Milk Urea Dynamics during its Transformation into Yogurt

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Abstract

The purpose of our work was to evaluate in what measure milk urea concentration stays in processed yogurt and in what measure urea dose influences its quality. We added known amounts of urea into milk destined to yogurt processing in order to obtain probes with concentrations from 0,5 to 28 mg/ 100 ml milk. Obtained results lead us to the conclusion that milk urea decreases dramatically until the finishing of the process of milk coagulation and its transformation into yogurt. All probes which contained higher amounts of urea than 6 mg/ 100 ml milk, urea totally disappeared from yogurt before 48 hours of keeping. Milk coagulation time and its transformation to yogurt is reduced proportional with urea concentration in milk.

Keywords: milk coagulation, urea in yogurt, milk urea

1. Introduction

Cow milk and milk obtained from other ruminants contains normally a certain urea quantity. It derives from nitrite substances fermentation from feed activated by ruminant microorganisms. It increases proportionally with the amount of proteins in cow feed. Milk urea can derive also accidentally by its pollution with chemical fertilizer or polluted water [1, 2, 3, 4, 5]. In order to know if milk urea not concerning its origins arrives on the consumers table, we proposed to explore what happens to milk urea of different concentrations once milk is transformed into yogurt.

2. Materials and methods

In order to find the correct answer to these this issues we organized the following experiment. In 20 recipients where we could find integral milk we added an increasing dose of urea from 0,5 mg to 28 mg/ 100 ml milk. We obtained several milk probes with different urea concentrations. All milk samples were then inoculated with selected lactic bacteria and incubated at 42°C for 3 hours. At the end of incubation all probes were extracted from the incubator and left at room temperature for 2 hours, and afterwards they were kept in the refrigerator for 48 hours. During the transformation process of milk into yogurt we measured the clotting time of milk in each probe. At the end of incubation and also after 24 and 48 hours of keeping yogurt in the refrigerator we took some yogurt samples and analyzed their urea concentration[6, 7, 8, 9, 10].

3. Results and discussion

Concerning urea content in yogurt

In table 1 we expose results concerning urea content in raw milk (native urea derived from ruminal fermentations plus urea added deliberately), and also urea concentration found in fresh yogurt kept in the refrigerator for 24/ 48 hours.

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Table 1. Urea decreasing rate in samples during processing and preservation

Probe	Quantity of urea found in integral milk (mg%)	Quantity of added urea (mg%)	Final concentration of urea in milk	Quantity of urea in probes after incubation (mg%)	Quantity of urea from probes after 24 hours of refrigeration (mg%)	Quantity of urea from probes after 48 hours of refrigeration (mg%)
M1	0.32	0	0.32	0	0	0
PI1	0.32	0.5	0.37	0	0	0
PI2	0.32	1.0	1.32	0	0	0
PI 3	0.32	1.5	1.82	0	0	0
PI4	0.32	2.0	2.32	0	0	0
M2	0.43	0	0.43	0	0	0
PII 1	0.43	3.0	3.43	0.09	0	0
PII 2	0.43	4.0	4.43	0.12	0	0
PII 3	0.43	5.0	5.43	0.17	0	0
PII4	0.43	6.0	6.43	0.18	0	0
M3	0.39	0	0.39	0	0	0
PIII1	0.39	8.0	8.39	0.22	0.05	0
PIII2	0.39	10	10.39	0.31	0.08	0
PIII3	0.39	12	12.39	0.38	0.15	0
PIII4	0.39	14	14.39	0.44	0.22	0
M4	0.29	0	0.3	0	0	0
PIV1	0.29	16	16.3	0.66	0.29	0
PIV2	0.29	20	20.3	0.88	0.39	0
PIV3	0.29	24	24.3	1.06	0.55	0.19
PIV4	0.29	28	28.3	1.14	0.80	0.28

M- Control sample (without added urea)
P1, P2,.P4 Samples with different urea concentrations

Data written in the table above evidence that raw milk contains naturally urea derived from fermentative activity of ruminal microbes upon nitrite substances contained by feed. Its level is situated between 0,29 mg and 0,43 mg in 100 ml milk. After adding into milk increasing urea quantities, raw milk concentration destined to be transformed into yogurt, increased at values showed in the fourth column in the table mentioned above. In columns 5, 6, 7 we showed urea concentration that remained in yogurts composition after 3 hours of incubation and also after 24 and 48 hours of refrigerating the yogurt at 0-6°C.

