



INŠTITUT ZA MLEKARSTVO IN PROBIOTIKE
INSTITUTE OF DAIRY SCIENCE & PROBIOTICS

PROFICIENCY TESTING

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

MAREC

2025

Dear Sir/Madam!

Thank you for participating in the proficiency testing MAREC 2025. 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: 1171-0325 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

$mean = \frac{\sum x_n}{N}$	$povp$ = average sample value x_n = value of sample n N = number of samples
$diff = \bar{x}_n - ref$	$diff$ = deviation of sample value from reference value $\bar{x}_n$ = average sample value ref = robust average sample value
$Z - value = \frac{\bar{x}_n - ref}{S}$	$\bar{x}_n$ = average sample value ref = robust average sample value S = standard deviation of robust average sample value (ref)
	$ Z \leq 2,00$ satisfactory
	$2,00 < Z < 3,00$ questionable
	$ Z \geq 3,00$ unsatisfactory
$d = \frac{\sum(\bar{x}_n - ref)}{N}$	d = average of deviations x_n = value of sample n N = number of samples ref = robust average sample value
$Sd = \sqrt{\frac{\sum(\bar{x}_n - ref)^2}{N}}$	Sd = standard deviation of deviations x_n = value of sample n N = number of samples ref = robust average sample value
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 ($\alpha=0,05$)

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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 ($\alpha = 0,05$)

		Sample						n
	Person	1	2	3	4	5	6	
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							1
	13							0
n		0	0	0	0	1	0	

Legend:

n = number of outliers

Table 3: Reproducibility (log CFU/ml)

		Sample					
		1	2	3	4	5	6
LAB 1	$\bar{x}$	5,183	5,292	4,644	5,315	5,574	4,631
LAB 2	$\bar{x}$	4,898	5,176	4,653	5,322	5,415	4,623
LAB 3	$\bar{x}$	5,097	5,311	4,702	5,279	5,542	4,580
LAB 4	$\bar{x}$	5,130	5,267	4,651	5,311	5,602	4,662
LAB 5	$\bar{x}$	5,056	5,127	4,531	5,294	5,514	4,694
LAB 6	$\bar{x}$	4,638	4,600	4,756	5,341	5,034	4,772
R		0,21	0,27	0,08	0,04	0,22	0,07

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	5,204	5,322	4,591	5,362	5,633	4,580		
REF	5,071	5,216	4,655	5,309	5,535	4,654		
S	0,139	0,128	0,090	0,040	0,094	0,066		
d (Mean-REF)	0,133	0,107	-0,064	0,052	0,098	-0,074	0,042	0,090
Z-value	0,96	0,84	-0,70	1,33	1,05	-1,12		

Person 2	1	2	3	4	5	6	d	Sd
Mean	5,204	5,204	4,613	5,255	5,491	4,602		
REF	5,071	5,216	4,655	5,309	5,535	4,654		
S	0,139	0,128	0,090	0,040	0,094	0,066		
d (Mean-REF)	0,133	-0,011	-0,042	-0,054	-0,044	-0,052	-0,012	0,073
Z-value	0,96	-0,09	-0,46	-1,37	-0,47	-0,78		

Person 3	1	2	3	4	5	6	d	Sd
Mean	5,146	5,342	4,748	5,322	5,602	4,690		
REF	5,071	5,216	4,655	5,309	5,535	4,654		
S	0,139	0,128	0,090	0,040	0,094	0,066		
d (Mean-REF)	0,076	0,127	0,094	0,013	0,067	0,036	0,069	0,040
Z-value	0,54	0,99	1,03	0,33	0,72	0,55		

Person 4	1	2	3	4	5	6	d	Sd
Mean	5,176	5,301	4,623	5,322	5,568	4,653		
REF	5,071	5,216	4,655	5,309	5,535	4,654		
S	0,139	0,128	0,090	0,040	0,094	0,066		
d (Mean-REF)	0,105	0,085	-0,031	0,013	0,033	-0,001	0,034	0,052
Z-value	0,76	0,67	-0,35	0,33	0,35	-0,01		

