INŠTITUT ZA MLEKARSTVO IN PROBIOTIKE
INSTITUTE OF DAIRY SCIENCE & PROBIOTICS

PROFICIENCY TESTING

Determination of total bacterial count – plate count at 30 °C

NOVEMBER

2023

Dear Sir/Madam!

Thank you for participating in the proficiency testing NOVEMBER 2023. Participating in the proficiency testing will allow you to evaluate the performance of your work and obtain data for maintaining the quality system in your laboratory. Based on the independent results in this report, you can monitor, evaluate and ultimately improve your processes.

This report includes results of samples with serial number: 5309-1123 for parameter Determination of total bacterial count – plate count at 30 °C and they are presented in the form of tables and graphs.

Table 1: Used statistics

$\boldsymbol{mean = \frac{\sum x_n}{N}}$	$povp$ = average sample value x_n = value of sample n N = number of samples
$\boldsymbol{diff = \bar{x}_n - ref}$	$diff$ = deviation of sample value from reference value $\bar{x}_n$ = avrage sample value ref = robust average sample value
$\boldsymbol{Z - value = \frac{\bar{x}_n - ref}{S}}$	$\bar{x}_n$ = average sample value ref = robust average sample value S = standard deviation of robust average sample value (*ref*)
	|Z| ≤ 2,00 satisfactory
	2,00 < |Z| < 3,00 questionable
	|Z| ≥ 3,00 unsatisfactory
$\boldsymbol{d = \frac{\sum(\bar{x}_n - ref)}{N}}$	d = average of deviations x_n = value of sample n N = number of samples ref = robust average sample value
$\boldsymbol{Sd = \sqrt{\frac{\sum(\bar{x}_n - ref)^2}{N}}}$	Sd = standard deviation of deviations x_n = value of sample n N = number of samples ref = robust average sample value
$\boldsymbol{ref}$	Value ref represents robust average of each sample and it is calculated according ISO 13528 (Algorithm A) from results of all participating laboratories after excluding outliers according to Grubbs method (a=0,05)

Responsible for sample preparation and statistical analysis of results:
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Determination of total bacterial count – plate count at 30 °C (log CFU/ml)

Table 2: Outliers detection according to Grubbs method (a = 0,05)

		Sample						
	Person	1	2	3	4	5	6	n
LAB 1	1							0
	2							0
	3							0
	4							0
LAB 2	5							0
LAB 3	6							0
	7							0
LAB 4	8							0
	9							0
LAB 5	10							0
	11							0
LAB 6	12							0
	13							0
	n	0	0	0	0	0	0	

Legend:
n = number of outliers

Table 3: Reproducibility (log CFU/ml)

		Sample					
		1	**2**	**3**	**4**	**5**	**6**
LAB 1	$\bar{x}$	5,823	3,711	5,195	5,108	5,726	5,105
LAB 2	$\bar{x}$	5,690	3,663	5,176	5,143	5,663	5,009
LAB 3	$\bar{x}$	5,690	3,716	5,176	5,041	5,613	5,060
LAB 4	$\bar{x}$	5,060	3,602	4,449	4,315	5,000	4,483
LAB 5	$\bar{x}$	5,797	3,783	5,204	5,078	5,707	5,078
LAB 6	$\bar{x}$	5,652	3,562	5,094	5,021	5,447	5,079
R		0,13	0,29	0,09	0,30	0,31	0,28

Legend:
$\bar{x}$ = mean of laboratory (log CFU/ml)
R = reproducibility between laboratories for each sample (log CFU/ml)

Limit: R = 0,45 log CFU/ml

Table 4: Accuracy (log CFU/ml)

Person 1	1	2	3	4	5	6	d	Sd
Mean	5,820	3,613	5,176	5,041	5,724	5,000		
REF	5,716	3,680	5,150	5,050	5,596	5,046		
S	0,129	0,101	0,084	0,098	0,181	0,070		
d (Mean-REF)	0,104	-0,067	0,026	-0,009	0,128	-0,046	0,023	0,079
Z-value	0,80	-0,66	0,31	-0,09	0,71	-0,66		

