		
		result, cfu/g	result, log_{10}cfu/g	z-score
287		10575	4.024	0.6
296	*	7.7E+2	2.886	**-3.9**
299		1.2E+4	4.079	0.9
301		4.6E+2	2.663	**-4.8**
309		7.2E+3	3.857	0.0
310		2.3E+3	3.362	-2.0
311	*	8.1E+4	4.908	**4.2**
315		7.8E+3	3.892	0.1
319		6.5E+3	3.813	-0.2
327		8.4E+3	3.924	0.2
332	*	5.5E+3	3.740	-0.5
340		4.1E+3	3.613	-1.0
345		7.8E+3	3.892	0.1
349	*	7.9E+3	3.898	0.1
355		12000	4.079	0.9
359		6100	3.785	-0.3
360		5800	3.763	-0.4
362		7.0E+3	3.845	-0.1
365	*	0		

z-scores outside |z| >2 are shown in **bold,** see Section 5
* tested outside of the time frame recommended for analysis

Table 7: Results and z-Scores for Coliforms in Milk Powder

laboratory number	coliforms			
	assigned value 3.96 log_{10}cfu/g			
	result, cfu/g	result, log_{10}cfu/g	z-score	MPN
001	11240	4.051	0.3	no
003	7.7E+3	3.886	-0.3	NO
004	1.1E+4	4.041	0.3	no
006	12364	4.092	0.5	No
009	3.6E+3	3.556	-1.6	no
011	11000	4.041	0.3	yes
012	>1100			yes
013	3.65E+03	3.562	-1.6	no
014	9.1E+3	3.959	0.0	yes
018	9.0E+3	3.954	0.0	No
020	8.9E+3	3.949	-0.1	yes
035	9600	3.982	0.1	YES
037	1.6E+3	3.204	**-3.0**	NO
038	1.2E+4	4.079	0.5	yes
039	1.1E+4	4.041	0.3	No
042	2.9E+3	3.462	-2.0	YES
043	7318	3.864	-0.4	no
048	9.4E+3	3.973	0.0	NO
050	1.6E+4	4.204	1.0	no
051	1100	3.041	**-3.7**	No
052	1.2E+4	4.079	0.5	yes
054	5.6E+3	3.748	-0.9	No
055	1.3E+4	4.114	0.6	yes
059	6.1E+3	3.785	-0.7	no
069	1.3E+4	4.114	0.6	yes
070	1.1E+4	4.041	0.3	no
071	6.5E+3	3.813	-0.6	no
072	8000	3.903	-0.2	YES
074	5.6E+3	3.748	-0.9	No

z-scores outside |z| >2 are shown in **bold,** see Section 5
MPN - most probable number technique used

Table 7 (continued): Results and z-Scores for Coliforms in Milk Powder

laboratory number		coliforms			
		assigned value 3.96 log_{10}cfu/g			
		result, cfu/g	result, log_{10}cfu/g	z-score	MPN
075	*	7400	3.869	-0.4	no
085		1.8E+4	4.255	1.2	NO
089		660	2.820	**-4.6**	NO
092		4.2E+3	3.623	-1.4	no
095		1.3E+4	4.114	0.6	no
099		9.8E+3	3.991	0.1	
100		9.4E+3	3.973	0.0	No
103		2.4E+4	4.380	1.7	no
106		2.4E+4	4.380	1.7	no
107		9.2E+3	3.964	0.0	no
113		2.1E+4	4.322	1.4	no
117		1.0E+4	4.000	0.1	no
128		2.6E+4	4.415	1.8	no
131		1.0E+4	4.000	0.1	Yes
134		8.7E+3	3.940	-0.1	no
136		1.6E+4	4.204	1.0	no
137		1.6E+4	4.204	1.0	no
138		5.5E+3	3.740	-0.9	no
150		6.5E+3	3.813	-0.6	no
164		9.5E+3	3.978	0.1	yes
167		8.9E+3	3.949	-0.1	NO
169		3.2E+3	3.505	-1.8	No
176		8800	3.944	-0.1	no
182		3.023E+3	3.480	-1.9	NO
186		5.6E+3	3.748	-0.9	no

z-scores outside |z| >2 are shown in **bold,** see Section 5
* tested outside of the time frame recommended for analysis
MPN - most probable number technique used

Table 7 (continued): Results and z-Scores for Coliforms in Milk Powder

laboratory number	coliforms			
	assigned value 3.96 log_{10}cfu/g			
	result, cfu/g	result, log_{10}cfu/g	z-score	MPN
187	1.1E+4	4.041	0.3	yes
192	5800	3.763	-0.8	No
198	2.9E+3	3.462	-2.0	no
199	1.1E+4	4.041	0.3	no
201	1.3E+4	4.114	0.6	no
207	1.6E+4	4.204	1.0	no
208	2.3E+4	4.362	1.6	Yes
209	2.1E+3	3.322	**-2.6**	no
210	5200	3.716	-1.0	NO
213	7.17E+3	3.856	-0.4	NO
215	5.7E+3	3.756	-0.8	No
222	1.05E+4	4.021	0.2	No
226	2.5E+3	3.398	**-2.3**	no
231	7.8E+3	3.892	-0.3	???
232	7.7E+3	3.886	-0.3	no
235	3700	3.568	-1.6	no
236	1.2E+4	4.079	0.5	no
241	14000	4.146	0.7	no
242	2.6E+4	4.415	1.8	no
245	1.5E+4	4.176	0.8	no
246	7.8E+3	3.892	-0.3	no
251	1.6E+4	4.204	1.0	NO
253	1.06E+3	3.025	**-3.8**	no
255	7.9E+3	3.898	-0.3	no
257	7.4E+3	3.869	-0.4	no

z-scores outside |z| >2 are shown in **bold,** see Section 5
MPN - most probable number technique used

Table 7 (continued): Results and z-Scores for Coliforms in Milk Powder

laboratory number		coliforms			
		assigned value 3.96 log_{10}cfu/g			
		result, cfu/g	result, log_{10}cfu/g	z-score	MPN
264	*	1.4E+3	3.146	**-3.3**	no
267		5900	3.771	-0.8	no
268		6100	3.785	-0.7	no
270		2.7E+3	3.431	**-2.1**	no
281		6.4E+3	3.806	-0.6	No
295		1.8E+3	3.255	**-2.8**	No
301		7.8E+2	2.892	**-4.3**	no
302	*	80.9090E+2	3.908	-0.2	no
303	*	8.1E+03	3.908	-0.2	/
306		460	2.663	**-5.2**	No
308		1.6E+4	4.204	1.0	yes
312		1.12E+3	3.049	**-3.7**	No
314		1.7E+4	4.230	1.1	no
317		9.8E+2	2.991	**-3.9**	No
318		3600	3.556	-1.6	no
320		1.1E+4	4.041	0.3	no
322		13000	4.114	0.6	
325		1.3E+4	4.114	0.6	no
326		6.1E+3	3.785	-0.7	yes
330		6.1E+3	3.785	-0.7	yes
337		6.5E+3	3.813	-0.6	yes
342		8.8E+3	3.944	-0.1	yes
343		23000	4.362	1.6	yes
346		12000	4.079	0.5	yes
348	*	5.8E+3	3.763	-0.8	no

z-scores outside |z| >2 are shown in **bold,** see Section 5
* tested outside of the time frame recommended for analysis
MPN - most probable number technique used

Table 8: Results and Assessments for *L. monocytogenes* and *Listeria* spp. in Chicken

laboratory number	*L. monocytogenes*			*Listeria* spp.		
	test material A	test material B	assessment	test material A	test material B	assessment
	result present	result absent		result present	result absent	
015	detected	not detected	S			
022	detected	not detected	S			
024	detected	not detected	S			
031	detected	not detected	S			
041	detected	not detected	S			
058	detected	not detected	S			
081	detected	not detected	S	detected	not detected	S
086	detected	not detected	S	detected	not detected	S
098	detected	not detected	S	detected	not detected	S
104	detected	not detected	S	detected	not detected	S
105	detected	not detected	S	detected	not detected	S
109	detected	not detected	S			
112	detected	not detected	S	detected		
120	detected	not detected	S	detected	not detected	S
126	detected	not detected	S			
140	detected	not detected	S	detected	not detected	S
141	detected	not detected	S	detected	not detected	S

S - satisfactory

Table 8 (continued): Results and Assessments for *L. monocytogenes* and *Listeria* spp. in Chicken

laboratory number		*L. monocytogenes*			*Listeria* spp.		
		test material A	test material B	assessment	test material A	test material B	assessment
		result present	result absent		result present	result absent	
144		detected	not detected	S	detected	not detected	S
145		detected	not detected	S	detected	not detected	S
149		detected	not detected	S			
151		detected	not detected	S	detected	not detected	S
160		detected	not detected	S	detected	not detected	S
162		detected	not detected	S			
163		detected	not detected	S	detected	not detected	S
165		detected	not detected	S	detected	not detected	S
168		detected	not detected	S	detected	not detected	S
173	*	detected	not detected	S			
185		detected	not detected	S	detected		
188		detected	not detected	S	detected	not detected	S
189	*	detected	not detected	S	detected	not detected	S
196	*	detected	not detected	S	detected	not detected	S
206	*	detected	not detected	S	detected	not detected	S
218	*	detected	not detected	S	detected	not detected	S
219		detected	not detected	S			

S - satisfactory
* tested outside of the time frame recommended for analysis

Table 8 (continued): Results and Assessments for *L. monocytogenes* and *Listeria* spp. in Chicken

laboratory number		*L. monocytogenes*			*Listeria* spp.		
		test material A	test material B	assessment	test material A	test material B	assessment
		result present	result absent		result present	result absent	
221		detected	not detected	S			
222		detected	not detected	S	detected	not detected	S
223		not detected	detected	NS	not detected	detected	NS
225		detected	not detected	S			
234		detected	not detected	S	detected	not detected	S
237		detected	not detected	S			
239		detected	not detected	S	detected	not detected	S
243		detected	not detected	S			
249		detected	not detected	S			
258		detected	not detected	S	detected	not detected	S
259		detected	not detected	S	detected	not detected	S
260		detected	not detected	S			
265	*	not detected	not detected	NS	detected	not detected	S
266		detected	not detected	S	detected	not detected	S
272	*	detected	not detected	S	detected	not detected	S
276	^	detected	not detected	S	detected	not detected	S