Person 5	1	2	3	4	5	6	d	Sd
Mean	4,898	5,176	4,653	5,322	5,415	4,623		
REF	5,071	5,216	4,655	5,309	5,535	4,654		
S	0,139	0,128	0,090	0,040	0,094	0,066		
d (Mean-REF)	-0,173	-0,040	-0,001	0,013	-0,120	-0,030	-0,059	0,073
Z-value	-1,24	-0,31	-0,02	0,33	-1,28	-0,46		

Person 6	1	2	3	4	5	6	d	Sd
Mean	5,114	5,342	4,732	5,279	5,580	4,580		
REF	5,071	5,216	4,655	5,309	5,535	4,654		
S	0,139	0,128	0,090	0,040	0,094	0,066		
d (Mean-REF)	0,043	0,127	0,078	-0,031	0,045	-0,074	0,031	0,073
Z-value	0,31	0,99	0,86	-0,77	0,48	-1,12		

Person 7	1	2	3	4	5	6	d	Sd
Mean	5,079	5,279	4,672	5,279	5,505	4,580		
REF	5,071	5,216	4,655	5,309	5,535	4,654		
S	0,139	0,128	0,090	0,040	0,094	0,066		
d (Mean-REF)	0,009	0,063	0,017	-0,031	-0,030	-0,074	-0,008	0,048
Z-value	-0,62	-1,08	-0,59	-0,47	0,05	0,04		

To be continued...

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Person 8	1	2	3	4	5	6	d	Sd
Mean	5,114	5,279	4,613	5,342	5,672	4,643		
REF	5,071	5,216	4,655	5,309	5,535	4,654		
S	0,139	0,128	0,090	0,040	0,094	0,066		
d (Mean-REF)	0,043	0,063	-0,042	0,033	0,137	-0,010	0,037	0,062
Z-value	0,31	0,49	-0,46	0,84	1,46	-0,16		

Person 9	1	2	3	4	5	6	d	Sd
Mean	5,146	5,255	4,690	5,279	5,531	4,681		
REF	5,071	5,216	4,655	5,309	5,535	4,654		
S	0,139	0,128	0,090	0,040	0,094	0,066		
d (Mean-REF)	0,076	0,040	0,036	-0,031	-0,004	0,028	0,024	0,037
Z-value	0,54	0,31	0,39	-0,77	-0,04	0,42		

Person 10	1	2	3	4	5	6	d	Sd
Mean	5,079	5,107	4,544	5,310	5,538	4,681		
REF	5,071	5,216	4,655	5,309	5,535	4,654		
S	0,139	0,128	0,090	0,040	0,094	0,066		
d (Mean-REF)	0,009	-0,108	-0,111	0,000	0,003	0,028	-0,030	0,062
Z-value	0,06	-0,85	-1,22	0,01	0,03	0,42		

Person 11	1	2	3	4	5	6	d	Sd
Mean	5,033	5,146	4,519	5,279	5,490	4,708		
REF	5,071	5,216	4,655	5,309	5,535	4,654		
S	0,139	0,128	0,090	0,040	0,094	0,066		
d (Mean-REF)	-0,037	-0,069	-0,136	-0,031	-0,045	0,054	-0,044	0,062
Z-value	-0,27	-0,54	-1,50	-0,77	-0,48	0,82		

Person 12	1	2	3	4	5	6	d	Sd
Mean	4,653	4,681	4,771	5,380	4,954	4,820		
REF	5,071	5,216	4,655	5,309	5,535	4,654		
S	0,139	0,128	0,090	0,040	0,094	0,066		
d (Mean-REF)	-0,417	-0,534	0,116	0,071	-0,581	0,166	-0,197	0,350
Z-value	-3,00	-4,19	1,28	1,80	-6,20	2,51		

