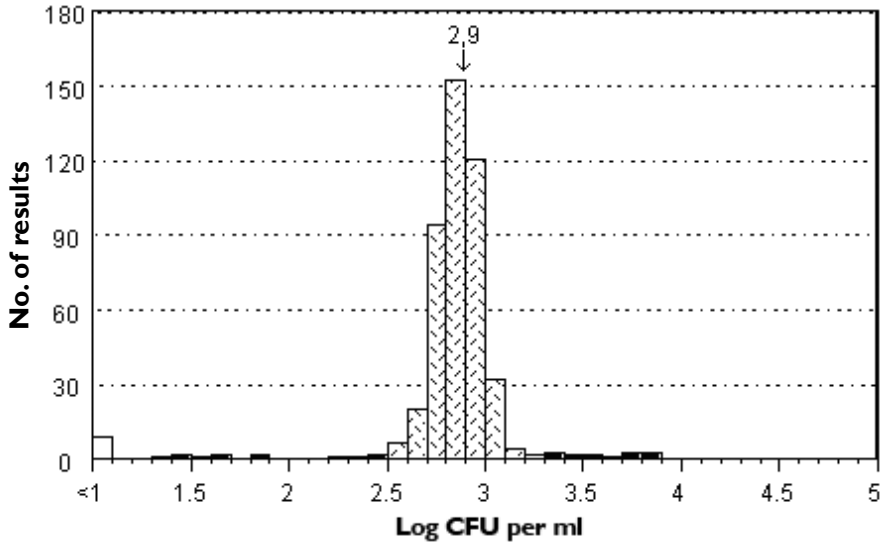
Rapport 4 – 2012

Proficiency testing

Food Microbiology

– January 2012

by Christina Normark, Irina Boriak and Laurence Nachin



LIVSMEDELS VERKET
NATIONAL FOOD AGENCY, Sweden

Proficiency Testing

Microbiology – Food

January 2012

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Abbreviations

Media

ALOA	Agar Listeria Ottaviani & Agosti
BGA	Brilliant Green agar
BPW	Buffered Peptone Water
BriS	Brilliance Salmonella agar
CT-SMAC	Cefixime-Tellurite-Sorbitol MacConkey agar
FR	Fraser broth
HF	Half Fraser broth
KTTn	Kauffmann -Tetrathionate –Novobiocin broth
LB	Lactose Broth
MKKTn	Muller-Kauffmann-Tetrathionate-Novobiocin broth
MLCB	Mannitol Lysine Crystal Violet Brilliant Green agar
MSRV	Rappaport-Vassiliadis, modified semi-solid medium
mTSB	Modified Tryptone Soya Broth
RV	Rappaport-Vassiliadis broth
RVS	Rappaport-Vassiliadis Sojapepton broth
XLD	Xylose Lysine Deoxycholate agar

Organisations

AFNOR	Association Française de Normalisation
AOAC	Association of Analytical Communities
IDF	International Dairy Federation
ISO	International Organization for Standardization
NMKL	Nordic Committee for Food Analyses
SLV	Livsmedelsverket/National Food Agency, Sweden

Introduction

All analytical activities require the maintenance of a work at high standard and well documented. For this purpose most laboratories practice some internal quality assurance, but the analyses work has also to be evaluated by an independent part. Such an external quality check of the laboratory competence is commonly required by accreditation bodies and can be done by taking part in proficiency tests (PT).

In a proficiency test, identical test material is examined by a number of laboratories. The laboratories shall follow instructions, perform analyses on the received samples and report their results to the organiser. They are also supposed to use their routine methods to analyse the received samples. The organiser subsequently evaluates the results using statistical tools and finally compiles them in a report.

Purpose with the microbiological proficiency tests of the National Food Agency,

1. The laboratories are externally evaluated with respect to their analytical competence, including usage of methods, documentation and orderliness.
2. The accreditation bodies get a tool for inspections regarding new accreditation or maintenance of accreditation.
3. The laboratories and the organiser receive increased knowledge on the efficiency of analytical methods used routinely by participating laboratories with respect to various types of organisms.

Design and analyses

This particular proficiency test was performed during January 2012 and is registered as no. 4600/2011 at the National Food Agency, Uppsala.

Samples were sent to 172 laboratories, out of which 28 in Sweden, 132 in other European countries and 12 outside of Europe. Analytical results have been reported by 159 laboratories.

Analyses to perform

Quantitative analyses	***Qualitative analyses***
Aerobic plate count, 30 ºC	*Salmonella*
Enterobacteriaceae	*Escherichia coli* O157
Thermotolerant *Campylobacter*	Thermotolerant *Campylobacter*
Listeria monocytogenes	*Listeria monocytogenes*

Test material

Each laboratory received three freeze-dried microbial mixtures; A-C.

The manufactured test material was freeze-dried in portions of 0.5 ml, in vials, as described by Peterz and Steneryd (1). Each laboratory received one vial of each mixture. Before analysing the samples, the content of each vial should be dissolved in 254 ml of diluent. The organisms present in the mixtures are listed in Table 1.

Table 1. *Microorganisms present in each mixture.*

Mixture [1]	**Microorganism**	**Strain no.**
A	*Escherichia coli*	SLV-165
	Campylobacter coli	SLV-271
	Listeria monocytogenes	SLV-361
	Salmonella agona	SLV-318
B/C	*Klebsiella pneumoniae*	SLV-537
	Campylobacter jejuni	SLV-540
	Listeria monocytogenes	SLV-444
	Listeria innocua	SLV-312
	Salmonella bovismorbificans	SLV-443
	Escherichia coli O157	SLV-515

1. The links between the mixtures and the randomised sample numbers are listed in Appendix 1.

Quality control of the mixtures

Homogeneous mixtures and uniform volumes in all vials are prerequisites in order to enable comparison of all freeze-dried samples derived from one mixture. Quality control was performed in connection with the manufacture of the mixtures, according to the Scheme Protocol (2). The results are presented in Table 2.

The standard deviations for the analysed mixtures ranged from 0.03 to 0.14 $\log_{10}$ units. Homogeneity requires that the standard deviation and the difference between the highest and lowest value of results from 10 analysed samples do not exceed 0.15 $\log_{10}$ units and 0.5 $\log_{10}$ units, respectively.

For qualitative analyses, the target organism must be detected in all samples. The concentration of *Salmonella* and *E. coli* O157 were determined in parallel mixtures lacking background flora.

Table 2. *Concentrations mean (m) and standard deviation (s) from the analyses of ten randomly selected vials per mixture, expressed in $\log_{10}$ cfu (colony forming units) per ml of sample*.

Analysis and method	A		B and C	
	m	**s**	**m**	**s**
Aerobic microorganisms, 30 ˚C NMKL method no. 86	4.7	0.07	4.4	0.08
Enterobacteriaceae NMKL method no. 144	4.7	0.07	4.5	0.09
Thermotolerant campylobacter, quant. NMKL method no. 119	1.4	0.08	2.8	0.14
Thermotolerant campylobacter, qual. NMKL method no. 119	pos	–	pos	–
Listeria monocytogenes, quant. NMKL method no. 136	2.8	0.03	2.7	0.04
Listeria monocytogenes, qual. NMKL method no. 136	pos	–	pos	–
Salmonella NMKL method no. 71	0.8*	0.05*	1.0*	0.04*
Escherichia coli O157 NMKL method no. 164	neg	–	1.5*	0.03*

* Internal value based on the analyses results of parallel mixtures.
– Numerical value cannot be calculated

Laboratories results

General information regarding the results

Out of the 159 laboratories that reported results, 61 laboratories (38 %) got, at least, one analytical result with annotation. However, it is worth noticing that after publication of the preliminary results, some laboratories informed that they did not take into account the serial dilution of the sample for the calculation of quantitative analyses results. For the previous rounds with the same analyses (October 2008, October 2010), the proportion was 31 %. All reported results are presented in Appendix 1.

Highly deviating values that do not belong to a strictly normal distribution are identified as statistical outliers, and are illustrated by black bars in the histograms. They appear in most analyses. The statistical tool Grubbs' test modified by Kelly (3) was used to identify outliers. The method is in theory objective, but in order to obtain correct outliers, it is a prerequisite that the results are normally distributed. In some cases, subjective adjustments are made to set the right limits, based on the knowledge of the mixtures content. The number of false results and outliers obtained by each laboratory are presented below the box plots (Figure 5). False results and outliers are not included in the calculations of means and standard deviations. Results reported as ">value" cannot be evaluated statistically and are hence excluded from the evaluation. Results reported as "<value" are interpreted as zero (negative result).

In order to enable the comparison of different results from different analyses and mixtures between each other, all the results from quantitative analyses are transformed into standard values (z-scores). A z-score is either positive or negative, depending on whether the individual result is higher or lower than the mean value calculated from all laboratory results for each analysis. Z-scores, listed in Appendix 2, may be used as a tool by the laboratories when making a follow-up of the results according to the Scheme Protocol (2).

Description of the mixture A

General information

The mixture contained *Escherichia coli, Campylobacter coli, Listeria monocytogenes* and *Salmonella* agona.

Analyses of aerobic microorganisms, Enterobacteriaceae and *Listeria monocytogenes* did not cause any major problems. The results from these analyses are listed in table 3 and subsequent histograms only. The analysis of thermotolerant *Campylobacter* is discussed further below. Analyses of *Salmonella* and *E. coli* O157 are commented in the section "Outcome of the methods".

Table 3. *Outcome of each analysis for the mixture A*

Analysis	Organism	m[1]	s[2]	F+	F−	Outl<	Outl>	n
Aerobic microorg. 30˚C	*E. coli*	4.81	0.13	–	0	6	4	141
Enterobacteriaceae	*E. coli*	4.69	0.14	–	0	9	3	119
Campylobacter, quant.	*C. coli*	0.74	0.48	–	6	0	0	18
Campylobacter, qual.	*C. coli*	pos	–	–	7	–	–	39
L. monocytogenes, quant.	*L. monocytogenes*	2.76	0.09	–	0	8	3	76
L. monocytogenes, qual.	*L. monocytogenes*	pos	–	–	1	–	–	101
Salmonella, qual.	*S.* agona	pos	–	–	13	–	–	127
E. coli O157, qual.	–	neg	–	6	–	–	–	35

1 Mean value of the laboratories results expressed in $\log_{10}$ cfu/ml (Appendix 1)
2 Standard deviation of the laboratories results (Appendix 1)
F+ and F- are the numbers of false positive and false negative results, respectively.
Outl < and Outl> are the number of low and high outliers, respectively.
n Number of performed analyses
– Numerical value cannot be calculated

Analysis of thermotolerant Campylobacter

- The mixture contained *C. coli.* Analyses results from the participants gave an average concentration of 5 cfu/ml. From the analysis of ten vials an average concentration of 25 cfu/ml was obtained at the National Food Agency, using spiral spreading technique (Table 2).
- The quantitative analysis was performed by only 18 laboratories. Among these, 6 did not detect the organism and, as in previous round, the dispersion of the results is large (Figure 1).
- The plate moisture can have an influence on the result. *Campylobacter* is sensitive to dry plates; therefore, it is preferable to use moist plates and let the sample dry on the plate before incubation. However, if the plates are too moist, colonies tend to flow together which makes the reading more difficult.
- The surface spreading on plates should be done carefully. Studies at the National Food Agency have shown that strong surface spreading gives fewer colonies on the plates than careful spreading.

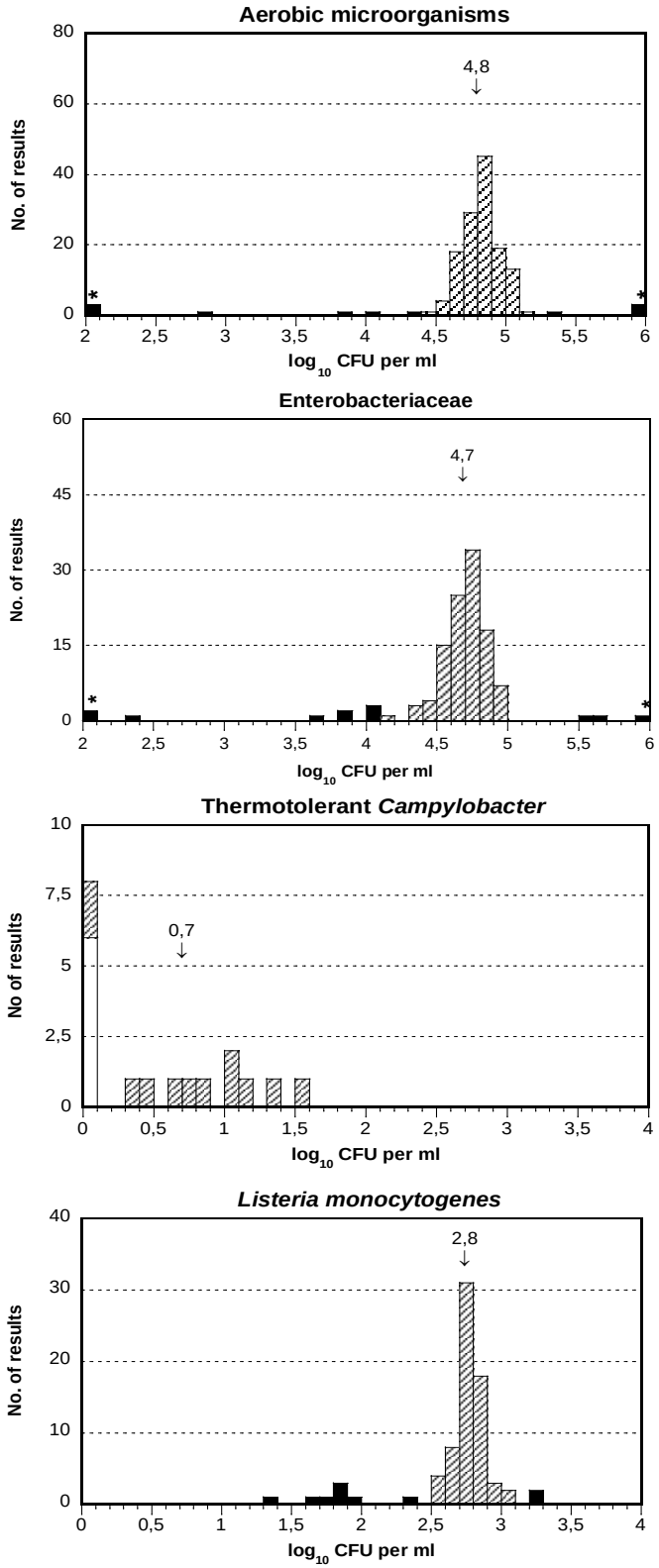


Figure 1. *Histograms of all analytical results obtained for the mixture A.*
values within the interval of acceptance (Appendix 1), ■ *outliers,*
□ *false negative results, * outliers outside of the x-axis scale.*
The mean value of the analysis results is indicated in the histograms.