S - satisfactory
NS - not satisfactory
* tested outside of the time frame recommended for analysis
^ PCR – polymerase chain reaction used

Table 8 (continued): Results and Assessments for *L. monocytogenes* and *Listeria* spp. in Chicken

laboratory number		*L. monocytogenes*			*Listeria* spp.		
		test material A	test material B	assessment	test material A	test material B	assessment
		result present	result absent		result present	result absent	
278		detected	not detected	S	detected	detected	NS
284		detected	not detected	S	detected	not detected	S
287		detected	not detected	S			
289		detected	not detected	S	detected	not detected	S
290		detected	not detected	S	detected	not detected	S
307		detected	not detected	S			
313		detected	not detected	S			
316		detected	not detected	S	detected	not detected	S
321		detected	not detected	S	detected	not detected	S
323		detected	not detected	S	detected	not detected	S
338		detected	detected	NS	detected	not detected	S
341	*	detected	not detected	S	detected	detected	NS
344		detected	not detected	S	detected	not detected	S
347	*	detected	not detected	S	detected	not detected	S
353	*	detected	not detected	S			
361	*	not detected	detected	NS			
363	*	not detected	detected	NS			

S - satisfactory
NS - not satisfactory
* tested outside of the time frame recommended for analysis

Table 9: Results and Assessments for *E. coli* O157:H7 in Sprouting Seeds and Lettuce

laboratory number	*E. coli* O157:H7		assessment
	test material A	test material B	
	result not detected	result detected	
029	not detected	detected	S
046	not detected	detected	S
063	not detected	detected	S
065	not detected	detected	S
096	not detected	detected	S
097	not detected	detected	S
110	not detected	detected	S
114	not detected	detected	S
123	not detected	detected	S
141	not detected	detected	S
183	not detected	detected	S
188	not detected	detected	S
189	not detected	detected	S
197	not detected	detected	S
247	not detected	detected	S
275	not detected	detected	S
342	not detected	detected	S

S - satisfactory

Table 10: Results and Assessments for *Salmonella* spp. in Ground Pepper

laboratory number		*Salmonella* spp.		assessment
		test material A	test material B	
		result present	result absent	
019		detected	not detected	S
031		detected	not detected	S
032		detected	not detected	S
036		detected	not detected	S
058		detected	not detected	S
065		detected	not detected	S
077		detected	not detected	S
110		detected	not detected	S
111	*	detected	not detected	S
114		detected	not detected	S
127		detected	not detected	S
141		detected	not detected	S
143		detected	not detected	S
152		detected	not detected	S
156		detected	not detected	S
166		detected	not detected	S
183		detected	not detected	S

S - satisfactory
* tested outside of the time frame recommended for analysis

Table 10 (continued): Results and Assessments for *Salmonella* spp. in Ground Pepper

laboratory number		*Salmonella* spp.		assessment
		test material A	test material B	
		result present	result absent	
188		detected	not detected	S
193		detected	not detected	S
200		detected	not detected	S
202		detected	not detected	S
209		detected	not detected	S
211		detected	not detected	S
212		detected	not detected	S
228	#	detected	not detected	S
240	*	detected	not detected	S
261		detected	not detected	S
273		detected	detected	NS
292		detected	not detected	S
297		detected	not detected	S
332	*	not detected	not detected	NS
350		detected	not detected	S
364	*	detected	not detected	S

S - satisfactory
NS - not satisfactory
* tested outside of the time frame recommended for analysis
# samples received outside of recommended timeframe for analysis

Table 11: Assigned Values and Standard Deviations for Enumeration Tests

proficiency test	data points, n	assigned value, x_a, $\log_{10}$cfu/g	uncertainty, u	standard deviation for proficiency, σ_p, $\log_{10}$cfu/g
enumeration of *C. perfringens* in beef	28	3.67	0.046	0.25
enumeration of enterobacteriaceae in beef	89	4.21	0.019	0.25
enumeration of coliforms in beef	86	4.18	0.019	0.25
enumeration of *E. coli* in beef	98	4.17	0.019	0.25
enumeration of enterobacteriaceae in milk powder	46	3.98	0.040	0.25
enumeration of yeasts & moulds [sum] in flour	68	3.86	0.015	0.25
enumeration of coliforms in milk powder	103	3.96	0.029	0.25

Table 12: Number and Percentage of z-Scores where |z| ≤2

proficiency test	number of scores where |z| ≤2	total number of scores	% |z| ≤2
enumeration of *C. perfringens* in beef	26	28	93
enumeration of enterobacteriaceae in beef	86	89	97
enumeration of coliforms in beef	82	86	95
enumeration of *E. coli* in beef	92	98	94
enumeration of enterobacteriaceae in milk powder	34	46	74
enumeration of yeasts & moulds [sum] in flour	62	68	91
enumeration of coliforms in milk powder	90	103	87

Table 13: Intended Results for Proficiency Tests in Detection

proficiency test	test material A	test material B
detection of *Listeria* spp. in chicken	detected	not detected
detection of *L. monocytogenes* in chicken	detected	not detected
detection of in *E. coli* O157 in sprouting seeds and lettuce	not detected	detected
detection of *Salmonella* spp. in ground pepper	detected	not detected

Table 14: Number and Percentage of Satisfactory Assessments and False Results for Proficiency Tests in Detection

proficiency test	number of satisfactory assessments	total number of assessments	satisfactory / agreement with intended result %	false negatives %	false positives %
detection of *Listeria* spp. in chicken	38	41	93	2	7
detection of *L. monocytogenes* in chicken	62	67	93	6	6
detection of in *E. coli* O157 in sprouting seeds and lettuce	17	17	100	0	0
detection of *Salmonella* spp. in ground pepper	31	33	94	3	3

