



INŠTITUT ZA MLEKARSTVO IN PROBIOTIKE
INSTITUTE OF DAIRY SCIENCE & PROBIOTICS

PROFICIENCY TESTING

Urea

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: 5307-1123 for parameter UREA in milk 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 ≤ 2,00 satisfactory
	2,00 < Z < 3,00 questionable
	Z ≥ 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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Table 2: Outliers detection according to Grubbs method ($\alpha = 0,05$)

Laboratory	Sample							n
	1	2	3	4	5	6	7	
1								0
2								0
3								0
4								0
5								0
6								0
7								0
8								0
9								0
10								0
n	0	0	0	0	0	0	0	0

Legend:

n = number of outliers

Table 4: Repeatability (g/100g)

Laboratory	Sample (r)							N	Sr
	1	2	3	4	5	6	7		
1	0,90	0,30	0,60	1,70	2,20	0,60	3,90	7	1,18
2	1,20	2,20	1,70	4,40	1,60	3,50	1,20	7	1,14
3	0,90	1,20	1,30	0,10	0,40	1,50	0,20	7	0,52
4	0,80	0,80	0,10	1,20	0,60	0,70	0,50	7	0,31
5	0,48	0,38	0,52	0,01	0,09	0,52	0,17	7	0,20
6	1,20	0,30	0,30	0,60	0,90	0,80	1,10	7	0,33
7	0,80	0,30	0,70	0,50	0,30	0,00	0,10	7	0,27
8	0,80	3,40	1,10	1,30	3,10	1,70	0,90	7	0,99
9	0,40	0,30	2,40	0,90	0,80	0,50	0,10	7	0,71
10	0,10	1,30	2,03	0,10	2,40	1,30	0,20	7	0,88
N									
Sr									

Legend:

r = repeatability; absolute difference between two measurements of the same sample

N = number of measurements

Sr = standard deviation of repeatability

Limits:

r = 1,5 mg/100 ml (ISO 14637/IDF 195:2004)

r = 3,9 mg/100 ml r = 2,8 × sr ; sr = 1,4 mg/100 ml (ISO 8196-3/IDF 128-3:2009)

Table 4: Repeatability (S_r) in reproducibility (S_R) (ISO 5725-2:2019)

	Vzorec						
	1	2	3	4	5	6	7
S_r (mg/100ml)	0,58	1,02	0,92	1,16	1,11	1,03	0,98
S_R (mg/100ml)	2,29	3,05	2,55	2,37	4,61	3,38	2,18

S_r (mg/100ml) proficiency testing	0,97
S_R (mg/100ml) proficiency testing	2,92

Table 5: Accuracy (mg/100 ml)

Laboratory	Samples	1	2	3	4	5	6	7	d	Sd
1	Mean	16,65	50,95	5,60	24,55	63,70	15,30	30,95		
	REF	16,94	47,61	9,81	24,79	58,80	18,22	32,54		
	S	2,13	3,32	2,77	2,44	4,74	3,40	2,33		
	diff	-0,29	3,34	-4,21	-0,24	4,90	-2,92	-1,59	-0,14	3,26
	z-value	-0,14	1,01	-1,52	-0,10	1,03	-0,86	-0,68		

Laboratory	Samples	1	2	3	4	5	6	7	d	Sd
2	Mean	16,20	50,30	10,25	27,90	61,40	13,55	32,10		
	REF	16,94	47,61	9,81	24,79	58,80	18,22	32,54		
	S	2,13	3,32	2,77	2,44	4,74	3,40	2,33		
	diff	-0,74	2,69	0,44	3,11	2,60	-4,67	-0,44	0,43	2,74
	z-value	-0,35	0,81	0,16	1,27	0,55	-1,37	-0,19		

Laboratory	Samples	1	2	3	4	5	6	7	d	Sd
3	Mean	17,15	50,20	12,15	26,05	59,90	20,95	35,80		
	REF	16,94	47,61	9,81	24,79	58,80	18,22	32,54		
	S	2,13	3,32	2,77	2,44	4,74	3,40	2,33		
	diff	0,21	2,59	2,34	1,26	1,10	2,73	3,26	1,93	1,09
	z-value	0,10	0,78	0,85	0,52	0,23	0,80	1,40		

Laboratory	Samples	1	2	3	4	5	6	7	d	Sd
4	Mean	18,50	43,40	10,85	24,00	51,90	18,95	30,55		
	REF	16,94	47,61	9,81	24,79	58,80	18,22	32,54		
	S	2,13	3,32	2,77	2,44	4,74	3,40	2,33		
	diff	1,56	-4,21	1,04	-0,79	-6,90	0,73	-1,99	-1,51	3,11
	z-value	0,73	-1,27	0,38	-0,32	-1,46	0,22	-0,85		