Description of the mixtures B and C

General information

The mixtures B and C were identical. They contained *Klebsiella pneumoniae, Campylobacter jejuni, Listeria monocytogenes, Listeria innocua, Salmonella* bovismorbificans and *Escherichia coli* O157.

Analyses of aerobic microorganisms, Enterobacteriaceae and *Campylobacter* did not cause any major problems. The results from the two first are listed in Table 4 and subsequent histograms only. The analyses of *Campylobacter* and *L. monocytogenes* are discussed below. Results obtained for the detection of *Salmonella* and *E. coli* O157 are commented in the following section "Outcome of the methods".

Means, standard deviations and number of deviating results from the mixture B/C are calculated for each analysis based on all results from the two mixtures (Table 4 and Figures 2). The majority of laboratories reported similar results for the two samples. All results from the quantitative analysis are also presented as Youden plots in figure 3.

Table 4. *The outcome of each analysis in mixture B/C (details as in table 3)*

Analysis	Organism	m [1]	s [2]	F+	F−	Outl<	Outl>	n
Aerobic microorg., 30˚C	*K. pneumoniae*	4.60	0.22	–	1	12	5	281
Enterobacteriaceae	*K. pneumoniae*	4.55	0.22	–	1	6	4	136
Campylobacter, quant.	*C. jejuni*	2.24	0.27	–	0	0	0	35
Campylobacter, qual.	*C. jejuni*	pos	–	–	2	–	–	78
L. monocytogenes, quant.	*L. monocytogenes* [*L. innocua*]	2.61	0.14	–	2	11	1	152
L. monocytogenes, qual.	*L. monocytogenes* [*L. innocua*]	pos	–	–	12	–	–	202
Salmonella, qual.	*S.* bovismorbificans	pos	–	–	5	–	–	156
E. coli O157, qual.	*E. coli* O157	pos	–	–	13	–	–	68

[ ] The organism can emerge as false positive colonies before confirmation

Analysis of thermotolerant Campylobacter

- In this case, only one laboratory reported false negative results, instead of six for the mixture A (Table 3). One explanation for this difference can be that the concentration of *C. jejuni* in mixture B/C was more than ten times higher than the concentration of *C. coli* in mixture A (Table 2). Furthermore C. *jejuni* is often easier to detect than *C. coli*.

Analysis of Listeria monocytogenes

- The mixture contained both *Listeria monocytogenes* and *Listeria innocua*.
- *L. innocua* was present at a lower concentration than *L. monocytogenes* in the mixture. However, the strain of *L. innocua* has a higher growth rate than *L. monocytogenes* and can therefore outnumber *L. monocytogenes* in the enrichment steps for the qualitative analysis.
- When assayed at the National Food Agency, significantly more colonies of *L. monocytogenes* were obtained on ALOA plates after one day of enrichment in HFr than after one day of enrichment in HFr followed by one or two days of enrichment in Fr.
- Out of 101 laboratories that performed the qualitative analysis, one reported false negative results for both the qualitative and the quantitative analysis on both mixtures. Seven other laboratories which reported false negative results, for one or both mixtures, performed only the qualitative analysis.

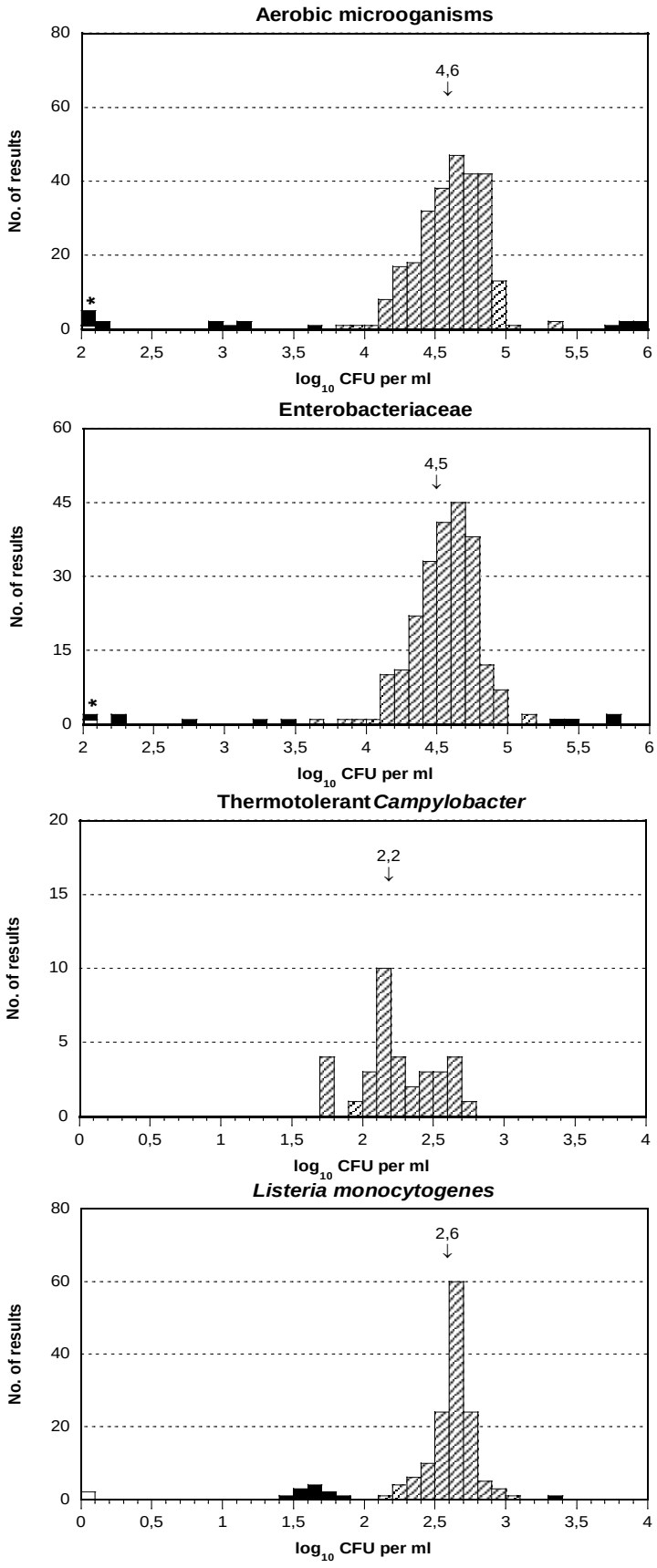


Figure 4 *. Histograms of all analytical results obtained for the mixture B/C. For details, report to the legend of figure 2.*

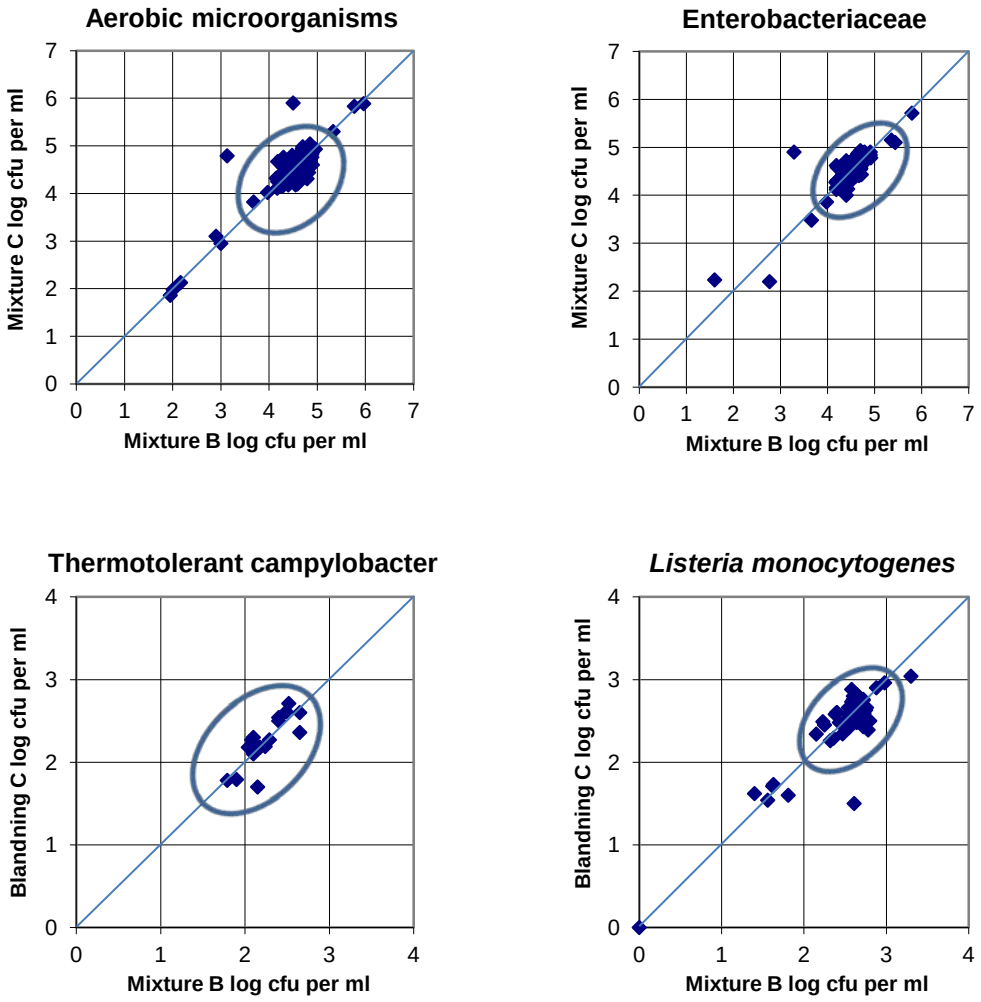


Figure 3. *Youden plot for analyses of mixtures B and C. Values outside the results cluster (circled) but still similar or close to the 45 º line are from laboratories that obtained results systematically deviating from the overall outcome. Few laboratories obtained different results for the same analyses performed on the two mixtures (away from the 45 º line).*

Outcome of the methods

General comments

According to EN ISO/IEC 17043, which the Proficiency testing programme organised by the National Food Agency is accredited for from 2012, it is mandatory for the participating laboratories to give method information for all analyses they report results for (Table 5). However, the method information are sometimes difficult to interpret e.g., many laboratories choose medium that differ from reported standard methods.

Table 5. *Distribution of the methods used by the laboratories for each analysis.*

Analysis	Method info[a]	NMKL method	ISO/IDF	Analysis	Method info	NMKL method
Aerobic plate count, 30˚C	141	56	45	22	18	0
Enterobacteriaceae	119	71	19	17	12	0
Campylobacter, quant.	18	9	8	–	1	0
Campylobacter, qual.	39	21	14	–	4	0
L. monocytogenes, quant.	76	21	35	–	20	0
L. monocytogenes, qual.	101	20	28	1	45	7
Salmonella, qual.	128	42	33	–	44	9
E. coli O157, qual.	35	8	10	3	14	0

[a] Number of laboratories that gave method information for the respective analysis

In this test round the method outcome for the analysis of *Salmonella* and *E. coli* O157 are commented.

Outcome of the methods –analysis of *Salmonella*

Most of the laboratories used the references method NMKL no. 71 or ISO 6579 (Table 6).The NMKL-method prescribes a pre-enrichment in BPW medium, followed by a selective enrichment in RVS medium and then plating out on XLD and a second medium of choice. The ISO method prescribes a pre-enrichment in BPV medium, followed by a selective enrichment in RVS and MKTTn media and an isolation on XLD and a second medium of choice. However, many laboratories modified the methods by excluding an enrichment step or a medium for isolation. Fifteen laboratories which indicated “other method” used in majority the same media. Table 6 presents the results obtained with different methods, and table 7 presents the results obtained with traditional methods using different combination of media.

PCR, VIDAS, ELISA and TECRA are based on different principles than the traditional culturing methods. However, enrichment step and confirmation of positive results by culture on selective media take also place in these methods.

Table 6. *Analysis of Salmonella. False negative results obtained with different methods for each mixture*

Methods of analysis	**No of method info**	**No. of false results**		
		A	**B**	**C**
NMKL 71	43	**6**	0	**1**
ISO 6579	33	**3**	**1**	**1**
NMKL 187	5	0	0	0
ISO 6579 D	2	0	0	0
Other methods	15	**2**	**1**	**1**
PCR	13	**1**	0	0
VIDAS	12	**1**	0	0
ELISA	3	0	0	0
TECRA	1	0	0	0
Several methods	9	0	0	0
All results [a]	128	13	2	3

[a] All results independent of method and medium. See Tables 3-4 and Appendix 1

- More false negative results were obtained for the mixture A. This can be due to the fact that the strain of *S.* agona used in the mixture A was more difficult to identify than the strain of *S.* bovismorbificans in mixture B/C.
- Most *Salmonella* spp. produce H_2S and do not ferment lactose. They form red colonies with black centre on XLD agar. However the strain of *S.* agona is H_2S negative and gives red colonies without black centre. Lactose positive strains as *S.* bovismorbificans in mixture B/C form red colonies with black centre on XLD agar.
- In order to detect the rare strains that are H_2S -negative all pink colonies with or without black centre on XLD should be considered as suspected *Salmonella*. In addition, it is advisable to choose a second medium that also allows for the detection of H_2S negative and lactose positive strains (Figure 4).
- Out of the 13 laboratories that reported false negative results for the mixture A, nine performed the analysis, with or without modifications, according to NMKL no 71 or ISO 6579 with plating out on XLD and BGA, Rambach, Önöz or another second medium of choice. But many laboratories excluded an enrichment step or an isolation medium (Table 7).