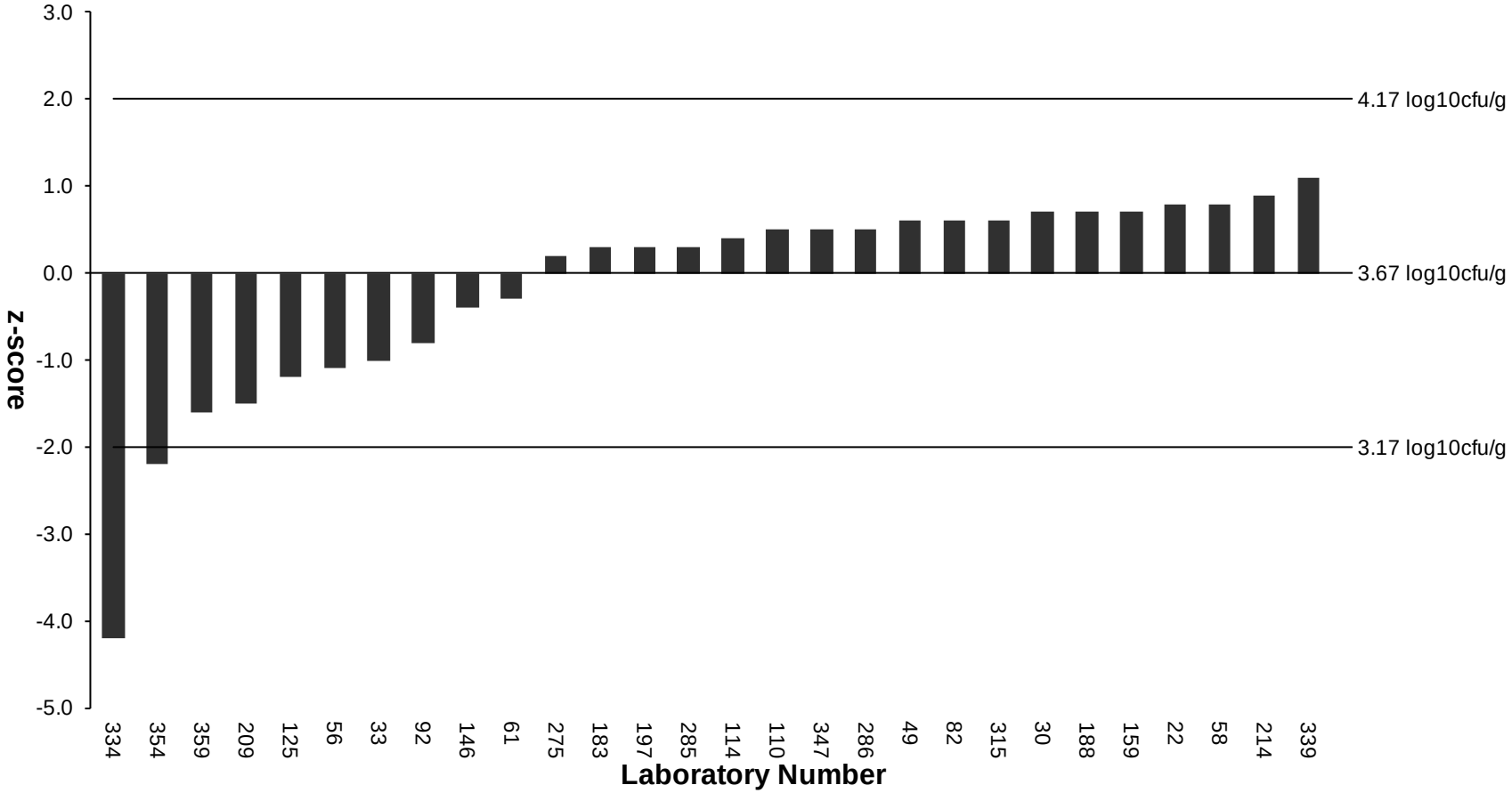

Figure 1: z-Scores for *C. perfringens* in Beef

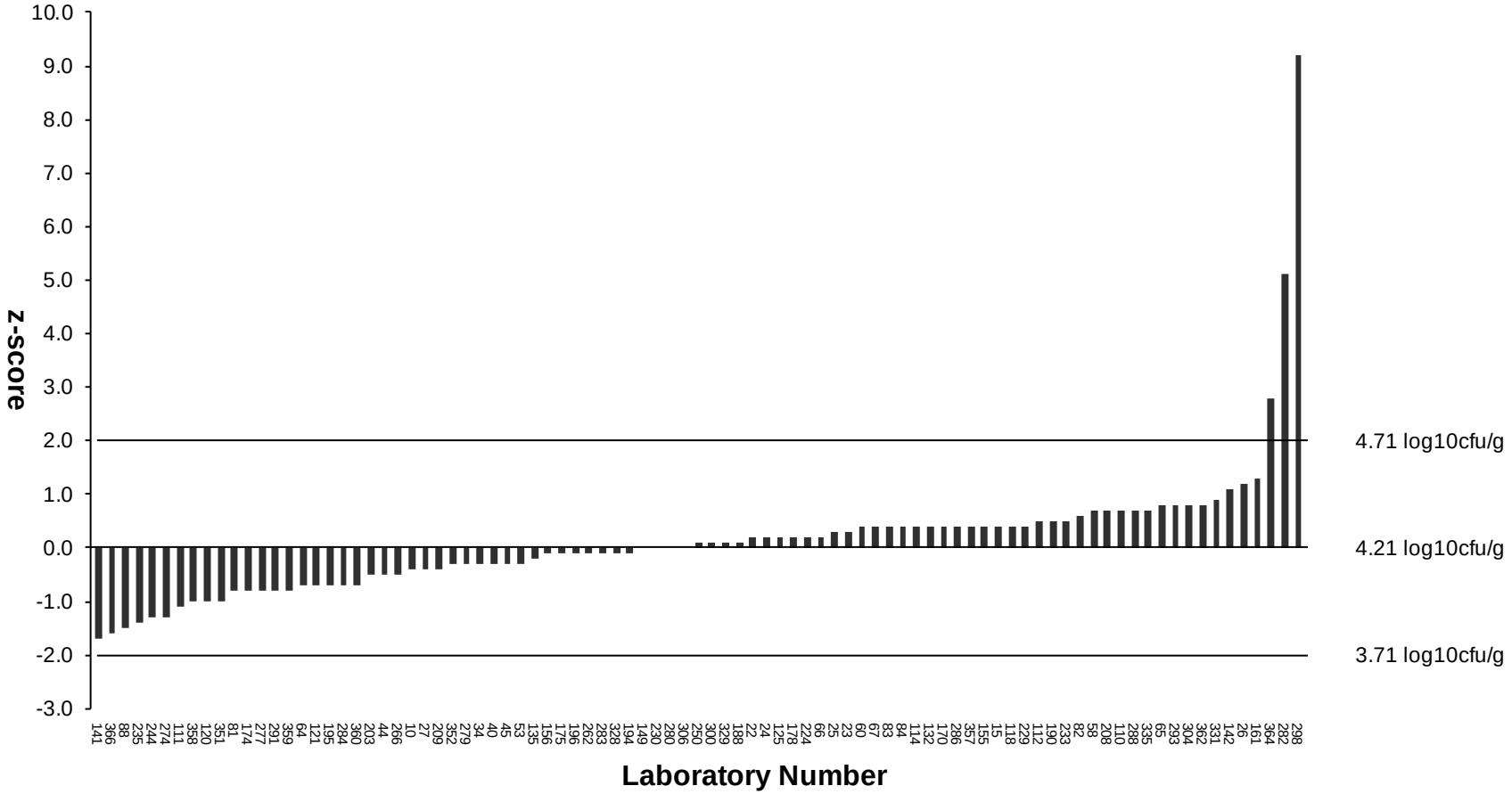

Figure 2: z-Scores for Enterobacteriaceae in Beef

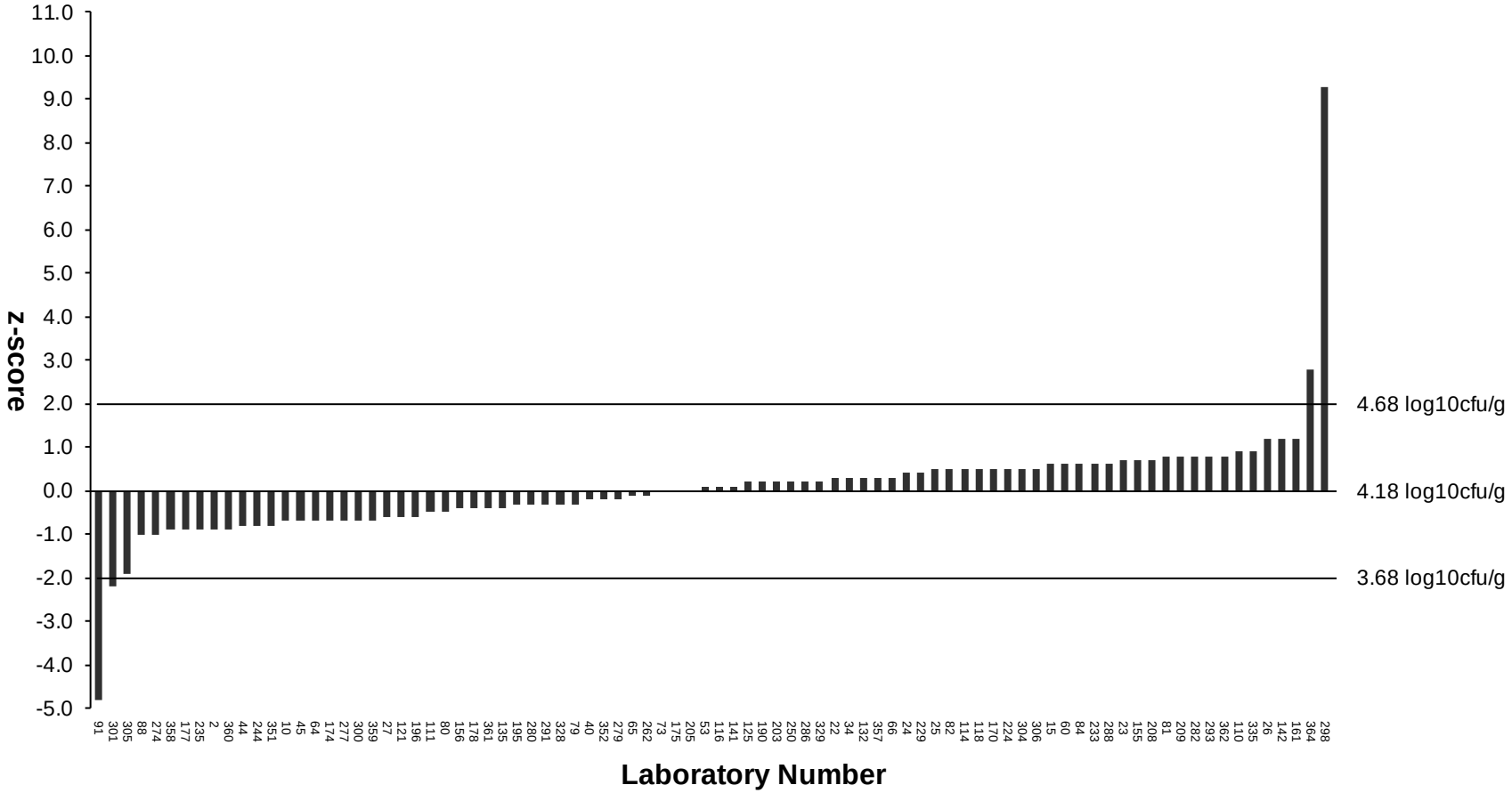

Figure 3: z-Scores for Coliforms in Beef

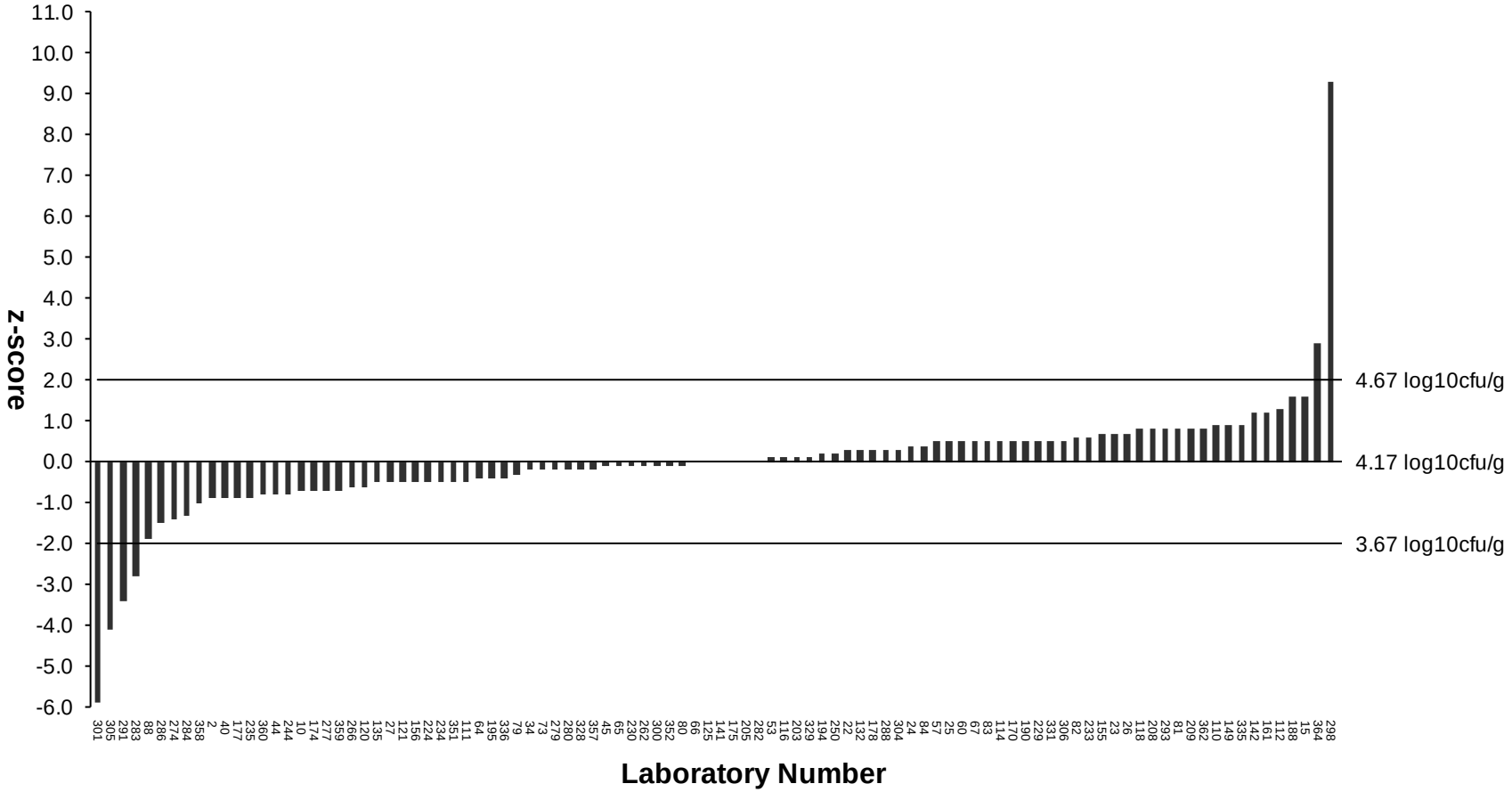

Figure 4: z-Scores for *E. coli* in Beef

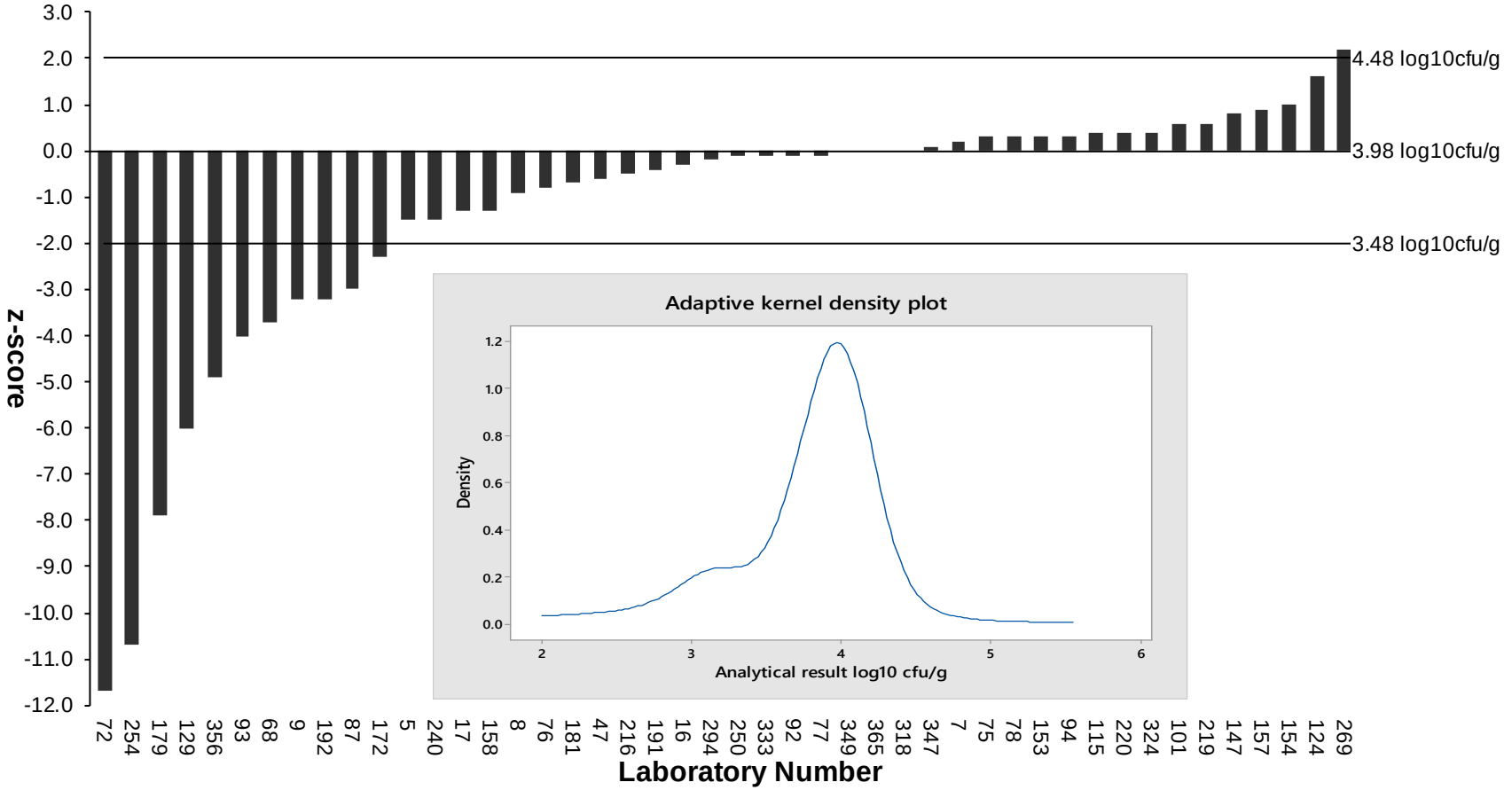

Figure 5: z-Scores for Enterobacteriaceae in Milk Powder

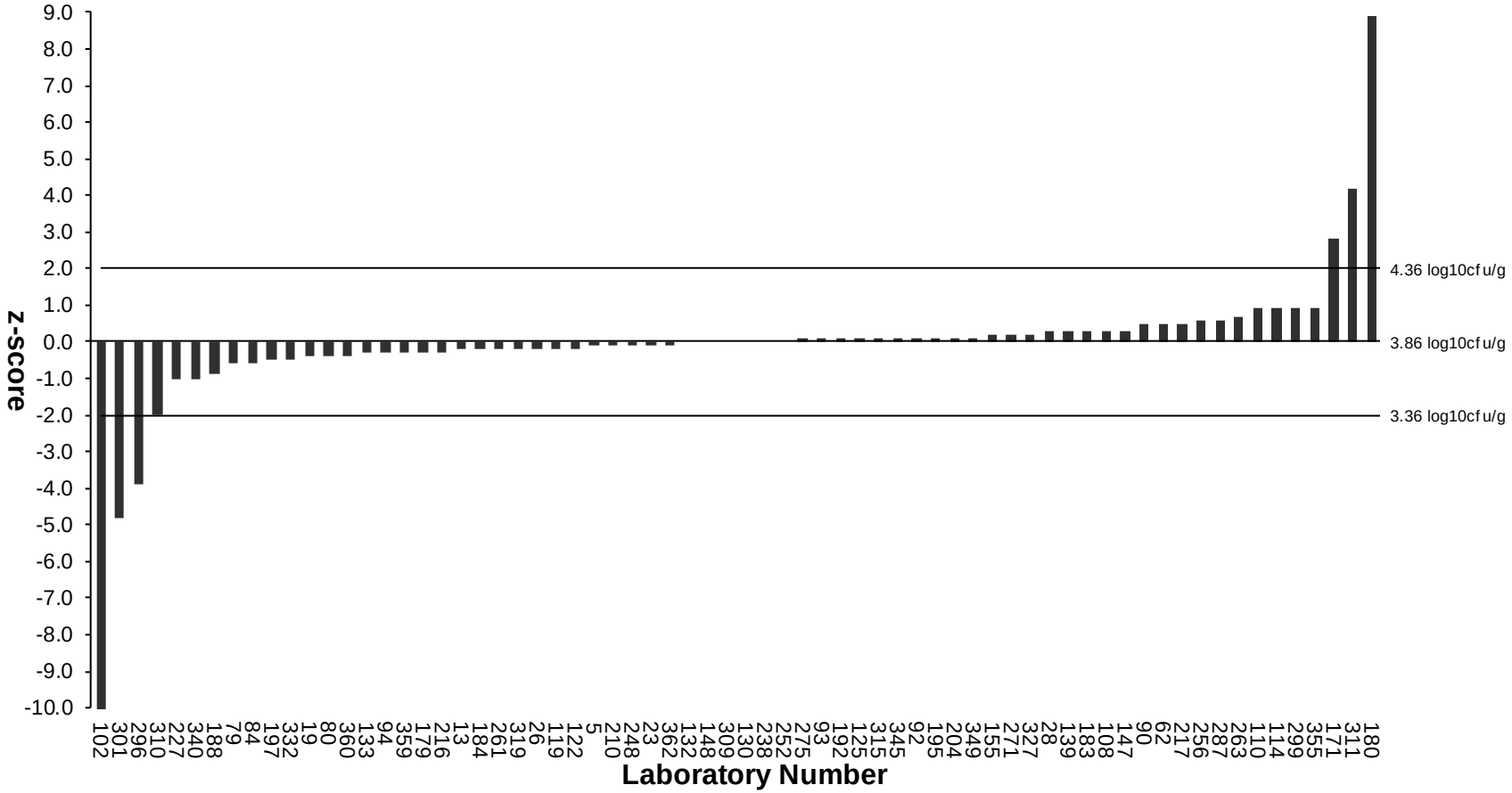

Figure 6: z-Scores for Yeasts and Moulds in Flour

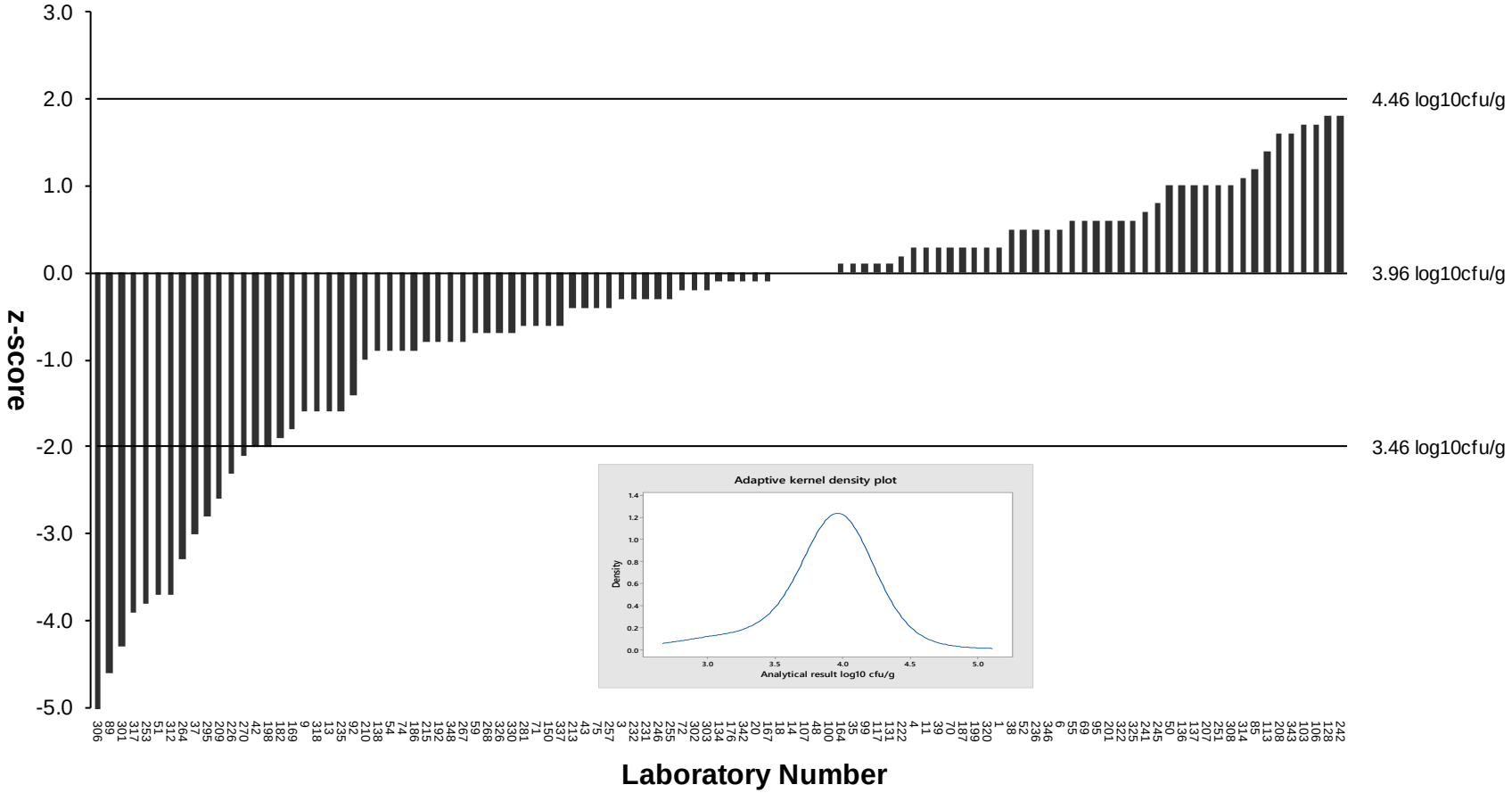

Figure 7: z-Scores for Coliforms in Milk Powder

APPENDIX I: Organisms present in Fapas® – Food Microbiology Test Materials

proficiency test	matrix	target organism	background flora
enumeration of *C. perfringens*	beef	*Clostridium perfringens*	*Bacillus cereus*
enumeration of Enterobacteriaceae/coliforms/ *E. coli*	beef	*Escherichia coli*	*Kocuria rhizophila* *Staphylococcus aureus* *B. cereus*
enumeration of enterobacteriaceae	milk powder	*E. coli*	*Pseudomonas fluorescens* *Enterobacter faecalis*
enumeration of yeast & moulds	flour	*Penicillium brevicompactum*	*Bacillus subtilis*
enumeration of coliforms	milk powder	*E. coli*	*P. fluorescens* *E. faecalis*
detection of *Listeria* spp. and *L. monocytogenes* test material A	chicken	*Listeria monocytogenes*	*S. aureus* *E. coli* *Proteus mirabilis*
detection of *Listeria* spp. and *L. monocytogenes* test material B	chicken	none	*S. aureus* *E. coli* *P. mirabilis*
detection of *E. coli* O157:H7 test material A	sprouting seeds and lettuce	none	*E. coli* *Pseudomonas putida* *Bacillus coagulans*
detection of *E. coli* O157:H7 test material B	sprouting seeds and lettuce	*E. coli* O157:H7	*B. cereus* *P. putida* *B. coagulans*
detection of *Salmonella* spp. test material A	ground pepper	*Salmonella* Cerro	*B. coagulans*
detection of *Salmonella* spp. test material B	ground pepper	none	*B. coagulans* *Citrobacter freundii*

APPENDIX II: Verification of Positive Qualitative Test Materials

target organism	level of target organism, as assessed by the most probable number technique, MPN/g
L. monocytogenes	7.8 (2.5 to 25*) / 7.8 (2.5 to 25*)
E. coli O157:H7	2.3 (0.76 to 7*) / 13 (4.4 to 37*)
Salmonella Cerro	33 (11 to 100*) / 4.9 (1.5 to 16*)

*confidence limit at >95%