From table 1 we can conclude that activity of lactic bacteria during incubation at 42°C for 3 hours, a high concentration of urea disappears from milk. During this period urea activity in milk and the one added by lactic bacteria inoculated and grown in milk can completely hydrolyze a quantity of 2,32 mg urea / 100 ml milk.

Urea quantity which remains in yogurt after incubation is hydrolyzed in the following 24 hours by urease during refrigeration. During this period an amount of 3 mg urea/ 100 mg yogurt will be hydrolyzed.

After other 24 hours of refrigeration of yogurt (48 hours after the processing), other 10 mg urea disappear from yogurt. After 28 hours of refrigeration, no trace of urea is found anymore in yogurt excepting the probes which contain a higher concentration than 16- 20 mg urea / 100 ml raw milk.

Concerning the milk clotting time under the influence of an increasing urea concentration

In figure 1 we expose the obtained results regarding the necessary time for milk clotting after inoculation of starter cultures of lactic bacteria into the milk for yogurt production.

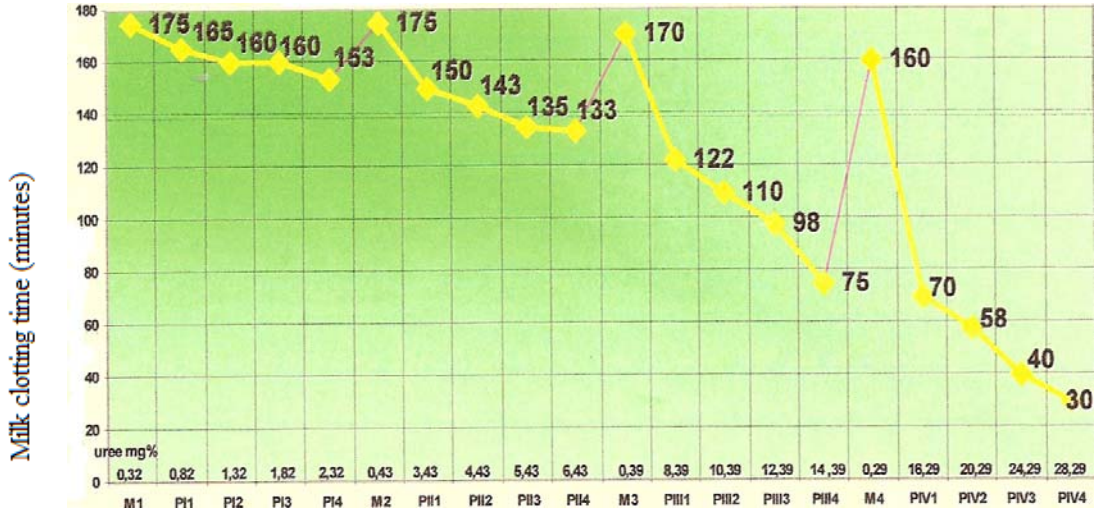

Figure 1. Influence of the quantity of urea on milk clotting

In the picture mentioned above we expose the clotting time of 4 milk probes with different and increasing urea concentrations noted with P1 – P4. Each of the probes has a control probe noted M1-M4. From data mentioned in fig. 1 we conclude that as urea concentration in milk increases, the milk clotting time decreases. It is possible that urea has an inhibitory action upon the transformation process of casein transformation into calcium paracasein. The process seems to repeat itself because the phenomenon is emphasized with each increasing step of milk urea. It is also possible that milk urea influences negatively the multiplying of lactic bacteria leading to a slow lactic acid increasing, modifying the normal time of milk clotting.

4. Conclusions

From our research we can conclude the following:
Existent urea is hydrolyzed by ureasic enzymes which exist in milk or which are synthesized by lactic bacteria during the process of milk transformation into yogurt
During milk incubation (5 hours), 2,30 mg urea disappear from 100 ml milk. In the next 24 hours of yogurt keeping in the refrigerator, another 3 mg urea disappear at 100 ml milk. During processing and keeping of yogurt in the refrigerator for 48 hours the entire quantity of urea, which is higher than 16- 20 mg at % ml milk, disappears by hydrolysis.
Time for milk clotting and yogurt formation decreases as the concentration of urea in milk increases.

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