- In addition six false negative results were reported by laboratories that used PCR-, VIDAS- or other methods (Table 6).
- Two laboratories reported an enrichment in One broth and plating out on BriS, according to the alternative method "Salmonella Precis" validated by AFNOR (certificate reference n# 03/06). Both laboratories reported false negative results for the mixture B/C. It is unknown if (i) the background flora competed *Salmonella* in the enrichment step (18 hours at 42 °C), (ii) the strain formed atypical colonies on the plate or (iii) gave false result in the confirmation step.

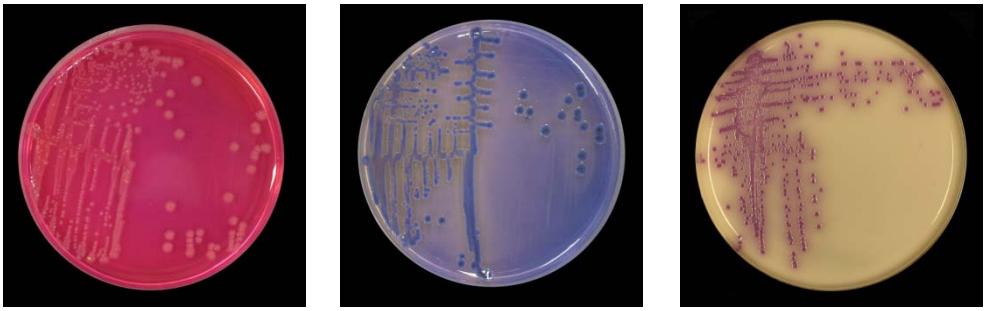


Figure 4. *Isolation of S. agona in mixture A on XLD, MLCB and BriS media at National Food Agency.*

Table 7. *Analysis of Salmonella. Results obtained with different choice of media.*

Choice of media		**No of**	**No. of false results**		
Enrichment	**Plating out**	**method info**	**A**	**B**	**C**
BPW, RVS/RV	XLD + second medium	19	**1**	0	0
BPW, RVS/RV + MKTTn	XLD+ second medium	16	**3**	0	0
BPW, RVS/RV + KTTn	XLD+ second medium	3	0	0	0
BPW, RV	XLD or second medium	3	0	0	0
BPW,RVS,MSRV	XLD+ second medium	1	0	0	0
BPW, MSRV	XLD+ second medium	7	0	0	0
BPW, MSRV	XLD or second medium	3	0	0	0
BPW	XLD + second medium	12	**2**	**1**	0
BPW	XLD or second medium	3	0	0	0
RVS/RV+ MKTTn	XLD + second medium	5	0	0	0
RVS/RV	XLD + second medium	12	**2**	0	0
RVS	XLD/XLT-4	4	**1**	0	0
LB, RV	XLD + second medium	2	**1**	0	0
One broth	Bri S	2	0	**2**	**2**

Outcome of the methods – analysis of *E. coli* O157

The majority of laboratories used the reference methods ISO 16654 or NMKL nr 164 (Table 8).These methods prescribe pre-enrichment in mTSB, immuno-magnetic separation followed by plating out on CT-SMAC and a second medium of choice.

Five laboratories used traditional methods for analysis of *E. coli* . These methods do not allow the specific detection of *E. coli* 0157 .

Table 8: *E. coli O157 analysis. False results obtained with different methods for each mixture.*

Methods of analysis	**No of method info**	**No. of false results**		
		A	**B**	**C**
ISO 16654/EB-SM-5036	13	1	1	3
NMKL 164	8	0	0	0
PCR	3	0	0	0
VIDAS	3	0	0	0
AOAC 996.09 VIP	2	0	1	1
Other method	1	0	0	0
Methods not intended for *E. coli* O 157	5	**5**	**4**	**3**
All results [a]	35	6	6	7

[a] All results independent of method and medium. See Tables 3-4 and Appendix 1

- Only the mixture B/C contained *E. coli* serotype O157.
- The mandatory reporting of method information shows that nearly all false positive results for mixture A and many false negative results for mixture B/C were obtained by the laboratories which did not use methods intended for the analysis of *E. coli* O157.
- In previous rounds, false results were explained by mixing up of values or samples, cross reaction or samples contamination. However, for those rounds, the method information was not complete; it is therefore impossible to know if part of those results were also method-dependent.

General outcome of the results- assessment

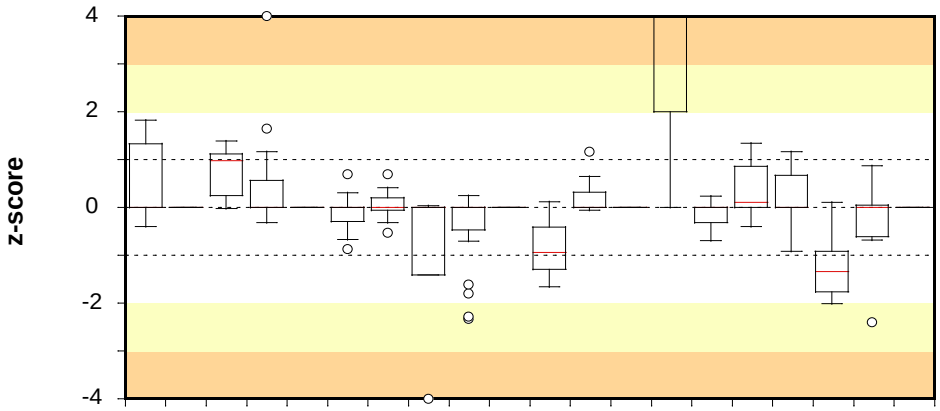
The reported results from all laboratories are listed in Appendix 1. A compilation of all the results from each laboratory – outliers included and false results excluded– is illustrated by a box plot (Figure 5) based on the z-scores listed in Appendix 2. Z-scores enable a good comparison of the results obtained by different laboratories. The smaller and the more centred round zero the box of a laboratory is, the closer are the results of this laboratory from the general mean values calculated for all laboratories results.

The laboratories are not grouped or ranked based on their results. However, for each laboratory, the number of false results and outliers are presented below the box plots. These results are also highlighted in Appendix 1, where the minimum and maximum accepted values for each analysis are stated.

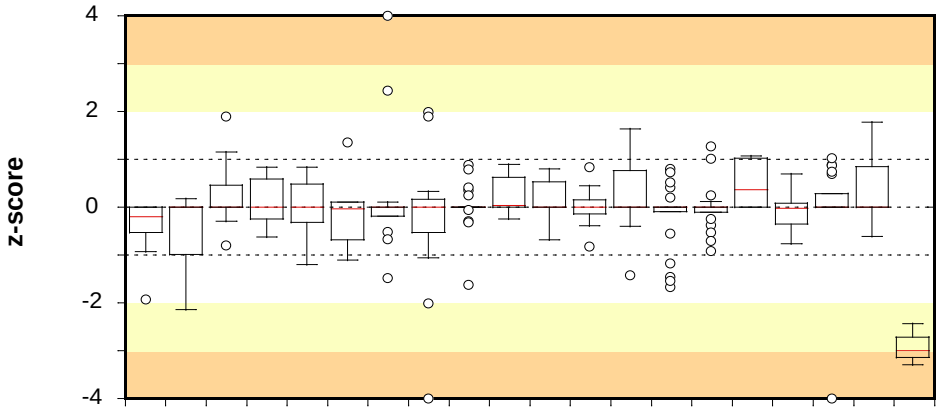
Information on the results processing and recommendations for follow- up are described in the Scheme Protocol (2). Samples for follow-up can be ordered, free of charge, by e-mail to PT-micro@slv.se.

Figure 5. *Box plots and number of deviating results for each laboratory.*

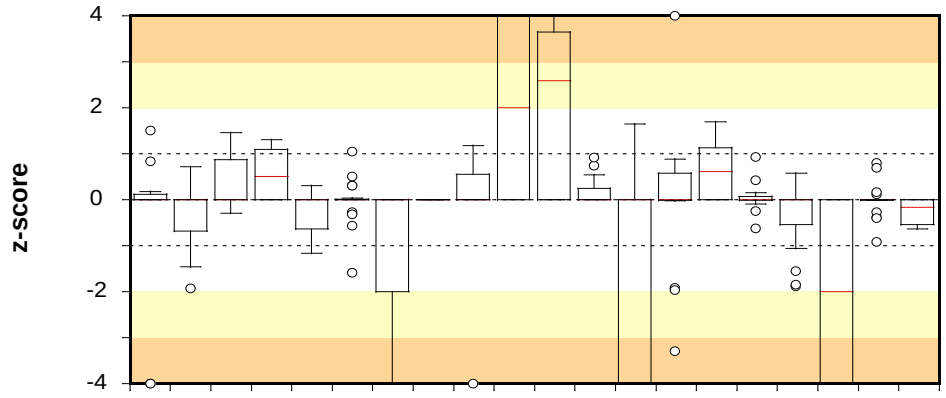
- *The plots are based on the laboratory results from all analyses transformed into z-scores calculated according to the formula: z = (x-m)/s, where x is the result of the individual laboratory, m is the mean of the results of all participating laboratories, and s is the standard deviation.*
- *For qualitative analysis, correct results are assigned a z-value of zero and are included in the "Number of results".*
- *The laboratory median value is illustrated by a horizontal red line in the box.*
- *The box includes 50% of a laboratory results (25 % of the results above the median and 25% of the results below the median). The remaining 50 % are illustrated by lines and circles outside the box.*
- *Very deviating results are represented by circles and are calculated as follow: the lowest result in the box − 1.5 × (the highest result in the box − the lowest result in the box) or the highest result in the box + 1.5 × (the highest result in the box − the lowest result in the box). Z-scores superior to +4 and inferior to −4 are positioned at +4 and−4, respectively, in the plot.*
- *The background is divided with lines and shaded fields to indicate ranges in order to simplify localisation of the laboratory results.*



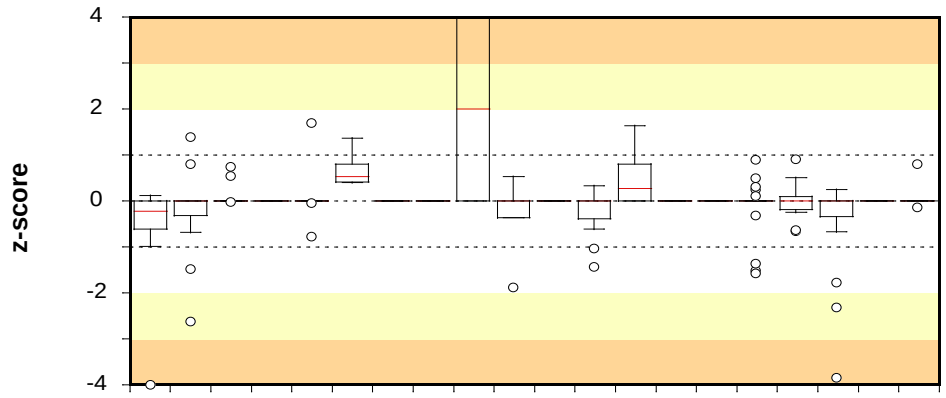
Lab no	1081	1254	1594	1970	2002	2035	2050	2058	2072	2151	2372	2386	2402	2459	2553	2637	2704	2720	2745	2757
No. of results	15	-	6	23	-	15	9	6	20	5	3	8	3	4	21	15	15	6	15	-
False positive	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-
False negative	-	-	-	1	-	-	-	-	1	1	-	1	-	1	-	-	-	-	-	-
Low outliers	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-
High outliers	-	-	-	1	-	-	-	-	-	-	-	-	-	3	-	-	-	-	-	-



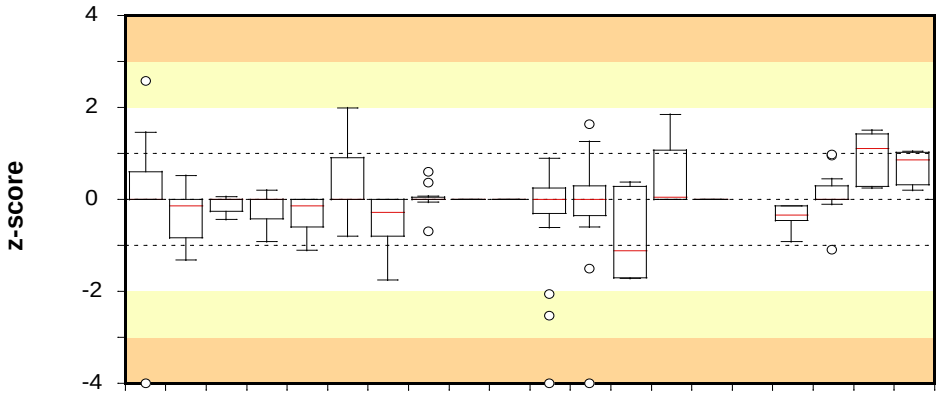
Lab no	2764	2842	2908	2920	3159	3188	3305	3327	3346	3457	3511	3588	3595	3626	3803	3925	4064	4153	4171	4246
No. of results	12	21	24	9	12	6	16	12	21	15	12	14	15	21	24	5	6	21	12	3
False positive	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
False negative	3	3	-	-	-	-	2	-	-	-	-	1	-	-	-	1	-	-	-	-
Low outliers	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	3	-	-
High outliers	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-