APPENDIX III: Analytical Methods Used by Participants

Methods are tabulated according to the information supplied by participants, but some responses may have been combined or edited for clarity.

C. perfringens in Beef

Accredited Method Used	laboratory number
yes	058 061 082 110 114 125 146 209 214 315 334 339 347
no	030 159

Method Based on an International Standard	laboratory number
yes	030 058 061 082 110 114 125 146 159 209 214 339 347
no	315 334

Which International Standard	laboratory number
Clostridium perfringens enumeration ISO 7937:2004	030 058 061 082 110 114 125 159 209 214 339 347
Clostridium perfringens enumeration FDA/BAM Chapter 16	146
GB 4789.13-2012	315

Which Initial Suspension/Diluent Used	laboratory number
Buffered Peptone Water (BPW)	030 061 110 114 125 159 209 214 315 339
Butterfield's Phosphate Buffer	146
Maximum Recovery Diluent (MRD)	082
Peptone Water	058 347

Which Primary Enrichment Medium Used	laboratory number
Buffered Peptone Water (BPW)	058 339
Cooked Meat Medium	146
MAXIMUM RECOVERY DILUENT	209
TSC	334

Which Secondary Enrichment Medium Used	laboratory number
Tetrathionate Broth	058 146
TRYPTOSE SULPHITE CYCLOSERINE AGAR	209

Plating Method Used	laboratory number
Pour plate	030 058 061 082 146 209 214 315 334 339 347
Spread plate	125
Overlay	110 114

Inoculum Volume (ml)	laboratory number
0.1	347
1.0	030 058 061 082 110 114 125 146 159 209 214 315 334 339

Incubation Temperature (°C)	laboratory number
35	146 334
37	030 058 061 082 110 114 125 159 209 315 339 347
44	214

Time Incubated (hours) Approximately	laboratory number
18	030
24	058 061 082 110 114 125 146 159 209 214 315 339
48	347

Confirmation of Organism's Identity	laboratory number
API 20A	058 125 214
Latex slide agglutination	209
Morphology	030
Microscopy	058 347
Motility	315
Nitrate/nitrite reduction	315
VITEK	146

Which Selective/Chromogenic Medium Used	laboratory number
Oleandomycin Polymixin Sulphadiazine Perfringens Agar (OPSP)	030
Tryptose Sulphite Cycloserine Agar (TSC)	110 114 125 146 159 209 334 347
TSC agar egg yolk free	061 082 315

Enterobacteriaceae / coliforms / *E. coli* in Beef

Accredited Method Used	laboratory number
yes	010 024 034 053 058 060 064 066 067 073 081 082 083 110 111 114 116 118 125 141 156 161 174 175 177 178 190 203 205 209 224 229 234 282 283 286 293 300 301 304 305 306 331 336 357 362 366