Person 13	1	2	3	4	5	6	d	Sd
Mean	4,623	4,519	4,740	5,301	5,114	4,724		
REF	5,071	5,216	4,655	5,309	5,535	4,654		
S	0,139	0,128	0,090	0,040	0,094	0,066		
d (Mean-REF)	-0,447	-0,697	0,086	-0,008	-0,421	0,071	-0,236	0,329
Z-value	-3,22	-5,46	0,95	-0,21	-4,50	1,07		

Limits : d = $\pm 0,3$ log CFU/ml Sd = 0,3 log CFU/ml

Figure 1: Accuracy (see Table 4)

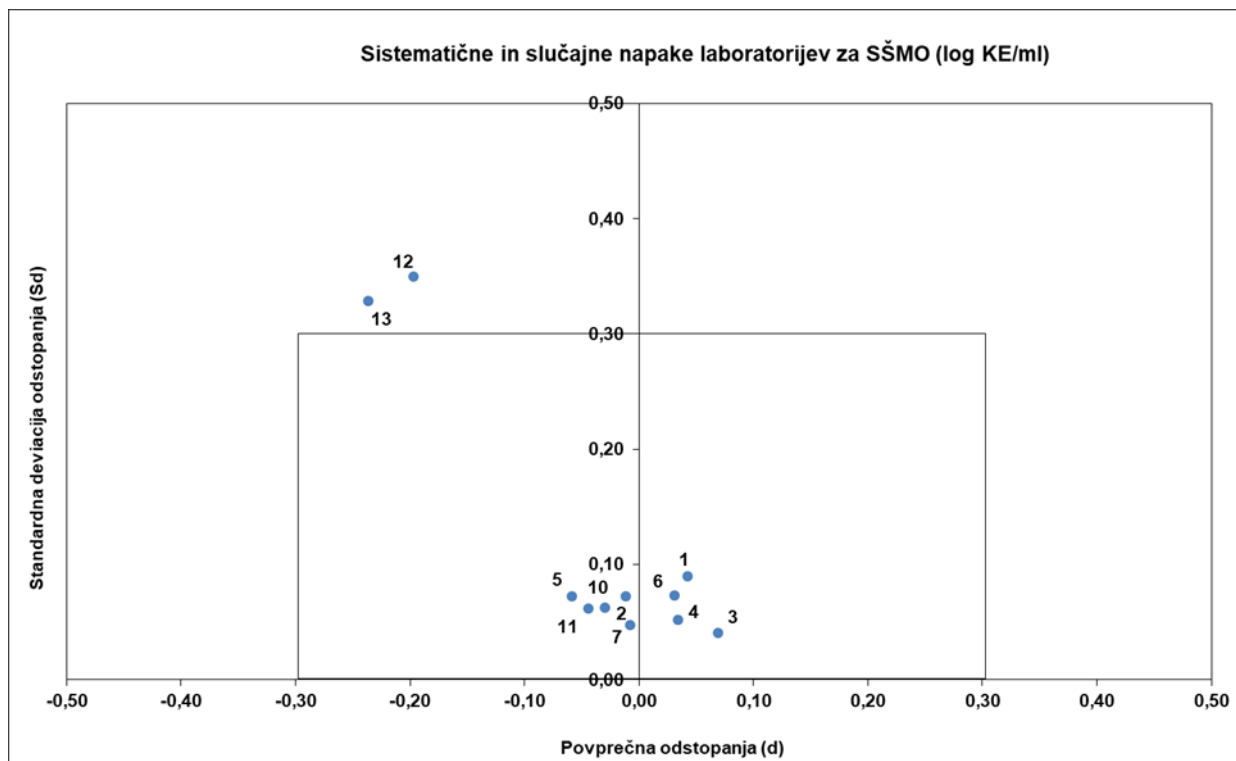


Figure 2: Z-value (see Table 4)