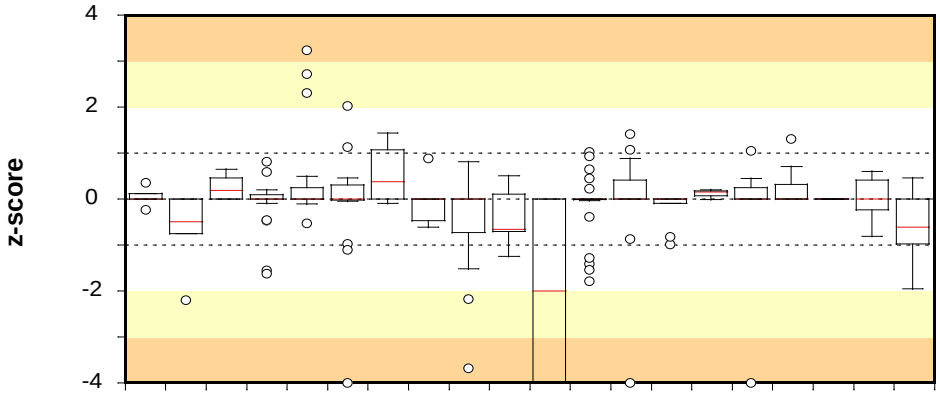
Lab no	4288	4339	4352	4353	4356	4562	4605	4635	4683	4689	4713	4817	4840	4889	4955	4980	5018	5100	5120	5188
No. of results	11	18	20	6	18	19	4	-	12	6	15	21	18	15	15	15	21	6	18	6
False positive	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
False negative	-	-	1	2	-	2	-	-	-	-	-	-	3	-	-	-	-	-	-	-
Low outliers	2	-	-	-	-	-	1	-	1	-	-	-	4	-	-	-	-	3	-	-
High outliers	-	-	-	-	-	-	-	-	-	3	4	-	-	1	-	-	-	-	-	-



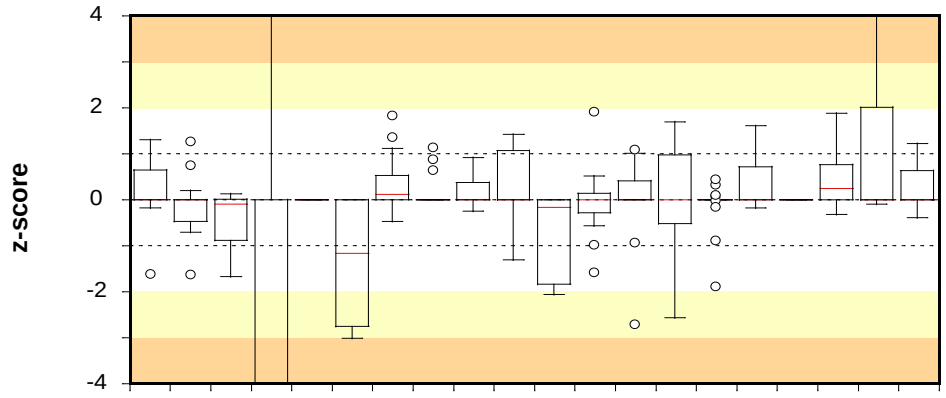
Lab no	5197	5204	5220	5221	5304	5329	5333	5342	5350	5447	5545	5553	5615	5647	5701	5774	5850	5883	5993	6109
No. of results	9	23	9	-	9	6	6	-	6	6	-	15	12	2	3	21	14	15	-	9
False positeve	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-
False negative	-	1	-	-	-	-	-	-	-	-	-	2	-	1	-	-	1	-	-	-
Low outliers	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-
High outliers	-	-	-	-	-	-	-	-	3	-	-	-	-	-	-	-	-	-	-	-



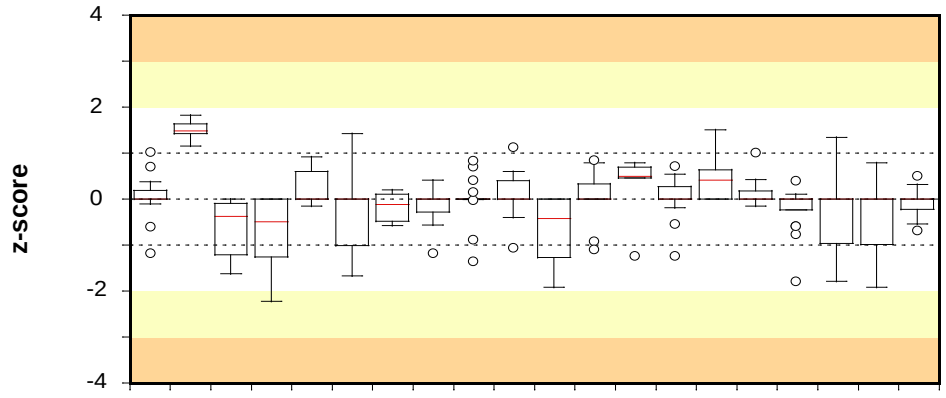
Lab no	6138	6232	6253	6343	6352	6368	6443	6456	6527	6594	6707	6751	6762	6860	6944	6971	7024	7096	7182	7207
No. of results	15	9	12	7	10	15	9	12	6	-	15	20	6	22	-	6	6	15	6	6
False positive	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-
False negative	-	-	-	2	1	-	-	-	-	-	-	1	-	2	-	-	-	-	2	-
Low outliers	3	-	-	-	-	-	-	-	-	-	1	1	-	-	-	6	-	-	-	-
High outliers	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-



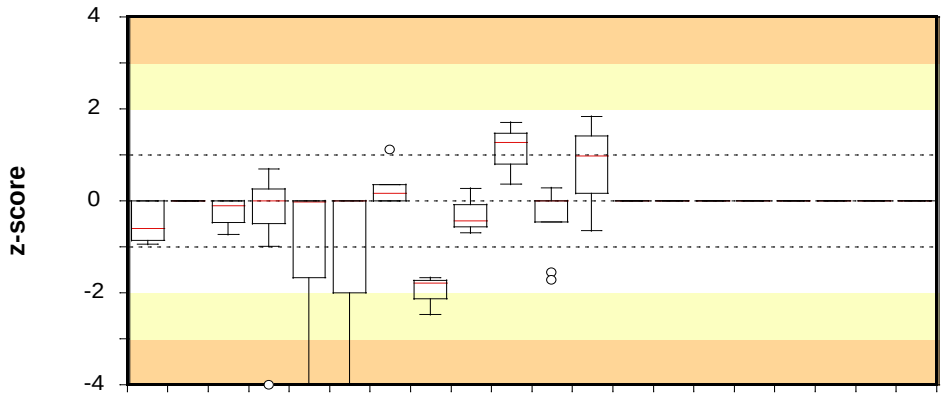
Lab no	7232	7242	7244	7248	7253	7282	7330	7334	7438	7449	7543	7564	7596	7627	7631	7688	7728	7762	7793	7825
No. of results	6	6	6	21	15	15	9	6	24	6	6	24	14	9	3	21	12	3	9	12
False positive	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
False negative	-	3	-	-	-	-	-	-	-	-	6	-	-	-	-	-	-	-	-	-
Low outliers	-	-	-	-	-	1	-	-	-	-	3	-	2	-	-	3	-	-	-	-
High outliers	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-



Lab no	7876	7930	7940	7946	7962	8066	8068	8165	8255	8260	8313	8333	8380	8397	8428	8435	8528	8529	8568	8626
No. of results	15	15	3	8	-	6	15	15	15	14	12	12	18	12	20	12	2	15	12	12
False positive	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
False negative	-	-	-	1	-	6	-	-	-	1	-	-	-	-	1	-	1	-	-	-
Low outliers	-	-	-	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
High outliers	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-



Lab no	8628	8657	8734	8742	8756	8766	8865	8918	8955	9002	9034	9051	9245	9359	9420	9429	9436	9441	9451	9453
No. of results	15	6	8	14	9	15	6	12	18	15	12	12	6	15	9	15	18	15	13	12
False positive	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-
False negative	-	-	1	1	-	-	2	-	-	-	-	-	-	-	-	-	-	-	2	-
Low outliers	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
High outliers	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-



Lab no	9465	9512	9555	9569	9589	9655	9716	9747	9783	9890	9903	9950
No. of results	10	-	9	15	18	12	6	3	3	6	9	3
False positive	-	-	-	-	-	-	-	-	-	-	-	-
False negative	2	-	-	-	-	-	-	-	-	-	-	-
Low outliers	-	-	-	3	3	3	-	-	-	-	-	-
High outliers	-	-	-	-	-	-	-	-	-	-	-	-

References

1. Peterz. M. Steneryd. A.C. 1993. Freeze-dried mixed cultures as reference samples in quantitative and qualitative microbiological examinations of food. J. Appl. Bacteriol. 74:143-148.
2. Anonymous, 2007. Protocol. Microbiology. Drinking Water & Food. The National Food Administration.
3. Kelly, K. 1990. Outlier detection in collaborative studies. J. Assoc. Off. Anal. Chem. 73:58 – 64. 1.

Appendix 1.

Results from the participating laboratories.

All results are expressed in log_{10} cfu per ml sample.

Results reported as "< value" have been regarded as zero (negative).

Results reported as "> value" are exluded in the calculations.

A dash in the table indicates that the analysis was not performed.

Outliers and false results are highlighted and counted for each analysis in the end of the table.

Lab no.	Sample			Aerobic microorganisms			Enterobacteriaceae			Campylobacter						*Listeria monocytogenes*						Salmonella			*E. coli* O157			Lab no.
										Quantitative			Qualitative			Quantitative			Qualitative									
	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	D	
1081	2	1	3	4.9	4.95	4.93	4.86	4.91	4.84	-	-	-	-	-	-	2.72	2.58	2.88	Pos	Pos	Pos	Pos	Pos	Pos	-	-	-	1081
1254	2	1	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1254
1594	1	3	2	4.81	4.85	4.83	4.72	4.82	4.77	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1594
1970	1	3	2	4.97	4.57	4.52	4.79	4.57	4.6	0.7	2.65	2.36	**Neg**	Pos	Pos	**3.2**	2.72	2.76	Pos	Pos	Pos	Pos	Pos	Pos	Neg	Pos	Pos	1970
2002	2	3	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2002
2035	3	1	2	-	-	-	4.6	4.6	4.4	-	-	-	Pos	Pos	Pos	2.7	2.7	2.5	Pos	Pos	Pos	Pos	Pos	Pos	-	-	-	2035
2050	2	1	3	4.84	4.7	4.47	4.64	4.68	4.54	-	-	-	-	-	-	-	-	-	-	-	-	Pos	Pos	Pos	-	-	-	2050
2058	2	1	3	-	-	-	-	-	-	-	-	-	-	-	-	2.62	2.61	**1.5**	Pos	Pos	Pos	-	-	-	-	-	-	2058
2072	1	3	2	4.5	4.56	4.65	4.36	4.51	4.6	**<1**	1.79	1.78	Pos	Pos	Pos	2.69	2.62	2.64	Pos	Pos	Pos	Pos	Pos	Pos	-	-	-	2072
2151	1	2	3	-	-	-	-	-	-	-	-	-	**Neg**	Pos	Pos	-	-	-	-	-	-	Pos	Pos	Pos	-	-	-	2151
2372	3	1	2	4.59	4.41	4.62	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2372
2386	1	3	2	4.97	4.75	4.58	-	-	-	-	-	-	-	-	-	-	-	-	Pos	Pos	Pos	**Neg**	Pos	Pos	-	-	-	2386
2402	1	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Pos	Pos	Pos	-	-	-	2402
2459	2	1	3	**6.03**	**5.96**	**5.89**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**Pos**	**Neg**	Pos	2459
2553	3	2	1	4.72	4.62	4.47	4.63	4.53	4.47	-	-	-	Pos	Pos	Pos	2.71	2.56	2.66	Pos	Pos	Pos	Pos	Pos	Pos	Neg	Pos	Pos	2553
2637	3	1	2	4.89	4.79	4.81	4.81	4.81	4.76	-	-	-	-	-	-	2.72	2.62	2.72	Pos	Pos	Pos	Pos	Pos	Pos	-	-	-	2637
2704	1	3	2	4.69	4.86	4.82	4.65	4.71	4.77	-	-	-	-	-	-	2.81	2.62	2.67	Pos	Pos	Pos	Pos	Pos	Pos	-	-	-	2704
2720	1	2	3	4.69	4.18	4.25	4.7	4.18	4.27	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2720
2745	1	2	3	4.85	4.48	4.45	4.81	4.4	4	-	-	-	-	-	-	2.77	2.66	2.53	Pos	Pos	Pos	Pos	Pos	Pos	-	-	-	2745
2757	1	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2757
2764	3	2	1	4.76	4.52	4.45	4.41	4.45	4.34	-	-	-	-	-	-	-	-	-	Pos	**Neg**	**Neg**	Pos	Pos	Pos	Neg	Pos	**Neg**	2764
2842	2	3	1	4.62	4.4	4.18	4.38	4.34	4.11	**<1**	2.18	2.18	**Neg**	Pos	Pos	2.65	2.63	2.64	Pos	Pos	Pos	Pos	Pos	Pos	Neg	Pos	**Neg**	2842
2908	2	3	1	4.89	4.85	5.04	4.85	4.76	4.68	0.6	2.04	2.18	Pos	Pos	Pos	2.74	2.63	2.68	Pos	Pos	Pos	Pos	Pos	Pos	Neg	Pos	Pos	2908
2920	1	2	3	4.78	4.79	4.51	4.77	4.67	4.41	-	-	-	-	-	-	-	-	-	-	-	-	Pos	Pos	Pos	-	-	-	2920
3159	3	2	1	4.9	4.79	4.31	4.71	4.67	4.43	-	-	-	-	-	-	2.72	2.65	2.59	Pos	Pos	Pos	-	-	-	-	-	-	3159
3188	3	2	1	4.8	4.9	4.6	4.7	4.4	4.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3188
3305	1	2	3	4.8	4.5	**5.9**	4.7	4.5	4.4	-	-	-	**Neg**	Pos	Pos	3	2.4	2.6	Pos	Pos	Pos	**Neg**	Pos	Pos	-	-	-	3305
3327	3	2	1	4.67	4.18	4.67	-	-	-	-	-	-	-	-	-	**1.75**	2.88	2.9	Pos	Pos	Pos	Pos	Pos	Pos	-	-	-	3327
3346	2	3	1	4.86	4.8	4.69	4.72	4.7	4.54	-	-	-	Pos	Pos	Pos	2.73	2.38	2.58	Pos	Pos	Pos	Pos	Pos	Pos	Neg	Pos	Pos	3346
3457	1	3	2	4.78	4.74	4.8	4.71	4.72	4.73	-	-	-	-	-	-	2.8	2.61	2.72	Pos	Pos	Pos	Pos	Pos	Pos	-	-	-	3457
3511	3	1	2	-	-	-	4.8	4.4	4.52	-	-	-	-	-	-	2.82	2.67	2.71	Pos	Pos	Pos	Pos	Pos	Pos	-	-	-	3511
m				4.81	4.61	4.59	4.69	4.54	4.55	0.74	2.24	2.24	pos	pos	pos	2.76	2.6	2.63	pos	pos	pos	pos	pos	pos	neg	pos	pos	m
s				0.134	0.21	0.24	0.14	0.2	0.23	0.49	0.25	0.29	-	-	-	0.09	0.14	0.15	-	-	-	-	-	-	-	-	-	s