no	002 121 194 230 235 250 284 288 364

Method Based on an International Standard	laboratory number
yes	002 024 034 053 058 060 064 066 067 073 081 082 083 111 114 116 118 121 125 141 156 174 175 177 190 194 203 205 209 224 229 230 235 250 283 284 286 293 300 301 304 305 306 331 336 357 362 364
no	010 110 161 178 234 282 288 366

Which International Standard	laboratory number
APC (spread plate) ISO 4833-1:2013	366
APC FDA/BAM Chapter 3	111
Coliforms enumeration ISO 4832:2006	034 064 066 073 082 114 118 156 174 190 224 229 286
Coliforms enumeration AOAC 991.14	002 053 177 203
Enterobacteriaceae enumeration ISO 21528-2:2004	024 034 053 058 064 066 081 082 083 114 118 121 125 174 190 194 209 224 229 230 250 283 284 286 293 331 364
Escherichia coli enumeration ISO 16649-1:2001	083
Escherichia coli enumeration ISO 16649-2:2001	034 064 066 082 114 118 174 190 224 229 283 286
Escherichia coli enumeration AOAC 991.14	203 205
Listeria monocytogenes enumeration ISO 11290-2:1998	067
Salmonella spp. detection ISO 6579:2002/Amd 1:2007	288
3M Petrifilm	336
CCFRA 2.3.1:2007,CCFRA 2.2.1:2007,CCFRA 2.4.2:2003	300
CCFRA-2.2.1:2007, CCFRA-2.4.4:2007	306
Chromo ID Coli agar	024
Enterobacteriaceae AOAC 2003.01	203
FDA/BAM 2002 Chapter 4	301
in-house method	141
IS-5401 (Part -1); 2012 (For Enumeration of Coliforms) and IS:5887 (Part-1)-1976 (Reaffirmed 2005) for Enumeration of Escherichia coli.	305
ISO21528-2:2017	175
SR ISO 21528-2:2007; SR ISO 4832:2009; SR ISO 16649-2:2007	060

Which Initial Suspension/Diluent Used	laboratory number
Buffered Peptone Water (BPW)	002 024 034 053 066 067 073 081 110 111 114 116 118 125 156 161 174 177 178 194 203 209 229 250 283 284 293 304 306 336 357 364 366
Butterfield's Phosphate Buffer	010 141 244 300 305
Maximum Recovery Diluent (MRD)	060 082 190 230 282
Peptone Water	058 083 205 234 288 331
Phosphate Buffered Saline (PBS)	064 121 175 224 235 362
Ringer's Solution	301

Which Primary Enrichment Medium Used	laboratory number
Buffered Peptone Water (BPW)	002 010 066 111 118 125 178 224 229 305 331 336 362
Lauryl Tryptose Broth	357
Agua peptonada al 0,1%	366
MAXIMUM RECOVERY DILUENT	209
Petri film ,Violet red BILE agar	304
Violet red bile glucose agar (VRBG); Crystal violet red bile lactose agar (VRBL); TBX	060
VRBGA	230
VRGB	175