Person 2	1	2	3	4	5	6	d	Sd
Mean	5,785	3,699	5,204	5,041	5,623	5,079		
REF	5,716	3,680	5,150	5,050	5,596	5,046		
S	0,129	0,101	0,084	0,098	0,181	0,070		
d (Mean-REF)	0,070	0,019	0,054	-0,009	0,027	0,033	0,032	0,027
Z-value	0,54	0,19	0,64	-0,09	0,15	0,48		

Person 3	1	2	3	4	5	6	d	Sd
Mean	5,881	3,826	5,146	5,146	5,778	5,041		
REF	5,716	3,680	5,150	5,050	5,596	5,046		
S	0,129	0,101	0,084	0,098	0,181	0,070		
d (Mean-REF)	0,165	0,146	-0,004	0,096	0,182	-0,004	0,097	0,083
Z-value	1,28	1,45	-0,05	0,98	1,01	-0,06		

Person 4	1	2	3	4	5	6	d	Sd
Mean	5,806	3,708	5,255	5,204	5,778	5,301		
REF	5,716	3,680	5,150	5,050	5,596	5,046		
S	0,129	0,101	0,084	0,098	0,181	0,070		
d (Mean-REF)	0,091	0,028	0,105	0,154	0,182	0,255	0,136	0,079
Z-value	0,70	0,28	1,25	1,57	1,01	3,65		

Person 5	1	2	3	4	5	6	d	Sd
Mean	5,690	3,663	5,176	5,143	5,663	5,009		
REF	5,716	3,680	5,150	5,050	5,596	5,046		
S	0,129	0,101	0,084	0,098	0,181	0,070		
d (Mean-REF)	-0,025	-0,017	0,026	0,093	0,067	-0,037	0,018	0,053
Z-value	-0,20	-0,17	0,31	0,95	0,37	-0,53		

Person 6	1	2	3	4	5	6	d	Sd
Mean	5,699	3,708	5,176	5,041	5,613	5,041		
REF	5,716	3,680	5,150	5,050	5,596	5,046		
S	0,129	0,101	0,084	0,098	0,181	0,070		
d (Mean-REF)	-0,017	0,028	0,026	-0,009	0,017	-0,004	0,007	0,019
Z-value	-0,13	0,28	0,31	-0,09	0,09	-0,06		

Person 7	1	2	3	4	5	6	d	Sd
Mean	5,681	3,724	5,176	5,041	5,613	5,079		
REF	5,716	3,680	5,150	5,050	5,596	5,046		
S	0,129	0,101	0,084	0,098	0,181	0,070		
d (Mean-REF)	-0,034	0,045	0,026	-0,009	0,017	0,033	0,013	0,029
Z-value	-0,27	0,44	0,31	-0,09	0,09	0,48		

To be continued…

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Person 8	1	2	3	4	5	6	d	Sd
Mean	5,041	3,613	4,456	4,320	5,000	4,470		
REF	5,716	3,680	5,150	5,050	5,596	5,046		
S	0,129	0,101	0,084	0,098	0,181	0,070		
d (Mean-REF)	-0,674	-0,067	-0,694	-0,730	-0,596	-0,576	-0,556	0,247
Z-value	-5,21	-0,66	-8,24	-7,46	-3,29	-8,24		

Person 9	1	2	3	4	5	6	d	Sd
Mean	5,079	3,591	4,442	4,310	5,000	4,496		
REF	5,716	3,680	5,150	5,050	5,596	5,046		
S	0,129	0,101	0,084	0,098	0,181	0,070		
d (Mean-REF)	-0,636	-0,089	-0,708	-0,741	-0,596	-0,550	-0,553	0,238
Z-value	-4,92	-0,88	-8,40	-7,56	-3,29	-7,87		

Person 10	1	2	3	4	5	6	d	Sd
Mean	5,845	3,826	5,204	5,114	5,699	5,114		
REF	5,716	3,680	5,150	5,050	5,596	5,046		
S	0,129	0,101	0,084	0,098	0,181	0,070		
d (Mean-REF)	0,129	0,146	0,054	0,063	0,103	0,068	0,094	0,038
Z-value	1,00	1,45	0,64	0,65	0,57	0,97		