Lab no.	Sample			Aerobic microorganisms			Enterobacteriaceae			Campylobacter						*Listeria monocytogenes*						Salmonella			*E. coli* O157			Lab no.
										Quantitative			Qualitative			Quantitative			Qualitative									
	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	D	
3588	3	1	2	4.76	4.58	4.4	4.66	4.54	4.59	-	-	-	-	-	-	2.79	2.72	2.69	Pos	Pos	Pos	**Neg**	Pos	Pos	-	-	-	3588
3595	1	2	3	4.96	4.67	4.85	4.79	4.7	4.93	-	-	-	-	-	-	2.83	2.55	2.42	Pos	Pos	Pos	Pos	Pos	Pos	-	-	-	3595
3626	1	2	3	4.8	4.3	4.2	4.8	4.3	4.2	1.1	2.1	2.3	Pos	Pos	Pos	2.8	2.6	2.7	Pos	Pos	Pos	Pos	Pos	Pos	-	-	-	3626
3803	2	3	1	4.8	4.53	4.62	4.61	4.54	4.61	0.3	2.49	2.61	Pos	Pos	Pos	2.69	2.57	2.61	Pos	Pos	Pos	Pos	Pos	Pos	Neg	Pos	Pos	3803
3925	2	3	1	4.95	4.84	4.68	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**Neg**	Pos	Pos	-	-	-	3925
4064	3	2	1	4.71	4.63	4.51	4.67	4.68	4.57	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4064
4153	2	1	3	4.85	4.76	4.8	4.81	4.69	4.79	-	-	-	Pos	Pos	Pos	**1.86**	**1.62**	**1.71**	Pos	Pos	Pos	Pos	Pos	Pos	Neg	Pos	Pos	4153
4171	1	3	2	4.92	4.48	4.56	4.94	4.77	4.76	-	-	-	-	-	-	-	-	-	-	-	-	Pos	Pos	Pos	Neg	Pos	Pos	4171
4246	2	1	3	4.37	3.97	4.02	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4246
4288	2	3	1	4.82	**3.13**	4.79	4.71	**3.29**	4.9	-	-	-	-	-	-	-	-	-	Pos	Pos	Pos	-	Pos	Pos	-	-	-	4288
4339	1	2	3	4.65	4.3	4.76	4.41	4.4	4.72	-	-	-	Pos	Pos	Pos	2.73	2.64	2.51	Pos	Pos	Pos	Pos	Pos	Pos	-	-	-	4339
4352	1	3	2	5	4.84	4.9	4.83	4.67	4.89	-	-	-	Pos	Pos	Pos	2.73	2.58	2.73	Pos	Pos	Pos	**Neg**	Pos	Pos	Neg	Pos	Pos	4352
4353	1	2	3	4.96	4.89	4.83	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Pos	Pos	Pos	**Pos**	**Neg**	**Neg**	4353
4356	3	2	1	4.84	4.43	4.32	4.64	4.41	4.32	-	-	-	Pos	Pos	Pos	2.79	2.53	2.52	Pos	Pos	Pos	Pos	Pos	Pos	-	-	-	4356
4562	2	1	3	4.6	4.49	4.53	4.64	4.6	4.67	-	-	-	Pos	**Neg**	**Neg**	2.79	2.75	2.63	Pos	Pos	Pos	Pos	Pos	Pos	Neg	Pos	Pos	4562
4605	3	2	1	-	-	-	**1.11**	**>30**	**>30**	-	-	-	-	-	-	-	-	-	-	-	-	Pos	Pos	Pos	-	-	-	4605
4635	3	1	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4635
4683	3	2	1	4.86	4.78	4.87	**3.83**	4.58	4.73	-	-	-	-	-	-	-	-	-	Pos	Pos	Pos	Pos	Pos	Pos	-	-	-	4683
4689	2	1	3	-	-	-	**5.65**	**5.8**	**5.71**	-	-	-	-	-	-	-	-	-	-	-	-	Pos	Pos	Pos	-	-	-	4689
4713	1	3	2	**5.34**	5.33	5.3	4.93	**5.36**	5.15	-	-	-	-	-	-	**3.26**	**3.3**	3.04	Pos	Pos	Pos	Pos	Pos	Pos	-	-	-	4713
4817	3	1	2	4.86	4.72	4.63	4.72	4.69	4.57	-	-	-	Pos	Pos	Pos	2.85	2.68	2.65	Pos	Pos	Pos	Pos	Pos	Pos	Neg	Pos	Pos	4817
4840	3	2	1	**3.8**	**3.68**	3.82	**3.62**	3.66	**3.48**	**<1**	2.65	2.6	**Neg**	Pos	Pos	2.56	2.64	2.48	Pos	Pos	Pos	**Neg**	Pos	Pos	-	-	-	4840
4889	3	1	2	4.81	4.74	4.8	**7.8**	4.65	4.75	-	-	-	-	-	-	2.57	2.15	2.34	Pos	Pos	Pos	Pos	Pos	Pos	-	-	-	4889
4955	1	2	3	5.04	4.75	4.86	4.88	4.77	4.75	-	-	-	-	-	-	2.82	2.76	2.66	Pos	Pos	Pos	Pos	Pos	Pos	-	-	-	4955
4980	2	1	3	4.87	4.81	4.57	4.65	4.57	4.41	-	-	-	-	-	-	2.77	2.6	2.63	Pos	Pos	Pos	Pos	Pos	Pos	-	-	-	4980
5018	1	2	3	4.67	4.28	4.15	4.56	4.43	4.13	-	-	-	Pos	Pos	Pos	2.81	2.66	2.71	Pos	Pos	Pos	Pos	Pos	Pos	Neg	Pos	Pos	5018
5100	3	1	2	**2.8**	**3**	**2.95**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Pos	Pos	Pos	-	-	-	5100
5120	2	3	1	4.69	4.61	4.62	4.8	4.46	4.49	-	-	-	Pos	Pos	Pos	2.72	2.7	2.65	Pos	Pos	Pos	Pos	Pos	Pos	-	-	-	5120
5188	1	2	3	-	-	-	-	-	-	0.48	2.08	2.15	Pos	Pos	Pos	-	-	-	-	-	-	-	-	-	-	-	-	5188
5197	2	3	1	4.68	4.48	4.54	**3.89**	4.42	4.58	-	-	-	-	-	-	-	-	-	-	-	-	Pos	Pos	Pos	-	-	-	5197
5204	3	1	2	5	4.6	4.5	4.8	4.4	4.5	**<1**	2.1	2.1	Pos	Pos	Pos	2.5	2.4	2.6	Pos	Pos	Pos	Pos	Pos	Pos	Neg	Pos	Pos	5204
5220	3	1	2	4.81	4.77	4.72	-	-	-	-	-	-	-	-	-	-	-	-	Pos	Pos	Pos	Pos	Pos	Pos	-	-	-	5220
5221	3	2	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5221
5304	3	2	1	5.04	4.6	4.41	-	-	-	-	-	-	-	-	-	-	-	-	Pos	Pos	Pos	Pos	Pos	Pos	-	-	-	5304
5329	3	1	2	4.92	4.71	4.69	4.88	4.62	4.69	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5329
5333	1	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Pos	Pos	Pos	Pos	Pos	Pos	-	-	-	5333
5342	1	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5342
5350	3	2	1	**6.03**	**5.77**	**5.83**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Pos	Pos	Pos	-	-	-	5350
5447	1	2	3	-	-	-	-	-	-	1	2.15	1.7	Pos	Pos	Pos	-	-	-	-	-	-	-	-	-	-	-	-	5447
5545	1	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5545
5553	2	1	3	4.62	4.48	4.35	-	-	-	-	-	-	Pos	Pos	Pos	2.7	2.65	2.6	Pos	Pos	Pos	Pos	Pos	Pos	**Pos**	**Neg**	**Neg**	5553
5615	2	1	3	5	4.76	4.8	4.92	4.65	4.72	-	-	-	-	-	-	-	-	-	Pos	Pos	Pos	Pos	Pos	Pos	-	-	-	5615
m				4.81	4.61	4.59	4.69	4.54	4.55	0.74	2.24	2.24	pos	pos	pos	2.76	2.6	2.63	pos	pos	pos	pos	pos	pos	neg	pos	pos	m
s				0.134	0.21	0.24	0.14	0.2	0.23	0.49	0.25	0.29	-	-	-	0.09	0.14	0.15	-	-	-	-	-	-	-	-	-	s