Which Secondary Enrichment Medium Used	laboratory number
Brilliant Green Bile Broth (BGBB)	357
Brilliant Green Bile Lactose Broth (BGLB)	118 305
Rappaport Vassiliadis Soya Peptone(RVS)	111
Tetrathionate Broth	058 083
Agar VRBG	366
BPW	002
VIOLET RED BILE GLUCOSE AGAR	209

Plating Method Used	laboratory number
Pour plate	002 024 034 053 058 066 073 082 083 111 114 121 125 174 190 209 224 229 230 235 244 250 283 284 293 301 304 305 306 331 362 364 366
Spread plate	067 116 141 194 203 205 282 286 288 336
Overlay	060 081 118 175 300

Inoculum Volume (ml)	laboratory number
0.05	288
0.1	282 286
1.0	002 024 034 053 058 060 064 066 067 073 082 083 110 111 114 116 118 121 125 141 161 174 175 177 190 194 203 205 209 224 229 230 234 235 244 250 283 284 293 300 301 304 305 306 331 336 357 362 364 366

Alternative/Rapid Method	laboratory number
Most probable Number - Automated (e.g. TEMPO)	110 125 229
Petrifilm (3M)	002 010 053 175 177 178 234 244 304 336 357
VIDAS (ELFA)	161
miniVIDAS (ELFA)	111

Incubation Temperature (°C)	laboratory number
30	081 161
35	002 010 053 116 141 177 203 205 235 244 301 304 357 362 366
37	024 034 058 060 064 066 067 073 083 111 118 121 125 175 178 190 194 209 224 230 250 282 283 284 286 288 293 300 305 306 331 336 364
44	082

Time Incubated (hours) Approximately	laboratory number
18	141 301
24	002 010 024 034 053 058 060 064 066 073 082 110 111 114 118 121 125 161 175 177 178 190 194 203 209 224 229 230 235 244 250 282 283 286 293 300 304 305 306 331 336 364 366
48	067 081 083 116 205 284 288 357 362

Confirmation of Organism's Identity	laboratory number
API 20A	175 288
API 20E	178 235 284 306 357 364
API RapidID 20E	010 083
API Listeria	067
beta-glucoronidase activity	024 064 161
Catalase reaction	064
Coagulase reaction - tube test	064 116
Fermentation of Carbohydrates	024 053 064 175 190 250 305 306 331
Hippurate Hydrolysis	073
IMViC test	002 203 300 304 357
Indole production	024 224 301 305
Latex slide agglutination	209
Morphology	114 305
Microscopy	064 304 336
Oxidase reaction	034 053 058 064 066 118 175 190 194 224 229 230 283 304 305 331 366
VITEK	111 141 234
Voges-Proskauer (VP) reaction	305
Triple Sugar Iron Agar (TSI)	058 118 283

Enterobacteriaceae in Beef

Which Selective/Chromogenic Medium Used	laboratory number
Petrifilm (3M) Enterobacteriaceae	010 178 203 304
Violet Red Bile Agar (VRB)	288
Violet Red Bile Dextrose Agar (VRBD)	067 081 174 282 283 362
Violet Red Bile Glucose Agar (VRBG)	034 053 060 064 066 082 111 118 121 125 141 175 190 194 209 229 230 235 244 250 284 293 300 304 306 331 357 366
REBECA + EB	114

Coliforms in Beef

Which Selective/Chromogenic Medium Used	laboratory number
Brilliant Green Bile Broth (BGBB)	116 118 209 304 357
Brilliant Green Bile Lactose Broth (BGLB)	362
Chromocult Coliform Agar	111 141 244 288
Endo Agar	282
Lauryl Tryptose Broth	081
Petrifilm (3M) Colliforms	002 053 175 178 205 304
Violet Red Bile Agar (VRB)	034 121 125 174 229 235 293 300 301 304 306
Violet Red Bile Lactose Agar (VRBL)	060 064 066 073 082 118 190 305
Chrom ID Coli	250
Petrifilm (3M) E.coli/Coliform	203
Petrifilm (3M) E.coli/Coliform Count Plate	177
Rebeca CF	114

E. coli in Beef

Which Selective/Chromogenic Medium Used	laboratory number
Brilliance E.coli	111
Lauryl Sulphate Broth	081
Petrifilm (3M) Colliforms	002 053 175 178 336
Tryptone Bile Glucuronide Agar (TBX)	034 060 064 066 073 082 118 121 125 141 174 190 194 229 230 250 283 284 288 293 331
Tryptone Water	209
Eosine Methylene Blue Agar (EMB)	116 305 306 357 362
3M Petrifilm E.coli	234
BRVA-MUG	235
Chromocult coliform Agar	244
Chromogenic medium Hi-media M1300	282
Hichrome E.coli Agar	300
Petrifilm (3M) E. coli	205
petrifilm (3M) E.coli	304
Petrifilm (3M) E.coli/Coliform	203
Petrifilm (3M) E.coli/Coliform Count Plate	177
REBECA + EB	114

Enterobacteriaceae in Milk Powder

Accredited Method Used	laboratory number
yes	007 016 047 077 078 129 147 153 179 181 240 269 347 356
no	009 093 101 154 172 191 216 219 220 250 318 324

Method Based on an International Standard	laboratory number
yes	009 016 047 077 078 093 101 129 147 153 154 172 179 181 191 216 219 220 250 269 318 324 356
no	007 240 347

Which International Standard	laboratory number
Enterobacteriaceae enumeration ISO 21528-2:2004	009 047 078 093 129 153 154 179 191 216 219 220 250 269 318 324
AFNOR BRD 07124-11/13 RAPID' Enterobacteriaceae	007
Enterobacteriaceae ISO 21528-2: 2017	356
Enterobacteriaceae ISO 21528-2:2017	147
GB 4789.41-2016	101
ISO 21528-2:2017	077

Which Initial Suspension/Diluent Used	laboratory number
Buffered Peptone Water (BPW)	016 077 078 101 129 153 172 216 219 250 318 324
Butterfield's Phosphate Buffer	181 240
Maximum Recovery Diluent (MRD)	007 093 147 154 356
Peptone Water	179
Phosphate Buffered Saline (PBS)	220
Ringer's Solution	009 269 347
Tryptone Water	191

Which Primary Enrichment Medium Used	laboratory number
Buffered Peptone Water (BPW)	016 172 269 318
Fraser Broth	219
Violet red bile glucose agar	356

Which Secondary Enrichment Medium Used	laboratory number
Rappaport Vassiliadis Broth (RV)	219

Plating Method Used	laboratory number
Pour plate	007 009 016 047 077 093 101 129 147 153 172 179 181 216 219 220 240 250 269 318 324 356
Overlay	078 154 191

Inoculum Volume (ml)	laboratory number
0.1	078
1.0	007 009 016 047 077 093 101 129 147 153 154 172 179 181 191 216 219 220 240 250 269 318 324 347 356

Alternative/Rapid Method	laboratory number
Most probable Number - Automated (e.g. TEMPO)	077
Petrifilm (3M)	172 179 181 216 240 318

Incubation Temperature (°C)	laboratory number
30	318
35	172
37	007 009 016 047 077 078 093 101 129 147 153 154 179 181 191 216 219 220 240 250 269 324 347 356

Time Incubated (hours) Approximately	laboratory number
18	007
24	016 047 077 093 101 147 153 154 179 181 216 219 220 240 250 269 318 324 347 356
48	009 078 129 172 191

Confirmation of Organism's Identity	laboratory number
Enterotube (BBL)	078
Fermentation of Carbohydrates	047 077 147 153 250 269 324 356
Microscopy	179 347
Oxidase reaction	047 077 093 147 191 219 324 356
VITEK	101
Triple Sugar Iron Agar (TSI)	093

Which Selective/Chromogenic Medium Used	laboratory number
Petrifilm (3M) Enterobacteriaceae	172 181 216 318
Violet Red Bile Dextrose Agar (VRBD)	009 179 191 220
Violet Red Bile Glucose Agar (VRBG)	016 047 077 093 101 129 147 153 154 219 240 250 269 324 356
RAPID' Enterobacteriaceae	007

Yeasts and moulds in Flour

Accredited Method Used	laboratory number
yes	013 019 028 102 108 110 114 122 125 130 133 139 171 179 217 227 248 256 261 271 287 299 309 310 315 327 340 345 355 362
no	062 090 093 147 180 210 216 238 252 301 319

Method Based on an International Standard	laboratory number
yes	019 028 093 108 114 122 125 130 133 139 147 179 180 210 217 227 252 271 287 299 301 309 310 319 327 340 345 355 362
no	013 062 090 102 110 171 216 238 248 256 261 315

Which International Standard	laboratory number
APC FDA/BAM Chapter 3	108 252 319
CPS ISO 6888-1:1999 (Baird Parker)	340
Yeasts and Moulds (sum) enumeration (low water availability) ISO 21527-2:2008	019 028 093 114 122 125 133 139 147 271 287 345 355
3M™ Petrifilm™ Yeast and Mold Count Plates	013
AOAC official Method 2014.05 (2016)	180
CCFRA 2.1.1:2007	299
CCFRA2.1.1	309
CMMEF 5TH EDITION	210
FDA/BAM Chapter 18	179
FDA-BAM	130 310
ISO 7954	227
NF V08-59	216
Nissui Compact Dry	171
Yeast and Mold Plate Count Petrifilm	090
Yeast and Molds, FDA/BAM Online Chapter 18	217

Which Initial Suspension/Diluent Used	laboratory number
Buffered Peptone Water (BPW)	013 028 062 090 102 110 114 122 125 130 139 216 252 256 287 319 340 345 355
Butterfield's Phosphate Buffer	217 261 310
Maximum Recovery Diluent (MRD)	093 133 147 227
Peptone Water	019 171 179 180 299 301 309
Phosphate Buffered Saline (PBS)	210 327 362
Ringer's Solution	108 271

Which Primary Enrichment Medium Used	laboratory number
Buffered Peptone Water (BPW)	013 102 122 125 271 340 345
Half Fraser Broth	287
Tryptone Soya Broth	062
DG18	019
DG18 AGAR	355
Peptone Water	301