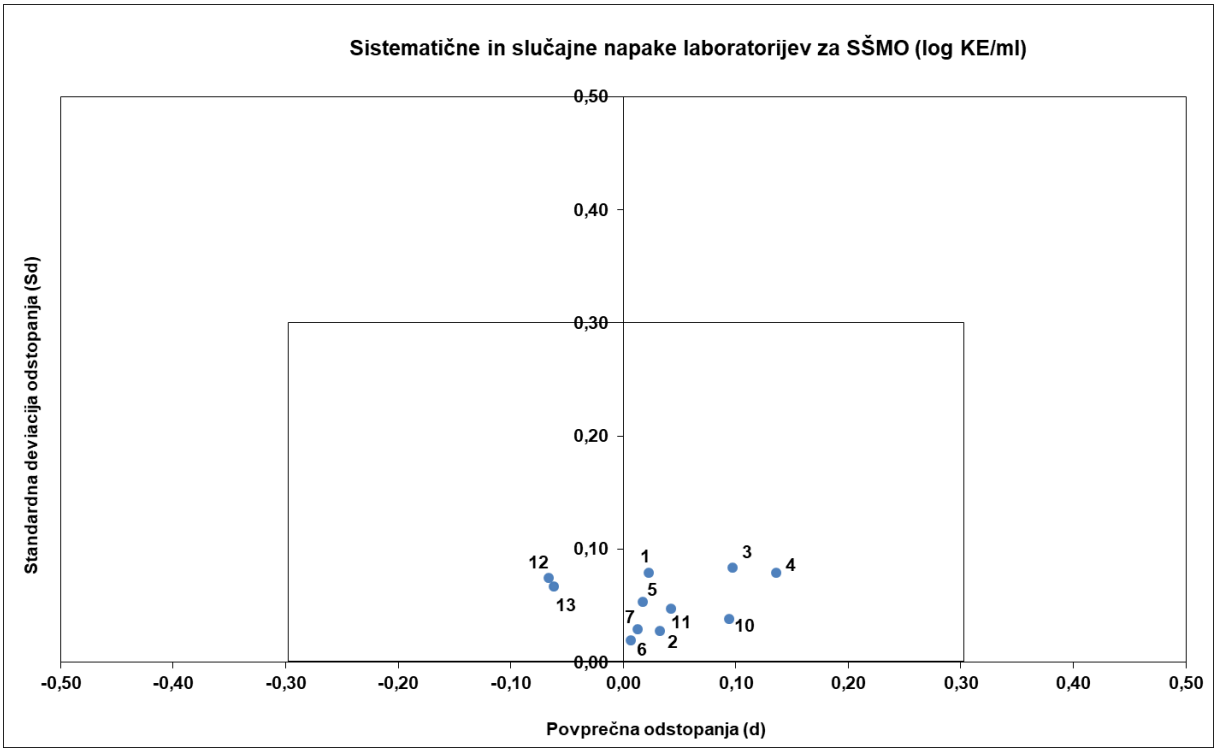
Person 11	1	2	3	4	5	6	d	Sd
Mean	5,748	3,740	5,204	5,041	5,716	5,041		
REF	5,716	3,680	5,150	5,050	5,596	5,046		
S	0,129	0,101	0,084	0,098	0,181	0,070		
d (Mean-REF)	0,033	0,061	0,054	-0,009	0,120	-0,004	0,042	0,048
Z-value	0,25	0,60	0,64	-0,09	0,66	-0,06		

Person 12	1	2	3	4	5	6	d	Sd
Mean	5,681	3,568	5,041	5,041	5,431	5,079		
REF	5,716	3,680	5,150	5,050	5,596	5,046		
S	0,129	0,101	0,084	0,098	0,181	0,070		
d (Mean-REF)	-0,034	-0,111	-0,109	-0,009	-0,165	0,033	-0,066	0,075
Z-value	-0,27	-1,10	-1,29	-0,09	-0,91	0,48		