Laboratory	Samples	1	2	3	4	5	6	7	d	Sd
5	Mean	15,45	46,19	10,74	21,63	52,25	24,26	32,95		
	REF	16,94	47,61	9,81	24,79	58,80	18,22	32,54		
	S	2,13	3,32	2,77	2,44	4,74	3,40	2,33		
	diff	-1,49	-1,42	0,93	-3,17	-6,55	6,04	0,41	-0,75	3,89
	z-value	-0,70	-0,43	0,34	-1,30	-1,38	1,77	0,17		

Laboratory	Samples	1	2	3	4	5	6	7	d	Sd
6	Mean	19,30	49,55	12,95	27,40	60,65	20,50	36,25		
	REF	16,94	47,61	9,81	24,79	58,80	18,22	32,54		
	S	2,13	3,32	2,77	2,44	4,74	3,40	2,33		
	diff	2,36	1,94	3,14	2,61	1,85	2,28	3,71	2,56	0,67
	z-value	1,11	0,59	1,13	1,07	0,39	0,67	1,59		

Laboratory	Samples	1	2	3	4	5	6	7	d	Sd
7	Mean	20,20	45,15	11,15	27,65	56,05	20,00	30,75		
	REF	16,94	47,61	9,81	24,79	58,80	18,22	32,54		
	S	2,13	3,32	2,77	2,44	4,74	3,40	2,33		
	diff	3,26	-2,46	1,34	2,86	-2,75	1,78	-1,79	0,32	2,58
	z-value	1,53	-0,74	0,48	1,17	-0,58	0,52	-0,77		

To be continued...

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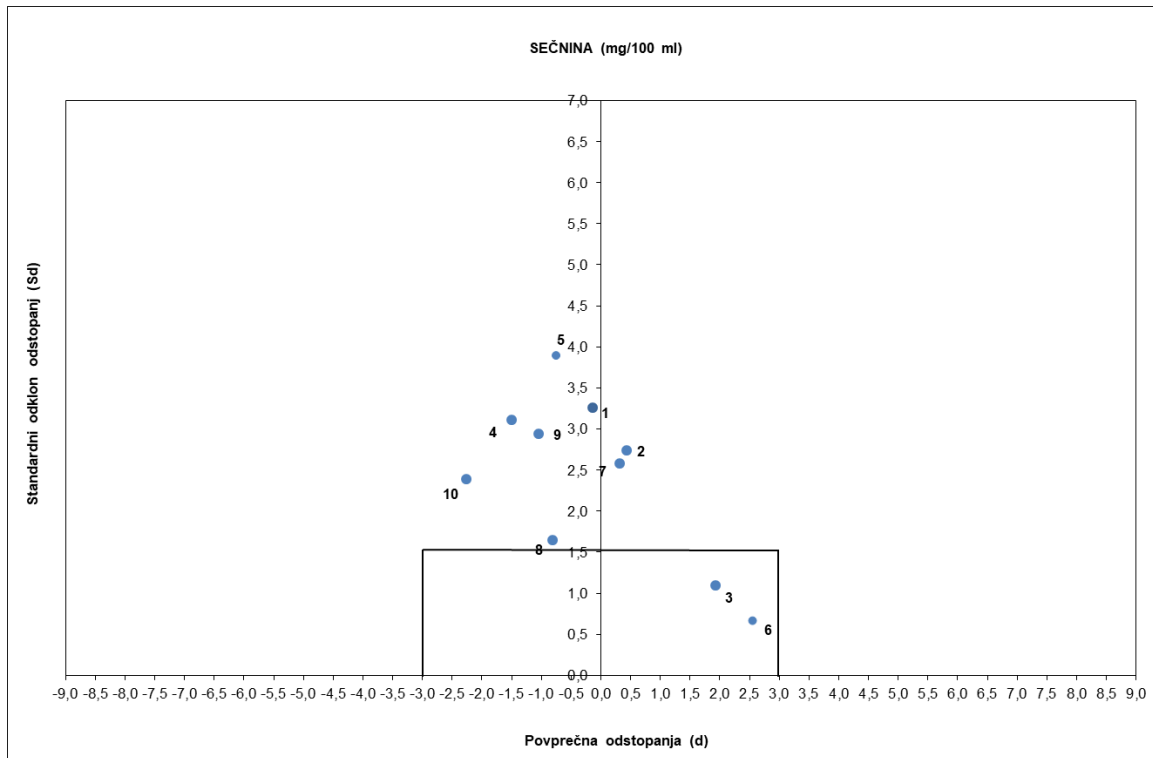
Laboratory	Samples	1	2	3	4	5	6	7	d	Sd
8	Mean	16,80	45,90	7,05	23,15	61,15	16,85	32,15		
	REF	16,94	47,61	9,81	24,79	58,80	18,22	32,54		
	S	2,13	3,32	2,77	2,44	4,74	3,40	2,33		
	diff	-0,14	-1,71	-2,76	-1,64	2,35	-1,37	-0,39	-0,81	1,64
	z-value	-0,07	-0,51	-1,00	-0,67	0,50	-0,40	-0,17		