Which Secondary Enrichment Medium Used	laboratory number
Rappaport Vassiliadis Broth (RV)	248
Tetrathionate Broth	217
NON-APPLICABLE	019
ROSE BENGAL AGAR	210

Plating Method Used	laboratory number
Pour plate	019 062 102 108 114 179 180 210 216 217 227 238 248 252 256 261 271 301 310 315 319 327 362
Spread plate	028 093 122 125 130 133 147 287 299 345 355

Inoculum Volume (ml)	laboratory number
0.01	090
0.1	019 028 062 093 122 125 130 133 147 287 345 355
0.5	299
1.0	013 102 108 110 114 139 171 179 180 210 216 217 227 238 248 252 256 261 271 301 310 315 319 327 362

Alternative/Rapid Method	laboratory number
Compact dry	171
Most probable Number - Automated (e.g. TEMPO)	110 125
PCR	355
Petrifilm (3M)	090 108 179 180

Incubation Temperature (°C)	laboratory number
25	013 019 028 062 090 093 102 108 110 114 122 125 130 133 139 147 171 179 180 210 216 217 227 238 248 252 256 271 287 299 301 309 310 315 319 327 345 355 362
30	261

Time Incubated (hours) Approximately	laboratory number
48	090 180
60	019 028 062 093 108 122 125 133 147 210 216 217 238 256 271 299 301 309 310 319 327 345 362

Confirmation of Organism's Identity	laboratory number
API 10S	355
Fermentation of Carbohydrates	271
Morphology	093 114
Microscopy	093 108 114 133 179 256 301 309 315
VITEK	122 248

Which Selective/Chromogenic Medium Used	laboratory number
Dichloran 18% Glycerol Agar (DG18)	019 093 114 122 125 130 139 147 179 217 248 271 287 315 327 340 345 355 362
Dichloran Rose-Bengal Chloramphenicol Agar (DRBC)	108 130 301
Petrifilm (3M) Yeasts & Moulds	013 090 180
Potato Dextrose Agar (PDA)	102 238 261 299 310
Yeast Glucose Chloramphenicol Agar (YGC)	062 216 252 256 319
RCA	309
ROSE BENGAL AGAR	210

Coliforms in Milk Powder

Accredited Method Used	laboratory number
yes	003 004 006 011 013 014 037 039 050 069 071 099 103 106 113 117 131 134 136 150 164 167 169 182 222 226 241 255 257 267 268 270 281 295 306 308 312 314 320 325 348
no	001 009 043 095 186 198 199 201 210 231 235 242 246 253 264 301 317 318

Method Based on an International Standard	laboratory number
yes	001 003 004 006 009 011 013 037 039 043 050 117 150 169 182 186 198 210 222 226 235 253 257 267 268 281 295 301 306 312 317 318 325
no	014 069 071 095 099 103 106 113 131 134 136 164 167 199 201 231 241 242 246 255 264 270 308 314 320 348

Which International Standard	laboratory number
APC FDA/BAM Chapter 3	253 317
Coliforms enumeration ISO 4832:2006	004 006 009 013 071 150 169 182 226 281 295
Coliforms enumeration AOAC 991.14	001 037 043 318
Escherichia coli enumeration AOAC 991.14	003
AOAC 996.02:2002	050
ASU L 01.00-3	267 268
Bacteriological Analitycal Manual, Edition 8, Revision A, 1998. Chapter 18	312
BAM:Enumeration of Escherichia coli and the Coliform bacteria Chapter 4	222
CCFRA-2.2.1:2007	306
Coliform enumeration ISO 4831:2006	186
Coliforms enumeration ISO/IEC 17025:2005	325
DIN 10110	117
GB 4789.3-2016	103 131 136 314
GB 4789.3-2016 ???	242
GB4789.3-2016	106

Which Initial Suspension/Diluent Used	laboratory number
Buffered Peptone Water (BPW)	006 013 039 043 050 169 182 198 222 253 267 268 281 295 312 317 318
Butterfield's Phosphate Buffer	003 011 241 257
Maximum Recovery Diluent (MRD)	150 186
Peptone Water	001 037 071 117 270 325
Phosphate Buffered Saline (PBS)	004 014 095 099 103 131 134 167 199 210 231 235 242 246 255 264 308 320
Ringer's Solution	009 164 301 306 348

Which Primary Enrichment Medium Used	laboratory number
Buffered Peptone Water (BPW)	013 039 117 169 226 231 267 268 318
Lauryl Tryptose Broth	011
saline water	134
Violet Red Bile Agar	241
Ringer's Solution	301
violet red bile agar	150
VRBA	071 106 136 242

Which Secondary Enrichment Medium Used	laboratory number
Brilliant Green Bile Lactose Broth (BGLB)	011 014 071 099 106 150 167 257
Rappaport Vassiliadis Broth (RV)	039
Rappaport Vassiliadis Soya Peptone(RVS)	210 267 268
saline water	134
BGLB	136 242
Coliform Agar	241

Plating Method Used	laboratory number
Pour plate	003 004 006 009 013 014 037 043 069 071 095 103 106 113 117 134 136 150 164 169 182 186 198 199 201 210 222 235 241 246 253 255 257 264 270 281 295 301 306 308 312 314 317 318 320 325 348
Spread plate	226 267 268
Overlay	050 167 242

Inoculum Volume (ml)	laboratory number
0.01	050 164
0.1	117 199 231 267 268 348
1.0	001 003 004 006 009 011 013 014 037 043 069 071 095 103 106 113 134 136 150 167 169 182 186 198 201 210 222 226 235 241 242 246 253 255 257 264 270 281 295 301 306 308 312 314 317 318 320 325

Alternative/Rapid Method	laboratory number
Enzyme Immunoassay	039
Most Probable Number - Tube	210
PCR	267
Petrifilm (3M)	001 003 004 037 043 050 099 164 318
VIDAS (ELFA)	241

Incubation Temperature (°C)	laboratory number
25	136
30	006 210 222 267 268 295 306 318
35	001 003 011 014 039 043 095 103 106 113 199 235 246 253 255 257 301 312 325
37	004 009 013 037 069 071 099 117 131 134 150 164 167 169 182 186 198 201 226 231 241 242 264 270 281 308 314 317 320 348

Time Incubated (hours) Approximately	laboratory number
18	014 199 246 255 301 325
24	001 003 004 006 013 037 039 043 050 095 103 113 131 150 164 169 182 186 210 222 226 231 235 241 242 253 257 264 267 268 270 281 295 306 308 312 314 318 320 348
36	136
48	009 011 069 071 099 106 134 167 198 201 317
60	117

Confirmation of Organism's Identity	laboratory number
API 20E	004 134 267 268 308
API Staph	198
API Listeria	242
beta-glucoronidase activity	235
Coagulase reaction - tube test	246
Fermentation of Carbohydrates	281 306
Haemolysis	071
Indole production	037 301
Morphology	167 226 270
Microscopy	014 226 270 348
Oxidase reaction	226 231
PCR	210
VITEK	164 222 241

Which Selective/Chromogenic Medium Used	laboratory number
Brilliant Green Bile Broth (BGBB)	210 235
Brilliant Green Bile Lactose Broth (BGLB)	004 011 069 131 164 169 201 241 242 281
Chromocult Coliform Agar	241 348
Endo Agar	226 270
Petrifilm (3M) Colliforms	001 037 043 050 241 318
Violet Red Bile Agar (VRB)	009 013 099 103 106 131 167 199 231 253 267 268 301 306 312 314 317 320
Violet Red Bile Glucose Agar (VRBG)	134 308
Violet Red Bile Lactose Agar (VRBL)	150 182 186 222 226 270 295
Desoxycholate Agar	014 246
E.coli-Coliform Chromogenic Agar	039
EMB Agar	325
RAPID'E.coli 2 Agar	241
VRBA	136
X-GAL Agar	095

Listeria spp./*L. monocytogenes* in Chicken

Accredited Method Used	laboratory number
yes	024 041 058 081 098 105 141 160 163 165 185 221 222 223 234 239 249 258 259 260 265 276 287 289 290 313 316 338 347
no	104 140 189 206 218 219 272 278 284 341

Method Based on an International Standard	laboratory number
yes	024 041 058 081 140 141 160 185 189 218 219 221 222 223 259 260 265 272 276 284 290 338 341
no	098 104 105 163 165 206 234 239 249 258 278 289 313 316 347

Which International Standard	laboratory number
Escherichia coli enumeration AOAC 991.14	206
Lactic Acid Bacteria enumeration ISO 15214:1998	272
Listeria monocytogenes detection ISO 11290-1:1996	081 185 259 272
Listeria monocytogenes detection ISO 11290-1:1996/Amd 1:2004	024 140 189 219 223 260 265 272 276 284 338 341
Listeria monocytogenes enumeration ISO 11290-2:1998	272
Listeria monocytogenes enumeration ISO 11290-2:1998/Amd 1:2004	058 272
Salmonella spp. detection ISO 6579:2002	272
Salmonella spp. detection ISO 6579:2002/Amd 1:2007	272
Salmonella spp. detection ISO 6579:2002/Cor 1:2004 (en)	272
Salmonella spp. detection FDA/BAM Chapter 5	272
Vibrio parahaemolyticus detection ISO/TS 21872-1:2007	272
Vibrio parahaemolyticus detection ISO/TS 21872-1:2007/Cor 1:2008	272
Yeasts and Moulds (sum) enumeration (high water availability) ISO 21527-1:2008	272
Yeasts and Moulds (sum) enumeration (low water availability) ISO 21527-2:2008	272
(Institute of Food Hygiene /Animal Clinic, Germany, PVM11-01 L00.00-22/L00.00-32- § 64 LFGB)	222
AOAC 2004.02	221
AOAC PTM#051401	041
FDA BAM Chapter 10 2003	141
GB 4789.30-2016	239 313
GB4789.30-2016	105
ISO 11290-1 Microbiology of the food chain-Horizontal method for the detection and enumeration of Listeria monocytogenes and of Listeria spp	160
ISO 11290-1:2017	218
Listeria monocytogenes ISO 11290-1:2017	272
SNI 01-4502:1998	258

Which Initial Suspension/Diluent Used	laboratory number
Buffered Peptone Water (BPW)	024 058 104 105 140 163 165 185 218 221 222 239 249 258 260 272 276 284 290 338
Half Fraser Broth	206 219 223 259 265 278 289 341
Peptone Water	041 347
Phosphate Buffered Saline (PBS)	098