Lab no.	Sample			Aerobic microorganisms			Enterobacteriaceae			Campylobacter						*Listeria monocytogenes*						Salmonella			*E. coli* O157			Lab no.
										Quantitative			Qualitative			Quantitative			Qualitative									
	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	D	
5647	3	1	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**Neg**	Pos	Pos	-	-	-	5647
5701	3	2	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Pos	Pos	Pos	-	-	-	5701
5774	1	2	3	-	-	-	4.72	4.64	4.76	0.01	1.9	1.79	Pos	Pos	Pos	2.79	2.62	2.58	Pos	Pos	Pos	Pos	Pos	Pos	Neg	Pos	Pos	5774
5850	3	2	1	4.88	4.47	4.55	-	-	-	**<1**	2.08	2.27	-	-	-	2.8	2.73	2.59	Pos	Pos	Pos	Pos	Pos	Pos	-	-	-	5850
5883	1	2	3	4.81	4.66	4.65	4.59	4.58	4.55	-	-	-	-	-	-	**2.38**	2.36	2.29	Pos	Pos	Pos	Pos	Pos	Pos	-	-	-	5883
5993	1	2	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5993
6109	2	1	3	4.92	4.58	4.56	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Pos	Pos	Pos	Neg	Pos	Pos	6109
6138	2	1	3	5.16	4.72	4.91	4.75	4.68	4.89	-	-	-	-	-	-	**1.6**	**1.4**	**1.62**	Pos	Pos	Pos	Pos	Pos	Pos	-	-	-	6138
6232	1	2	3	4.7	4.33	4.56	4.76	4.32	4.43	-	-	-	-	-	-	-	-	-	-	-	-	Pos	Pos	Pos	-	-	-	6232
6253	3	1	2	4.82	4.52	4.49	4.64	4.54	4.51	-	-	-	-	-	-	-	-	-	Pos	Pos	Pos	Pos	Pos	Pos	-	-	-	6253
6343	2	3	1	4.69	4.43	4.64	-	-	-	-	-	-	-	-	-	-	-	-	Pos	Pos	**Neg**	**Neg**	Pos	Pos	-	-	-	6343
6352	2	3	1	4.8	4.55	4.4	4.6	4.5	4.3	-	-	-	-	-	-	-	-	-	-	-	-	Pos	Pos	**Neg**	**Pos**	Pos	Pos	6352
6368	2	3	1	5.08	4.82	4.59	4.93	4.71	4.56	-	-	-	-	-	-	2.86	2.52	2.51	Pos	Pos	Pos	Pos	Pos	Pos	-	-	-	6368
6443	2	3	1	4.7	4.55	4.18	4.59	4.51	4.37	-	-	-	-	-	-	-	-	-	-	-	-	Pos	Pos	Pos	-	-	-	6443
6456	1	2	3	4.72	4.69	4.61	4.69	4.66	4.54	-	-	-	-	-	-	-	-	-	Pos	Pos	Pos	Pos	Pos	Pos	-	-	-	6456
6527	2	1	3	-	-	-	-	-	-	-	-	-	Pos	Pos	Pos	-	-	-	-	-	-	Pos	Pos	Pos	-	-	-	6527
6594	3	2	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6594
6707	3	2	1	4.73	4.72	4.65	4.72	4.72	4.63	-	-	-	-	-	-	**1.3**	2.32	2.26	Pos	Pos	Pos	Pos	Pos	Pos	-	-	-	6707
6751	3	2	1	4.61	4.74	4.89	**4.08**	4.69	4.76	1.54	-	2.15	Pos	Pos	Pos	2.7	2.54	2.57	Pos	Pos	Pos	**Neg**	Pos	Pos	Neg	-	-	6751
6762	2	1	3	4.85	4.42	4.28	4.74	4.19	4.16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6762
6860	3	1	2	5.06	4.74	4.9	4.95	4.72	4.8	**<0.1**	2.52	2.71	**Neg**	Pos	Pos	2.77	2.72	2.75	Pos	Pos	Pos	Pos	Pos	Pos	Neg	Pos	Pos	6860
6944	1	2	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6944
6971	2	3	1	**1.68**	**2.16**	**2.13**	**1.79**	**1.6**	**2.24**	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6971
7024	1	2	3	4.69	4.58	4.53	4.62	4.51	4.46	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7024
7096	2	1	3	4.94	4.82	4.61	4.53	4.63	4.62	-	-	-	-	-	-	2.77	2.59	2.67	Pos	Pos	Pos	Pos	Pos	Pos	-	-	-	7096
7182	1	2	3	4.85	4.82	4.93	4.72	4.79	4.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**Pos**	**Neg**	**Neg**	7182
7207	3	2	1	4.84	4.83	4.84	4.73	4.73	4.73	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7207
7232	2	1	3	4.86	4.64	4.54	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Pos	Pos	Pos	-	-	-	7232
7242	3	1	2	4.71	**0**	4.44	4.37	**0**	4.48	-	-	-	-	-	-	-	-	-	Pos	**Neg**	Pos	-	-	-	-	-	-	7242
7244	3	1	2	4.9	4.69	4.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Pos	Pos	Pos	-	-	-	7244
7248	2	1	3	4.75	4.28	4.57	4.62	4.21	4.58	1.03	2.29	2.27	Pos	Pos	Pos	2.84	2.62	2.64	Pos	Pos	Pos	Pos	Pos	Pos	-	-	-	7248
7253	2	3	1	-	-	-	4.61	4.64	4.53	-	-	-	Pos	Pos	Pos	**3.08**	2.98	2.96	Pos	Pos	Pos	Pos	Pos	Pos	-	-	-	7253
7282	3	1	2	4.84	4.6	4.7	**4.08**	4.34	4.3	-	-	-	-	-	-	2.96	2.66	2.79	Pos	Pos	Pos	Pos	Pos	Pos	-	-	-	7282
7330	2	1	3	4.8	4.85	4.8	4.74	4.83	4.8	-	-	-	-	-	-	-	-	-	-	-	-	Pos	Pos	Pos	-	-	-	7330
7334	2	3	1	4.75	4.48	4.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Pos	Pos	Pos	-	-	-	7334
7438	3	1	2	4.52	4.35	4.35	4.16	4.43	4.34	0.01	2.24	2.19	Pos	Pos	Pos	2.84	2.63	2.63	Pos	Pos	Pos	Pos	Pos	Pos	Neg	Pos	Pos	7438
7449	3	2	1	4.88	4.46	4.3	4.7	4.4	4.41	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7449
7543	3	1	2	**1.98**	**2.01**	**1.98**	-	-	-	-	-	-	-	-	-	-	-	-	**Neg**	**Neg**	**Neg**	**Neg**	Pos	Pos	Neg	**Neg**	**Neg**	7543
7564	3	2	1	4.76	4.23	4.26	4.75	4.28	4.2	0.85	2.4	2.54	Pos	Pos	Pos	2.76	2.6	2.76	Pos	Pos	Pos	Pos	Pos	Pos	Neg	Pos	Pos	7564
7596	3	1	2	**4**	-	4.8	**4**	4.6	4.8	-	-	-	-	-	-	2.8	2.8	2.5	Pos	Pos	Pos	Pos	Pos	Pos	-	-	-	7596
7627	1	3	2	4.8	4.4	4.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Pos	Pos	Pos	Neg	Pos	Pos	7627
7631	1	3	2	4.84	4.61	4.63	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7631
m				4.81	4.61	4.59	4.69	4.54	4.55	0.74	2.24	2.24	pos	pos	pos	2.76	2.6	2.63	pos	pos	pos	pos	pos	pos	neg	pos	pos	m
s				0.134	0.21	0.24	0.14	0.2	0.23	0.49	0.25	0.29	-	-	-	0.09	0.14	0.15	-	-	-	-	-	-	-	-	-	s

Lab no.	Sample			Aerobic microorganisms			Enterobacteriaceae			Campylobacter						*Listeria monocytogenes*						Salmonella			*E. coli* O157			Lab no.
										Quantitative			Qualitative			Quantitative			Qualitative									
	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	D	
7688	3	2	1	4.86	4.67	4.65	4.75	4.75	4.65	-	-	-	Pos	Pos	Pos	**1.82**	**1.56**	**1.54**	Pos	Pos	Pos	Pos	Pos	Pos	Neg	Pos	Pos	7688
7728	2	1	3	4.9	4.89	4.76	-	-	-	-	-	-	Pos	Pos	Pos	-	-	-	Pos	Pos	Pos	Pos	Pos	Pos	-	-	-	7728
7762	3	1	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Pos	Pos	Pos	-	-	-	7762
7793	2	3	1	4.78	4.74	4.69	4.57	4.65	4.5	-	-	-	-	-	-	-	-	-	-	-	-	Pos	Pos	Pos	-	-	-	7793
7825	2	3	1	4.87	4.31	4.4	4.74	4.35	4.33	-	-	-	-	-	-	2.72	2.47	2.34	Pos	Pos	Pos	-	-	-	-	-	-	7825
7876	1	2	3	4.9	4.8	4.9	4.7	4.7	4.7	-	-	-	-	-	-	2.6	2.6	2.6	Pos	Pos	Pos	Pos	Pos	Pos	-	-	-	7876
7930	3	2	1	4.84	4.58	4.77	4.59	4.43	4.46	-	-	-	-	-	-	2.69	2.78	2.39	Pos	Pos	Pos	Pos	Pos	Pos	-	-	-	7930
7940	1	3	2	4.83	4.59	4.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7940
7946	3	2	1	**7.3**	**2.9**	**3.1**	**2.33**	**2.77**	**2.2**	-	-	-	-	-	-	-	-	-	Pos	Pos	**Neg**	-	-	-	-	-	-	7946
7962	3	1	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7962
8066	1	3	2	-	-	-	4.51	3.98	3.86	-	-	-	-	-	-	2.65	**0**	**0**	Pos	**Neg**	**Neg**	Pos	**Neg**	**Neg**	-	-	-	8066
8068	1	2	3	5.06	4.85	4.69	4.88	4.67	4.58	-	-	-	-	-	-	2.78	2.54	2.66	Pos	Pos	Pos	Pos	Pos	Pos	-	-	-	8068
8165	3	1	2	-	-	-	-	-	-	1.3	2.4	2.5	Pos	Pos	Pos	-	-	-	Pos	Pos	Pos	Pos	Pos	Pos	Neg	Pos	Pos	8165
8255	3	2	1	4.79	4.56	4.75	4.7	4.64	4.71	-	-	-	-	-	-	2.85	2.64	2.59	Pos	Pos	Pos	Pos	Pos	Pos	-	-	-	8255
8260	2	1	3	4.8	4.8	4.9	4.5	4.7	4.8	-	-	-	-	-	-	2.9	2.6	2.8	Pos	Pos	Pos	**Neg**	Pos	Pos	-	-	-	8260
8313	1	3	2	4.77	4.17	4.11	4.43	4.19	4.12	-	-	-	-	-	-	-	-	-	Pos	Pos	Pos	Pos	Pos	Pos	-	-	-	8313
8333	3	2	1	5.07	4.67	4.46	4.76	4.34	4.19	-	-	-	-	-	-	-	-	-	-	-	-	Pos	Pos	Pos	Neg	Pos	Pos	8333
8380	2	1	3	4.96	4.66	4.85	4.83	4.54	4.71	-	-	-	Pos	Pos	Pos	2.8	2.23	2.49	Pos	Pos	Pos	Pos	Pos	Pos	-	-	-	8380
8397	2	3	1	5.04	4.84	4.56	4.84	4.72	4.43	-	-	-	-	-	-	2.71	2.25	2.45	Pos	Pos	Pos	-	-	-	-	-	-	8397
8428	2	1	3	4.56	4.63	4.59	4.56	4.56	4.52	-	-	-	**Neg**	Pos	Pos	2.76	2.65	2.69	Pos	Pos	Pos	Pos	Pos	Pos	Neg	Pos	Pos	8428
8435	1	2	3	5.03	4.72	4.81	4.66	4.64	4.86	-	-	-	-	-	-	-	-	-	Pos	Pos	Pos	Pos	Pos	Pos	-	-	-	8435
8528	1	2	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**Neg**	Pos	Pos	-	-	-	8528
8529	3	1	2	4.77	4.87	4.81	4.72	4.92	4.78	-	-	-	-	-	-	2.82	2.68	2.7	Pos	Pos	Pos	Pos	Pos	Pos	-	-	-	8529
8568	3	1	2	4.8	4.7	4.98	**5.59**	**5.44**	5.1	-	-	-	-	-	-	-	-	-	-	-	-	Pos	Pos	Pos	Neg	Pos	Pos	8568
8626	2	1	3	4.91	4.6	4.8	4.86	4.46	4.68	-	-	-	-	-	-	-	-	-	Pos	Pos	Pos	Pos	Pos	Pos	-	-	-	8626
8628	2	1	3	4.95	4.64	4.76	4.74	4.3	4.61	-	-	-	-	-	-	2.7	2.61	2.61	Pos	Pos	Pos	Pos	Pos	Pos	-	-	-	8628
8657	1	2	3	5.01	4.96	4.93	4.85	4.91	4.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8657
8734	1	2	3	4.77	4.52	4.23	4.66	4.36	4.18	-	-	-	-	-	-	-	-	-	Pos	**Neg**	Pos	-	-	-	-	-	-	8734
8742	1	3	2	4.63	4.48	4.28	4.62	4.45	4.43	-	-	-	-	-	-	2.54	2.43	2.48	Pos	Pos	Pos	**Neg**	Pos	Pos	-	-	-	8742
8756	2	1	3	4.86	4.78	4.81	4.67	4.66	4.52	-	-	-	-	-	-	-	-	-	-	-	-	Pos	Pos	Pos	-	-	-	8756
8766	3	1	2	4.7	4.3	4.2	4.6	4.3	4.2	-	-	-	-	-	-	2.9	2.6	2.7	Pos	Pos	Pos	Pos	Pos	Pos	-	-	-	8766
8865	1	2	3	4.84	4.59	4.48	4.7	4.51	4.42	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**Pos**	**Neg**	**Neg**	8865
8918	3	2	1	4.76	4.36	4.46	-	-	-	-	-	-	-	-	-	2.8	2.58	2.61	Pos	Pos	Pos	Pos	Pos	Pos	-	-	-	8918
8955	1	3	2	4.81	4.61	4.76	4.56	4.57	4.65	-	-	-	Pos	Pos	Pos	2.76	2.72	2.43	Pos	Pos	Pos	Pos	Pos	Pos	-	-	-	8955
9002	1	2	3	4.67	4.7	4.63	4.74	4.66	4.63	-	-	-	-	-	-	2.72	2.67	2.79	Pos	Pos	Pos	Pos	Pos	Pos	-	-	-	9002
9034	3	1	2	4.7	4.2	4.3	4.5	4.2	4.3	-	-	-	-	-	-	-	-	-	Pos	Pos	Pos	Pos	Pos	Pos	-	-	-	9034
9051	3	2	1	4.69	4.78	4.66	4.53	4.71	4.64	-	-	-	-	-	-	-	-	-	Pos	Pos	Pos	Pos	Pos	Pos	-	-	-	9051
9245	3	2	1	4.88	4.78	4.71	4.51	4.68	4.66	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	9245
9359	1	3	2	4.74	4.72	4.72	4.51	4.6	4.51	-	-	-	-	-	-	2.83	2.62	2.66	Pos	Pos	Pos	Pos	Pos	Pos	-	-	-	9359
9420	1	3	2	4.92	4.7	4.71	4.9	4.61	4.7	-	-	-	-	-	-	-	-	-	-	-	-	Pos	Pos	Pos	-	-	-	9420
9429	1	2	3	4.87	4.63	4.64	4.83	4.57	4.52	-	-	-	-	-	-	2.76	2.64	2.61	Pos	Pos	Pos	Pos	Pos	Pos	-	-	-	9429
9436	2	1	3	4.71	4.59	4.6	4.43	4.42	4.5	-	-	-	-	-	-	2.77	2.66	2.54	Pos	Pos	Pos	Pos	Pos	Pos	Neg	Pos	Pos	9436
m				4.81	4.61	4.59	4.69	4.54	4.55	0.74	2.24	2.24	pos	pos	pos	2.76	2.6	2.63	pos	pos	pos	pos	pos	pos	neg	pos	pos	m
s				0.134	0.21	0.24	0.14	0.2	0.23	0.49	0.25	0.29	-	-	-	0.09	0.14	0.15	-	-	-	-	-	-	-	-	-	s