Person 13	1	2	3	4	5	6	d	Sd
Mean	5,623	3,556	5,146	5,000	5,462	5,079		
REF	5,716	3,680	5,150	5,050	5,596	5,046		
S	0,129	0,101	0,084	0,098	0,181	0,070		
d (Mean-REF)	-0,092	-0,123	-0,004	-0,050	-0,134	0,033	-0,062	0,067
Z-value	-0,71	-1,22	-0,05	-0,52	-0,74	0,48		

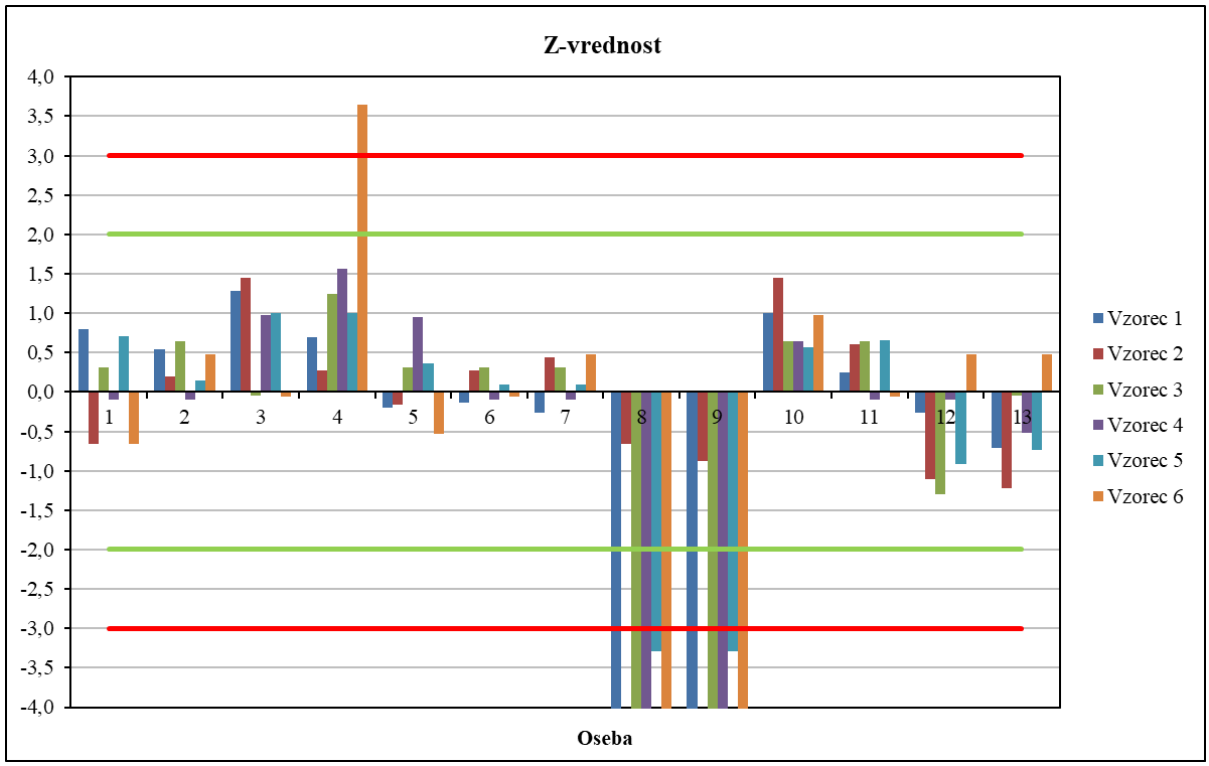
Limits : d = ± 0,3 log CFU/ml Sd = 0,3 log CFU/ml

Figure 1: Accuracy (see Table 4)



Limits: d = ± 0,3 log CFU/ml Sd = 0,3 log CFU/ml

Figure 2: Z-value (see Table 4)



Limits: $|Z| \leq 2{,}00$ satisfactoy $2{,}00 < |Z| < 3{,}00$ questionable $|Z| \geq 3{,}00$ unsatisfactory