Which Primary Enrichment Medium Used	laboratory number
Buffered Peptone Water (BPW)	234 316
Fraser Broth	041 219 223 265 278 289 341 347
Half Fraser Broth	024 058 081 140 160 185 189 206 218 221 222 259 260 272 276 284 287 338
Listeria Enrichment Broth 1 (LEB)	098 104 105 163 239 249 313
Listeria Enrichment Broth 2 (LEB)	098 104 165 239 249
24 LEB	141
Listeria Enrichment Broth	258
UVM broth	290

Which Secondary Enrichment Medium Used	laboratory number
Fraser Broth	041 058 081 140 160 185 189 218 221 222 223 259 260 265 272 276 278 284 290 338 341 347
Rappaport Vassiliadis Broth (RV)	219
LB2	316
LEB2	313
Listeria Enrichment Broth 2(LEB)	105 163
OXford and Palcam	258

Plating Method Used	laboratory number
Pour plate	105 265
Spread plate	024 058 081 140 185 189 218 219 222 223 239 258 259 260 272 276 284 290 338 341
Overlay	163 278

Inoculum Volume (ml)	laboratory number
0.01	058 163 185 219 276 290 316 338
0.1	024 098 105 140 160 165 218 222 223 239 258 259 260 272 341 347
0.5	284
1.0	206 221 278
>2.0	265

Alternative/Rapid Method	laboratory number
Loop Mediated Isothermal Amplification (LAMP)	041
PCR	141 163 206 259 276 287
VIDAS (ELFA)	098 104
miniVIDAS (ELFA)	189 265 289 347

Incubation Temperature (°C)	laboratory number
30	105 160 165 206 221 239 258 290 313 316
35	140 141 163
37	024 041 058 081 098 185 189 218 219 222 223 259 260 265 272 276 278 284 289 338 341 347

Time Incubated (hours) Approximately	laboratory number
18	141
24	058 160 163 185 206 221 223 272 278 290 313 338
48	024 041 081 105 140 165 189 218 219 222 239 258 259 260 284 289 316 341 347
60	098 265 276

Confirmation of Organism's Identity	laboratory number
Aesculin hydrolysis	258
API Listeria	058 141 160 185 219 265 272 284 290 313 341 347
CAMP test	058 098 223 239 260 265
Catalase reaction	058 223 239 258 260 265
Fermentation of Carbohydrates	024 218 223 239 258 276 290
Haemolysis	058 160 218 239 258 260 265 276
IMViC test	258
Indole production	258
Morphology	058 223 239 265 289
Microscopy	058 218 223 239 265 278 290
Motility	223 239 258 260
Nitrate/nitrite reduction	258
PCR	206 259 276
VITEK	104 163 189 221 222 234
Voges-Proskauer (VP) reaction	105 165 239 258
Triple Sugar Iron Agar (TSI)	258

Which Selective/Chromogenic Medium Used	laboratory number
Agar Listeria Ottavani Agosti (ALOA)	140 185 218 219 260 276 289 338 347
PALCAM Agar	098 104 163 239 259 260 316 338
Chromogenic Listeria Agar (Oxoid)	098 104 249 259 260 341
Ottavani Agosti Agar (OAA)	160 272 284 290
Oxford Agar	141 222 234 259 276 278
Modified Oxford Agar (MOX)	290
Brilliance Listeria Agar (OCLA)	081 222
Rapid L. mono	185 234 260
LPM agar	218
PALCAM Agar; Oxford Agar	313

E. coli 0157:H7 in Sprouting Seeds and Lettuce

Accredited Method Used	laboratory number
yes	046 110 114 123 141 189 247
no	029 097

Method Based on an International Standard	laboratory number
yes	029 046 097 110 114 123 141 189 247

Which International Standard?	laboratory number
APC FDA/BAM Chapter 3	123
Escherichia coli enumeration ISO 16649-2:2001	189
Escherichia coli O157:H7 detection ISO 16654:2001	029 046
Escherichia coli O157:H7 detection ISO/TS 13136:2012 (PCR)	110 114
BAM	247
Japanese Official Standard Method	097

Which Initial Suspension/Diluent Used	laboratory number
Buffered Peptone Water (BPW)	029 046 097 123 247
Maximum Recovery Diluent (MRD)	189

Which Primary Enrichment Medium Used	laboratory number
Buffered Peptone Water (BPW)	046 110 114 123 189
Modified E.coli Broth (Novobiocin)	097
Modified tryptone soya broth with Novobiocin	029
mTSB	247
mTSB with novobiocin	141

Plating Method Used	laboratory number
Pour plate	046
Spread plate	097 110 114 123 189

Inoculum Volume (ml)	laboratory number
0.01	110 114 123 247
0.1	046 097
0.5	189

Alternative/Rapid Method	laboratory number
PCR	123 247
miniVIDAS (ELFA)	029 110 189

Incubation Temperature (°C)	laboratory number
35	141 247
37	097
41.5	029 046 110 114
42	123
44	189

Time Incubated (hours) Approximately	laboratory number
18	029 110 114
24	097 123 141 189 247
48	046

Confirmation of Organism's Identity	laboratory number
IMViC test	097
Latex slide agglutination	029 097 110 114 189
Morphology	029 110 114
PCR	110 114
VITEK	046 123 141 247

Salmonella spp. in Ground Pepper

Accredited Method Used	laboratory number
yes	019 058 077 110 111 114 141 143 166 193 202 209 212 228 240 261 292 297
no	032 036 350 364

Method Based on an International Standard	laboratory number
yes	019 036 058 077 111 141 143 166 193 209 228 292 297 350 364
no	032 110 114 202 212 240 261

Which International Standard	laboratory number
APC FDA/BAM Chapter 3	111
Salmonella spp. detection ISO 6579:2002	019 036 058 143 193 209 228 364
Salmonella spp. detection ISO 6579:2002/Amd 1:2007	228 292
Salmonella spp. detection ISO 6579:2002/Cor 1:2004 (en)	350
Salmonella spp. detection FDA/BAM Chapter 5	297
GB 4789.4-2016	202
ISO 6579-1:2017	077
Korean Food Standards Codex	261

Which Initial Suspension/Diluent Used	laboratory number
Buffered Peptone Water (BPW)	019 032 036 058 077 111 143 166 193 202 209 212 228 261 350 364
Butterfield's Phosphate Buffer	240
Peptone Water	292

Which Primary Enrichment Medium Used	laboratory number
Buffered Peptone Water (BPW)	032 058 077 110 111 114 141 166 202 209 212 364
Mueller Kauffman Tetrathionate Novobiocin Broth (MKKTn)	077 143 292
Rappaport Vassiliadis Broth (RV)	019 261
Modified Semi-Solid Rappaport Vassiliadis (MSRV)	193
Rappaport Vassiliadis Soya Peptone(RVS)	077 228 292 350
Tryptone Soya Broth	297

Which Secondary Enrichment Medium Used	laboratory number
Rappaport Vassiliadis Broth (RV)	166 212 297
Rappaport Vassiliadis Soya Peptone(RVS)	058 111 143 193 209 292 364
Selenite Cysteine Broth	202
Tetrathionate Broth	058 202 212 261 364
Caldo M	228
Muller Kauffman Tetrathionate Novobiocin Broth (MKTTn)	350
SX2	110 114

Plating Method Used	laboratory number
Pour plate	077 111 193 240
Spread plate	019 032 058 110 114 143 166 202 209 212 228 297 364
Overlay	261

Inoculum Volume (ml)	laboratory number
0.001	202
0.01	058 110 114 228 364
0.1	019 143 166 193 209 212 261 297
1.0	032 111 240

Alternative/Rapid Method	laboratory number
PCR	019 032 036 110 114 141 209 240
Petrifilm (3M)	143
VIDAS (ELFA)	202 228
miniVIDAS (ELFA)	077 111

Incubation Temperature (°C)	laboratory number
35	141 166 212 297
37	019 036 058 077 111 202 209 228 240 261 350 364
41.5	110 114 143 193
42	032

Time Incubated (hours) Approximately	laboratory number
18	110 114
24	019 032 036 058 077 111 141 166 228 240 261 350 364
48	143 193 209 297
60	202 212

Confirmation of Organism's Identity	laboratory number
API 20E	019 058 077 209 228 292 350 364
beta-Galactosidase	077
Indole production	077
Latex slide agglutination	110 114
Lysine Decarboxylase	077 202
Morphology	110 114
Oxidase reaction	058 077 110 228
Serological agglutination test	058 077 193 202 364
PCR	032 110 114
VITEK	077 111 141 166 202 212 240 261
Voges-Proskauer (VP) reaction	077
Triple Sugar Iron Agar (TSI)	058 077 143 202 297

Which Selective/Chromogenic Medium Used	laboratory number
Bismuth Sulfite Agar (BSA)	202 240 297
Brilliant Green Agar (BGA)	019 143
Brilliance Salmonella Agar	032 141
ChromID Salmonella	228
Hektoen Agar	032 141 261 292 297
MacConkey Agar	297
Rambach Agar	077
Salmonella Chromogenic Medium	202
Xylose Lysine Desoxycholate Agar (XLD)	032 077 110 111 114 141 166 193 209 212 228 240 261 292 297 350
ASAP	110 114
Brilliant Green Sulfa Agar	212

APPENDIX IV: Fapas® SecureWeb, Protocol and Contact Details

1. Fapas® SECUREWEB

Access to the secure area of our website is only available to participants in our proficiency tests. Please contact us if you require a UserID and Password. Fapas® SecureWeb allows participants to:

- Obtain their laboratory numbers for the proficiency tests in which they have participated.
- View the results they submitted in past and current proficiency tests.
- Submit their results and methods for current tests.
- Review future tests they have ordered.
- Order proficiency tests, reference materials and quality control materials.
- Freely download copies of reports, in Acrobat PDF format, of proficiency tests in which they have participated.

2. PROTOCOL

The Protocols [4, 5] set out how Fapas® – Food Microbiology is organised. Copies can be downloaded from our website.

3. CONTACT DETAILS

This report was prepared and authorised on behalf of Fapas® by Emma Hutton (Round Coordinator). Participants with any comments or concerns about this proficiency test should contact:

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