Lab no.	Sample			Aerobic microorganisms			Enterobacteriaceae			Campylobacter						*Listeria monocytogenes*						Salmonella			*E. coli* O157			Lab no.
										Quantitative			Qualitative			Quantitative			Qualitative									
	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	D	
9441	3	2	1	4.81	4.23	4.3	4.73	4.23	4.32	-	-	-	-	-	-	2.67	2.64	2.82	Pos	Pos	Pos	Pos	Pos	Pos	-	-	-	9441
9451	1	3	2	4.61	4.2	4.36	4.56	4.39	4.25	-	-	-	-	-	-	2.78	2.69	2.74	Pos	Pos	Pos	Pos	**Neg**	**Neg**	-	-	-	9451
9453	1	2	3	4.74	4.72	4.53	4.73	4.4	4.51	-	-	-	-	-	-	-	-	-	Pos	Pos	Pos	Pos	Pos	Pos	-	-	-	9453
9465	2	3	1	4.72	4.41	4.39	4.61	4.4	4.34	-	-	-	-	-	-	-	-	-	Pos	**Neg**	**Neg**	Pos	Pos	Pos	-	-	-	9465
9512	3	2	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	9512
9555	2	3	1	4.75	4.53	4.59	4.61	4.39	4.53	-	-	-	-	-	-	-	-	-	-	-	-	Pos	Pos	Pos	-	-	-	9555
9569	3	2	1	4.86	4.73	4.36	4.71	4.68	4.7	-	-	-	-	-	-	**1.88**	**1.81**	**1.6**	Pos	Pos	Pos	Pos	Pos	Pos	-	-	-	9569
9589	3	1	2	4.67	4.15	4.32	4.68	4.2	4.28	-	-	-	Pos	Pos	Pos	**1.91**	**1.63**	**1.73**	Pos	Pos	Pos	Pos	Pos	Pos	-	-	-	9589
9655	2	1	3	**1.9**	**1.95**	**1.86**	-	-	-	-	-	-	-	-	-	-	-	-	Pos	Pos	Pos	Pos	Pos	Pos	Neg	Pos	Pos	9655
9716	2	1	3	4.86	4.85	4.67	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Pos	Pos	Pos	-	-	-	9716
9747	3	1	2	4.48	4.23	4.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	9747
9783	2	3	1	4.72	4.67	4.49	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	9783
9890	2	3	1	4.92	4.69	4.94	4.93	4.76	4.89	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	9890
9903	2	3	1	4.78	4.28	4.6	4.62	4.19	4.62	-	-	-	-	-	-	-	-	-	-	-	-	Pos	Pos	Pos	-	-	-	9903
9950	1	2	3	5.06	4.82	4.44	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	9950
n				141	140	141	119	118	118	18	17	18	39	39	39	76	76	76	101	101	101	127	128	128	35	34	34	n
Min				1.68	0	1.86	1.11	0	2.2	0	1.79	1.7	-	-	-	1.3	0	0	-	-	-	-	-	-	-	-	-	Min
Max				7.3	5.96	5.9	7.8	5.8	5.71	1.54	2.65	2.71	-	-	-	3.26	3.3	3.04	-	-	-	-	-	-	-	-	-	Max
Median				4.81	4.633	4.61	4.7	4.57	4.565	0.775	2.18	2.23	-	-	-	2.77	2.62	2.63	-	-	-	-	-	-	-	-	-	Median
m				4.81	4.61	4.59	4.69	4.54	4.55	0.74	2.24	2.24	pos	pos	pos	2.76	2.6	2.63	pos	pos	pos	pos	pos	pos	neg	pos	pos	m
s				0.134	0.21	0.24	0.14	0.2	0.23	0.49	0.25	0.29	-	-	-	0.09	0.14	0.15	-	-	-	-	-	-	-	-	-	s
F+				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0	F+
F-				0	1	0	0	1	0	6	0	0	7	1	1	0	1	1	1	6	6	13	2	3	0	6	7	F-
Ext<				6	7	5	9	3	3	0	0	0	-	-	-	8	5	6	-	-	-	-	-	-	-	-	-	Ext<
Ext>				4	2	3	3	3	1	0	0	0	-	-	-	3	1	0	-	-	-	-	-	-	-	-	-	Ext>
L. value OK				4.37	3.97	3.82	4.16	3.66	3.86	0.01	1.79	1.7	-	-	-	2.5	2.15	2.15	-	-	-	-	-	-	-	-	-	L. value
H. value OK				5.16	5.33	5.3	4.95	4.92	5.15	1.54	2.65	2.71	-	-	-	3	2.98	3.04	-	-	-	-	-	-	-	-	-	H. value

n = number of performed analyses
Min = lowest reported result
Max= highest reported result
Median = median value
m = mean value
s = standard deviation
F+ = false positive
F- = false negative
Outl< = low outlier
Outl> = high outlier
L. value OK = lowest accepted value
H. value OK = higest accepted value

Appendix 2

All participants z-scores.

z-scores have been calculated according the formula : z = (x-m)/s.
x = the result of the individual laboratory
m = the mean of the results of participating laboratories
s = standard deviation of the results of participating laboratories
Correct results in quantlitative analyses have obtained the z-score zero.

Lab nr.	Sample			Aerobic microorganisms			Enterobacteriaceae			Campylobacter Kvant			Campylobacter Kval			*Listeria monocytogenes* Kvant			*Listeria monocytogenes* Kval			Salmonella			*E. coli* O157			Lab nr.
	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	D	
1081	2	1	3	0.651	1.588	1.43	1.223	1.831	1.2442							-0.4	-0.177	1.757	0	0	0	0	0	0				1081
1254	2	1	3																									1254
1594	1	3	2	-0.019	1.12	1.006	0.243	1.388	0.9403																			1594
1970	1	3	2	1.172	-0.191	-0.309	0.733	0.155	0.2021	-0.089	1.652	0.404		0	0	4	0.836	0.929	0	0	0	0	0	0	0	0	0	1970
2002	2	3	1																									2002
2035	3	1	2				-0.597	0.303	-0.6664				0	0	0	-0.603	0.691	-0.865	0	0	0	0	0	0				2035
2050	2	1	3	0.205	0.418	-0.522	-0.317	0.698	-0.0585													0	0	0				2050
2058	2	1	3													-1.412	0.04	-4	0	0	0							2058
2072	1	3	2	-2.324	-0.238	0.242	-2.278	-0.14	0.2021		-1.803	-1.606	0	0	0	-0.704	0.112	0.101	0	0	0	0	0	0				2072
2151	1	2	3											0	0							0	0	0				2151
2372	3	1	2	-1.655	-0.94	0.115																						2372
2386	1	3	2	1.172	0.652	-0.055													0	0	0		0	0				2386
2402	1	3	2																			0	0	0				2402
2459	2	1	3	4	4	4																					0	2459
2553	3	2	1	-0.688	0.043	-0.522	-0.387	-0.042	-0.3624				0	0	0	-0.501	-0.322	0.239	0	0	0	0	0	0	0	0	0	2553
2637	3	1	2	0.577	0.839	0.921	0.873	1.338	0.8968							-0.4	0.112	0.653	0	0	0	0	0	0				2637
2704	1	3	2	-0.911	1.167	0.963	-0.247	0.845	0.9403							0.511	0.112	0.308	0	0	0	0	0	0				2704
2720	1	2	3	-0.911	-2.016	-1.455	0.103	-1.767	-1.2309																			2720
2745	1	2	3	0.279	-0.612	-0.606	0.873	-0.683	-2.4033							0.106	0.402	-0.658	0	0	0	0	0	0				2745
2757	1	3	2																									2757
2764	3	2	1	-0.39	-0.425	-0.606	-1.928	-0.436	-0.9269										0			0	0	0	0	0		2764
2842	2	3	1	-1.432	-0.986	-1.752	-2.138	-0.978	-1.9257		-0.236	-0.22		0	0	-1.109	0.185	0.101	0	0	0	0	0	0	0	0		2842
2908	2	3	1	0.577	1.12	1.897	1.153	1.092	0.5495	-0.295	-0.799	-0.22	0	0	0	-0.198	0.185	0.377	0	0	0	0	0	0	0	0	0	2908
2920	1	2	3	-0.242	0.839	-0.352	0.593	0.648	-0.623													0	0	0				2920
3159	3	2	1	0.651	0.839	-1.2	0.173	0.648	-0.5361							-0.4	0.329	-0.244	0	0	0							3159
3188	3	2	1	-0.093	1.354	0.03	0.103	-0.683	-1.1006																			3188
3305	1	2	3	-0.093	-0.518	4	0.103	-0.19	-0.6664					0	0	2.433	-1.479	-0.175	0	0	0		0	0				3305
3327	3	2	1	-1.06	-2.016	0.327										-4	1.993	1.895	0	0	0	0	0	0				3327
3346	2	3	1	0.353	0.886	0.412	0.243	0.796	-0.0585				0	0	0	-0.299	-1.624	-0.313	0	0	0	0	0	0	0	0	0	3346
3457	1	3	2	-0.242	0.605	0.879	0.173	0.895	0.7666							0.409	0.04	0.653	0	0	0	0	0	0				3457
3511	3	1	2				0.803	-0.683	-0.1453							0.612	0.474	0.584	0	0	0	0	0	0				3511
3588	3	1	2	-0.39	-0.144	-0.818	-0.177	0.008	0.1586							0.308	0.836	0.446	0	0	0		0	0				3588
3595	1	2	3	1.097	0.277	1.091	0.733	0.796	1.635							0.713	-0.394	-1.417	0	0	0	0	0	0				3595

Lab nr.	Sample			Aerobic microorganisms			Enterobacteriaceae			Campylobacter						*Listeria monocytogenes*						Salmonella			*E. coli* O157			Lab nr.
										Kvant			Kval			Kvant			Kval									
	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	D	
3626	1	2	3	-0.093	-1.455	-1.667	0.803	-1.175	-1.5348	0.734	-0.558	0.196	0	0	0	0.409	-0.033	0.515	0	0	0	0	0	0				3626
3803	2	3	1	-0.093	-0.378	0.115	-0.527	0.008	0.2455	-0.913	1.009	1.271	0	0	0	-0.704	-0.25	-0.106	0	0	0	0	0	0	0	0	0	3803
3925	2	3	1	1.023	1.073	0.369																	0	0				3925
4064	3	2	1	-0.762	0.09	-0.352	-0.107	0.698	0.0718																			4064
4153	2	1	3	0.279	0.699	0.879	0.873	0.747	1.0271				0	0	0	-4	-4	-4	0	0	0	0	0	0	0	0	0	4153
4171	1	3	2	0.8	-0.612	-0.14	1.783	1.141	0.8968													0	0	0	0	0	0	4171
4246	2	1	3	-3.291	-2.999	-2.431																						4246
4288	2	3	1	0.056	-4	0.836	0.173	-4	1.5048										0	0	0		0	0				4288
4339	1	2	3	-1.209	-1.455	0.709	-1.928	-0.683	0.7231				0	0	0	-0.299	0.257	-0.796	0	0	0	0	0	0				4339
4352	1	3	2	1.395	1.073	1.303	1.013	0.648	1.4613				0	0	0	-0.299	-0.177	0.722	0	0	0		0	0	0	0	0	4352
4353	1	2	3	1.097	1.307	1.006																0	0	0				4353
4356	3	2	1	0.205	-0.846	-1.158	-0.317	-0.633	-1.0138				0	0	0	0.308	-0.539	-0.727	0	0	0	0	0	0				4356
4562	2	1	3	-1.58	-0.565	-0.267	-0.317	0.303	0.506				0			0.308	1.053	0.032	0	0	0	0	0	0	0	0	0	4562
4605	3	2	1				-4															0	0	0				4605
4635	3	1	2																									4635
4683	3	2	1	0.353	0.792	1.175	-4	0.205	0.7666										0	0	0	0	0	0				4683
4689	2	1	3				4	4	4													0	0	0				4689
4713	1	3	2	3.924	3.367	3	1.713	4	2.5903							4	4	2.861	0	0	0	0	0	0				4713
4817	3	1	2	0.353	0.511	0.157	0.243	0.747	0.0718				0	0	0	0.915	0.546	0.17	0	0	0	0	0	0	0	0	0	4817
4840	3	2	1	-4	-4	-3.279	-4	-4	-4		1.652	1.236		0	0	-2.019	0.257	-1.003	0	0	0		0	0				4840
4889	3	1	2	-0.019	0.605	0.879	4	0.55	0.8534							-1.918	-3.288	-1.969	0	0	0	0	0	0				4889
4955	1	2	3	1.692	0.652	1.133	1.363	1.141	0.8534							0.612	1.125	0.239	0	0	0	0	0	0				4955
4980	2	1	3	0.428	0.933	-0.097	-0.247	0.155	-0.623							0.106	-0.033	0.032	0	0	0	0	0	0				4980
5018	1	2	3	-1.06	-1.548	-1.879	-0.877	-0.535	-1.8388				0	0	0	0.511	0.402	0.584	0	0	0	0	0	0	0	0	0	5018
5100	3	1	2	-4	-4	-4																0	0	0				5100
5120	2	3	1	-0.911	-0.004	0.115	0.803	-0.387	-0.2756				0	0	0	-0.4	0.691	0.17	0	0	0	0	0	0				5120
5188	1	2	3							-0.542	-0.638	-0.323	0	0	0													5188
5197	2	3	1	-0.985	-0.612	-0.225	-4	-0.584	0.1152													0	0	0				5197
5204	3	1	2	1.395	-0.05	-0.394	0.803	-0.683	-0.2322		-0.558	-0.497	0	0	0	-2.627	-1.479	-0.175	0	0	0	0	0	0	0	0	0	5204
5220	3	1	2	-0.019	0.746	0.539													0	0	0	0	0	0				5220
5221	3	2	1																									5221
5304	3	2	1	1.692	-0.05	-0.776													0	0	0	0	0	0				5304
5329	3	1	2	0.8	0.465	0.412	1.363	0.402	0.5929																			5329
5333	1	3	2																0	0	0	0	0	0				5333
5342	1	3	2																									5342
5350	3	2	1	4	4	4																0	0	0				5350
5447	1	2	3							0.528	-0.357	-1.883	0	0	0													5447
5545	1	3	2																									5545
5553	2	1	3	-1.432	-0.612	-1.031							0	0	0	-0.603	0.329	-0.175	0	0	0	0	0	0				5553
5615	2	1	3	1.395	0.699	0.879	1.643	0.55	0.7231										0	0	0	0	0	0				5615
5647	3	1	2																				0	0				5647
5701	3	2	1																			0	0	0				5701
5774	1	2	3				0.243	0.5	0.8968	-1.51	-1.362	-1.571	0	0	0	0.308	0.112	-0.313	0	0	0	0	0	0	0	0	0	5774
5850	3	2	1	0.502	-0.659	-0.182					-0.638	0.092				0.409	0.908	-0.244	0	0	0	0	0	0				5850