Laboratory	Samples	1	2	3	4	5	6	7	d	Sd
9	Mean	12,20	49,25	6,70	23,35	61,80	14,65	33,45		
	REF	16,94	47,61	9,81	24,79	58,80	18,22	32,54		
	S	2,13	3,32	2,77	2,44	4,74	3,40	2,33		
	diff	-4,74	1,64	-3,11	-1,44	3,00	-3,57	0,91	-1,04	2,94
	z-value	-2,23	0,50	-1,12	-0,59	0,63	-1,05	0,39		

Laboratory	Samples	1	2	3	4	5	6	7	d	Sd
10	Mean	15,65	43,25	10,39	23,05	52,30	17,45	30,80		
	REF	16,94	47,61	9,81	24,79	58,80	18,22	32,54		
	S	2,13	3,32	2,77	2,44	4,74	3,40	2,33		
	diff	-1,29	-4,36	0,58	-1,74	-6,50	-0,77	-1,74	-2,26	2,38
	z-value	-0,61	-1,31	0,21	-0,71	-1,37	-0,23	-0,75		

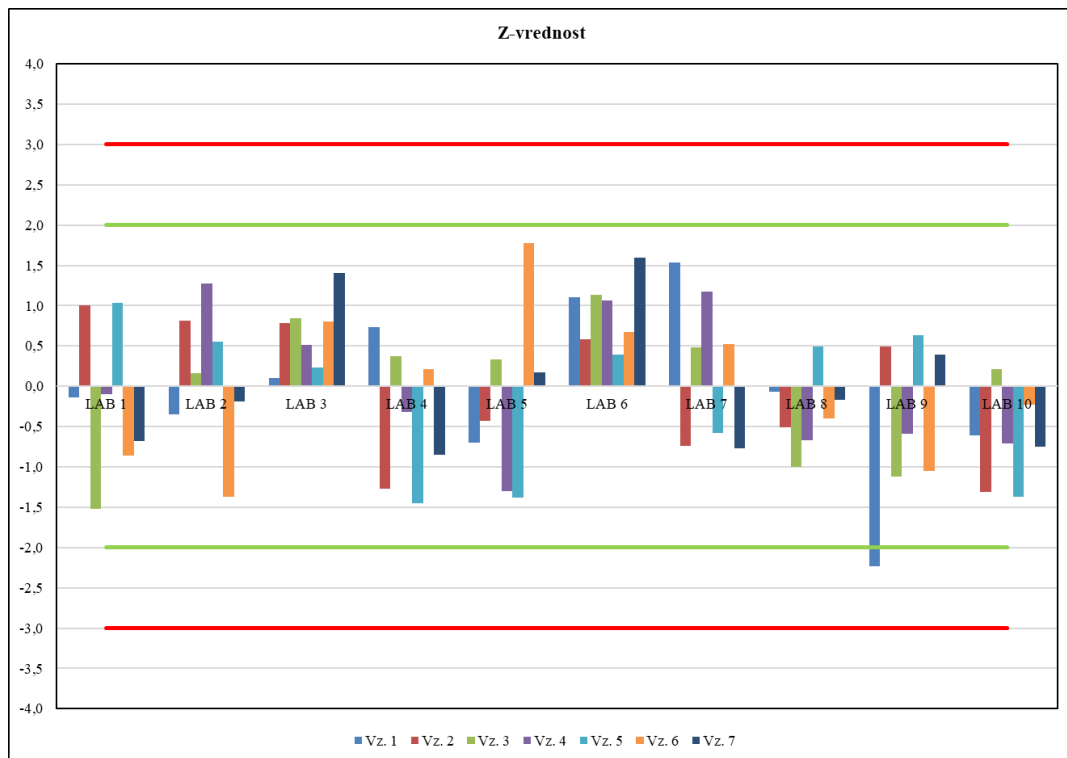
Limits: d = ± 3,00 mg/100 ml Sd = 1,50 mg/100 ml

Figure 1: Accuracy (see Table 5)



Limits: $d = \pm 3,00$ mg/100 ml, $Sd = 1,50$ mg/100 ml

Figure 2: Z-value (see Table 5)



Limits: $|Z| \leq 2,00$ satisfactory $2,00 < |Z| < 3,00$ questionable $|Z| \geq 3,00$ unsatisfactory