Lab nr.	Sample			Aerobic microorganisms			Enterobacteriaceae			Campylobacter Kvant			Campylobacter Kval			*Listeria monocytogenes* Kvant			*Listeria monocytogenes* Kval			Salmonella			*E. coli* O157			Lab nr.
	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	D	
5883	1	2	3	-0.019	0.231	0.242	-0.667	0.205	-0.015							-3.841	-1.769	-2.314	0	0	0	0	0	0				5883
5993	1	2	3																									5993
6109	2	1	3	0.8	-0.144	-0.14																0	0	0	0	0	0	6109
6138	2	1	3	2.585	0.511	1.345	0.453	0.698	1.4613							-4	-4	-4	0	0	0	0	0	0				6138
6232	1	2	3	-0.837	-1.314	-0.14	0.523	-1.077	-0.5361													0	0	0				6232
6253	3	1	2	0.056	-0.425	-0.437	-0.317	0.008	-0.1887										0	0	0	0	0	0				6253
6343	2	3	1	-0.911	-0.846	0.2													0	0			0	0				6343
6352	2	3	1	-0.093	-0.284	-0.818	-0.597	-0.19	-1.1006													0	0			0	0	6352
6368	2	3	1	1.99	0.98	-0.012	1.713	0.845	0.0284							1.017	-0.611	-0.796	0	0	0	0	0	0				6368
6443	2	3	1	-0.837	-0.284	-1.752	-0.667	-0.14	-0.7967													0	0	0				6443
6456	1	2	3	-0.688	0.371	0.072	0.033	0.599	-0.0585										0	0	0	0	0	0				6456
6527	2	1	3										0	0	0							0	0	0				6527
6594	3	2	1																									6594
6707	3	2	1	-0.614	0.511	0.242	0.243	0.895	0.3323							-4	-2.058	-2.521	0	0	0	0	0	0				6707
6751	3	2	1	-1.506	0.605	1.26	-4	0.747	0.8968	1.64		-0.323	0	0	0	-0.603	-0.467	-0.382	0	0	0		0	0	0			6751
6762	2	1	3	0.279	-0.893	-1.328	0.383	-1.718	-1.7085																			6762
6860	3	1	2	1.841	0.605	1.303	1.853	0.895	1.0705		1.13	1.617		0	0	0.106	0.836	0.86	0	0	0	0	0	0	0	0	0	6860
6944	1	2	3																									6944
6971	2	3	1	-4	-4	-4	-4	-4	-4																			6971
7024	1	2	3	-0.911	-0.144	-0.267	-0.457	-0.14	-0.4059																			7024
7096	2	1	3	0.949	0.98	0.072	-1.088	0.451	0.2889							0.106	-0.105	0.308	0	0	0	0	0	0				7096
7182	1	2	3	0.279	0.98	1.43	0.243	1.24	1.5048																			7182
7207	3	2	1	0.205	1.026	1.048	0.313	0.944	0.7666																			7207
7232	2	1	3	0.353	0.118	-0.233																0	0	0				7232
7242	3	1	2	-0.755		-0.653	-2.201		-0.332										0		0							7242
7244	3	1	2	0.651	0.371	0.454																0	0	0				7244
7248	2	1	3	-0.465	-1.548	-0.097	-0.457	-1.619	0.1152	0.59	0.206	0.092	0	0	0	0.814	0.112	0.101	0	0	0	0	0	0				7248
7253	2	3	1				-0.527	0.5	-0.1019				0	0	0	3.243	2.717	2.309	0	0	0	0	0	0				7253
7282	3	1	2	0.205	-0.05	0.454	-4	-0.978	-1.1006							2.029	0.402	1.136	0	0	0	0	0	0				7282
7330	2	1	3	-0.093	1.12	0.879	0.383	1.437	1.0705													0	0	0				7330
7334	2	3	1	-0.465	-0.612	0.879																0	0	0				7334
7438	3	1	2	-2.175	-1.22	-1.031	-3.678	-0.535	-0.9269	-1.51	0.005	-0.185	0	0	0	0.814	0.185	0.032	0	0	0	0	0	0	0	0	0	7438
7449	3	2	1	0.502	-0.706	-1.243	0.103	-0.683	-0.623																			7449
7543	3	1	2	-4	-4	-4																	0	0	0			7543
7564	3	2	1	-0.39	-1.782	-1.412	0.453	-1.274	-1.5348	0.22	0.648	1.028	0	0	0	0.005	-0.033	0.929	0	0	0	0	0	0	0	0	0	7564
7596	3	1	2	-4		0.879	-4	0.303	1.0705							0.409	1.414	-0.865	0	0	0	0	0	0				7596
7627	1	3	2	-0.093	-0.986	-0.818																0	0	0	0	0	0	7627
7631	1	3	2	0.205	-0.004	0.157																						7631
7688	3	2	1	0.353	0.277	0.242	0.453	1.043	0.4192				0	0	0	-4	-4	-4	0	0	0	0	0	0	0	0	0	7688
7728	2	1	3	0.651	1.307	0.709							0	0	0				0	0	0	0	0	0				7728
7762	3	1	2																			0	0	0				7762
7793	2	3	1	-0.242	0.605	0.412	-0.807	0.55	-0.2322													0	0	0				7793
7825	2	3	1	0.458	-1.408	-0.81	0.383	-0.919	-0.979							-0.4	-0.973	-1.955	0	0	0							7825
7876	1	2	3	0.651	0.886	1.303	0.103	0.796	0.6363							-1.615	-0.033	-0.175	0	0	0	0	0	0				7876
7930	3	2	1	0.205	-0.144	0.751	-0.667	-0.535	-0.4059							-0.704	1.27	-1.624	0	0	0	0	0	0				7930

Lab nr.	Sample			Aerobic microorganisms			Enterobacteriaceae			Campylobacter Kvant			Campylobacter Kval			*Listeria monocytogenes* Kvant			*Listeria monocytogenes* Kval			Salmonella			*E. coli* O157			Lab nr.
	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	D	
7940	1	3	2	0.13	-0.097	-1.667																						7940
7946	3	2	1	4	-4	-4	-4	-4	-4										0	0								7946
7962	3	1	2																									7962
8066	1	3	2				-1.228	-2.753	-3.0112							-1.109			0			0						8066
8068	1	2	3	1.841	1.12	0.412	1.363	0.648	0.1152							0.207	-0.467	0.239	0	0	0	0	0	0				8068
8165	3	1	2							1.146	0.648	0.889	0	0	0				0	0	0	0	0	0	0	0	0	8165
8255	3	2	1	-0.167	-0.238	0.666	0.103	0.5	0.6797							0.915	0.257	-0.244	0	0	0	0	0	0				8255
8260	2	1	3	-0.093	0.886	1.303	-1.298	0.796	1.0705							1.421	-0.033	1.205	0	0	0		0	0				8260
8313	1	3	2	-0.316	-2.063	-2.049	-1.788	-1.718	-1.8822										0	0	0	0	0	0				8313
8333	3	2	1	1.915	0.277	-0.564	0.523	-0.978	-1.5783													0	0	0	0	0	0	8333
8380	2	1	3	1.097	0.231	1.091	1.013	0.008	0.6797				0	0	0	0.409	-2.709	-0.934	0	0	0	0	0	0				8380
8397	2	3	1	1.692	1.073	-0.14	1.083	0.895	-0.5361							-0.501	-2.565	-1.21	0	0	0							8397
8428	2	1	3	-1.878	0.09	-0.012	-0.877	0.106	-0.1453					0	0	0.005	0.329	0.446	0	0	0	0	0	0	0	0	0	8428
8435	1	2	3	1.618	0.511	0.921	-0.177	0.5	1.3311										0	0	0	0	0	0				8435
8528	1	2	3																				0	0				8528
8529	3	1	2	-0.316	1.214	0.921	0.243	1.88	0.9837							0.612	0.546	0.515	0	0	0	0	0	0				8529
8568	3	1	2	-0.093	0.418	1.642	4	4	2.3732													0	0	0	0	0	0	8568
8626	2	1	3	0.725	-0.05	0.879	1.223	-0.387	0.5495										0	0	0	0	0	0				8626
8628	2	1	3	1.023	0.137	0.709	0.383	-1.175	0.2455							-0.603	0.04	-0.106	0	0	0	0	0	0				8628
8657	1	2	3	1.469	1.635	1.43	1.153	1.831	1.5048																			8657
8734	1	2	3	-0.316	-0.425	-1.54	-0.177	-0.88	-1.6217										0		0							8734
8742	1	3	2	-1.357	-0.612	-1.328	-0.457	-0.436	-0.5361							-2.222	-1.262	-1.003	0	0	0		0	0				8742
8756	2	1	3	0.353	0.792	0.921	-0.107	0.599	-0.1453													0	0	0				8756
8766	3	1	2	-0.837	-1.455	-1.667	-0.597	-1.175	-1.5348							1.421	-0.033	0.515	0	0	0	0	0	0				8766
8865	1	2	3	0.205	-0.097	-0.479	0.103	-0.14	-0.5795																			8865
8918	3	2	1	-0.39	-1.174	-0.564										0.409	-0.177	-0.106	0	0	0	0	0	0				8918
8955	1	3	2	-0.019	-0.004	0.709	-0.877	0.155	0.4192				0	0	0	0.005	0.836	-1.348	0	0	0	0	0	0				8955
9002	1	2	3	-1.06	0.418	0.157	0.383	0.599	0.3323							-0.4	0.474	1.136	0	0	0	0	0	0				9002
9034	3	1	2	-0.837	-1.923	-1.243	-1.298	-1.668	-1.1006										0	0	0	0	0	0				9034
9051	3	2	1	-0.911	0.792	0.285	-1.088	0.845	0.3758										0	0	0	0	0	0				9051
9245	3	2	1	0.502	0.792	0.497	-1.228	0.698	0.4626																			9245
9359	1	3	2	-0.539	0.511	0.539	-1.228	0.303	-0.1887							0.713	0.112	0.239	0	0	0	0	0	0				9359
9420	1	3	2	0.8	0.418	0.497	1.503	0.353	0.6363													0	0	0				9420
9429	1	2	3	0.428	0.09	0.2	1.013	0.155	-0.1453							0.005	0.257	-0.106	0	0	0	0	0	0				9429
9436	2	1	3	-0.762	-0.097	0.03	-1.788	-0.584	-0.2322							0.106	0.402	-0.589	0	0	0	0	0	0	0	0	0	9436
9441	3	2	1	-0.019	-1.782	-1.243	0.313	-1.52	-1.0138							-0.906	0.257	1.343	0	0	0	0	0	0				9441
9451	1	3	2	-1.506	-1.923	-0.988	-0.877	-0.732	-1.3177							0.207	0.619	0.791	0	0	0	0						9451
9453	1	2	3	-0.539	0.511	-0.267	0.313	-0.683	-0.1887										0	0	0	0	0	0				9453
9465	2	3	1	-0.688	-0.94	-0.861	-0.527	-0.683	-0.9269										0			0	0	0				9465
9512	3	2	1																									9512
9555	2	3	1	-0.465	-0.378	-0.012	-0.527	-0.732	-0.1019													0	0	0				9555
9569	3	2	1	0.353	0.558	-0.988	0.173	0.698	0.6363							-4	-4	-4	0	0	0	0	0	0				9569
9589	3	1	2	-1.06	-2.157	-1.158	-0.037	-1.668	-1.1875				0	0	0	-4	-4	-4	0	0	0	0	0	0				9589
9655	2	1	3	-4	-4	-4													0	0	0	0	0	0	0	0	0	9655

Lab nr.	Sample			Aerobic microorganisms			Enterobacteriaceae			Campylobacter Kvant			Campylobacter Kval			*Listeria monocytogenes* Kvant			*Listeria monocytogenes* Kval			Salmonella			*E. coli* O157			Lab nr.
	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	D	
9716	2	1	3	0.353	1.12	0.327																0	0	0				9716
9747	3	1	2	-2.473	-1.782	-1.667																						9747
9783	2	3	1	-0.688	0.277	-0.437																						9783
9890	2	3	1	0.8	0.371	1.472	1.713	1.092	1.4613																			9890
9903	2	3	1	-0.242	-1.548	0.03	-0.457	-1.718	0.2889													0	0	0				9903
9950	1	2	3	1.841	0.98	-0.649																						9950

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1. Lunch och lärande – skollunchens betydelse för elevernas prestation och situation i klassrummet av M Lennernäs.
2. Kosttillskott som säljs via Internet – en studie av hur kraven i lagstiftningen uppfylls av A Wedholm Pallas, A Laser Reuterswärd och U Beckman-Sundh.
3. Vetenskapligt underlag till råd om bra mat i äldreomsorgen. Sammanställt av E Lövestram.
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5. Riskprofil för material i kontakt med livsmedel av K Svensson, Livsmedelsverket och G Olafsson, Rikisendurskodun (Environmental and Food Agency of Iceland).
6. Proficiency Testing – Food Microbiology, January 2011 by C Normark and I Boriak
7. Proficiency Testing – Food Chemistry, Nutritional Components of Food, Round N 47.
8. Proficiency Testing – Food Chemistry, Trace Elements in Food, Round T-22 by C Åstrand and Lars Jorhem.
9. Riksprojekt 2010. Listeria monocytogenes i kyld ätfärdig mat av C Nilsson och M Lindblad.
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21. Råd om mat för barn 0-5 år. Vetenskapligt underlag med risk- och nyttovärderingar och kunskapsöversikter.
22. Råd om mat för barn 0-5 år. Hanteringsrapport som beskriver hur risk- och nyttovärderingar, tillsammans med andra faktorer, har lett fram till Livsmedelsverkets råd.
23. Proficiency Testing – Food Chemistry, Trace Elements in Food, Round T-23 by C Åstrand and L Jorhem.
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1. Fisk, skaldjur och fiskprodukter – analys av näringsämnen av V Öhrvik, A von Malmborg, I Mattisson, S Wretling och C Åstrand.
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