



Effect of heat treatments in the degradation of antibiotics in milk

D. Escobar¹, R. Pelaggio¹, S. Moreno¹, G. Cardozo¹, E. De Torres³, F. Rey¹, L. Olazabal²

¹Latitud, Fundación LATU, Montevideo, URUGUAY, ²Laboratorio Tecnológico del Uruguay, Montevideo, URUGUAY, ³Facultad de Veterinaria, UdelaR, San Jose, URUGUAY

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Facultad de Veterinaria
Universidad de la República
Uruguay



-15 β -lactam and 3 tetracyclines antibiotics were tested by HPLC-MS/MS

-Knowledge of the effects of different heat treatment conditions on antibiotic residues in milk are relevant for the development of tools and possible strategies that minimize risks to the environment and food safety.

INTRODUCTION



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The antibiotics, are chemical compounds used for the treatment and prevention of diseases such as mastitis and other infectious illnesses in dairy cows. Within them, the beta lactam and tetracycline are widely used (Oliver et al. 2011), by being recommended as a drug on first line, due to its low cost and toxicity.



The veterinary medicine residues, specially the antimicrobial, are considered a danger and potential risk for the public health, the processes of dairy industrialization and the environment.



There are regulations that forbid the processing of the milk with antibiotics residue if they are higher than the maximum limit of residue (LMR) (Codex Alimentarius, 2017).



Heat treatments are used in dairy farms, in artisanal cheese makers (63°C for 30 min) and the elaboration of dairy by-products, such as yogurt and deserts (80 °C, for 20 min), within others.



AIM

The stability and possible heat-inactivation of β -lactam and tetracyclines residues in milk for the final disposal or food safety is important when making decisions when the milk is contaminated.

AIM

The aim of this work was to study the effect of temperature and time on the degradation of 15 β -lactam antibiotics and 3 tetracycline in milk



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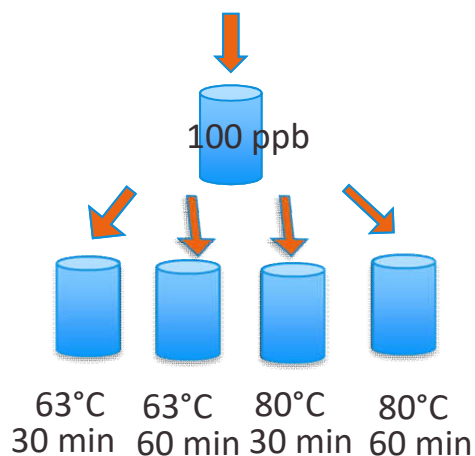
MATERIALS AND METHODS



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15 B-lactam and 3 tetracycline



Raw milk
(TS= 13,24% and MF= 4,32 %)

Fortified milk (0 and 100 ppb)
for each antibiotic

Heat treatments
Temperatures: 63 °C and 80 °C
Time: (30 and 60 min.)

Determination (HPLC-MS/MS)

$$Degradation(\%) = \left(\frac{C_i - C_f}{C_i} \right) * 100$$

RESULTS AND DISCUSSION



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Degradation of β -lactam (penicillins) in raw milk at different heating times and temperatures

T(° C)	Time (min.)	Degradation (%)					
		Amoxicillin	Dicloxacillin	Cloxacillin	Ampicillin	Penicillin G	Oxacillin
63	30	15a*	27a	18a	13a	20a	12a
	60	15a	22a	14a	14a	17a	12a
80	30	18a	24a	14a	19a	22a	12a
	60	38a	47b	34 b	39b	27a	31a

- Penicillin are stable to heat treatment. Degradation < 27% (60 and 80 °C, for 30 min).
- Only in Ampicilim, Cloxacillin and Dicloxacillin (80 °C , 60 min), significant difference was observed (39, 34 and 47%, respectively).

Degradation of β -lactam (cephalosporines) in raw milk at different heating times and temperatures

T(° C)	Time (min.)	Degradation (%)				
		Cephazolin	Cephalexin	Cephalonium	Ceftiofur	Cefquinome
63	30	13a*	15a	24a	29a	24a
	60	11a	26b	20a	30a	26a
80	30	10a	44c	49b	52b	37b
	60	32b	67d	73c	70c	64c

Cephalexin, Cephalonium and Ceftiofur presents degraatation (<30%) at 63 °C, for 30 and 60 min. Temperature have an significative effect, degradation increased when applied 80 °C, 30 min (44 y 52%) and when applied 80°C-60 min. (~70%)

* a - d Different superscripts in the same row indicate significant differences (P <0.05). Values are means of triplicate analysis.

RESULTS AND DISCUSSION



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Degradation of β -lactam (cephalosporines) in milk at different heating times and temperatures.

T (° C)	Time (min.)	Degradation (%)			
		Cephapirin	Cephacetrile	Cephuroxime	Cephoperazone
63	30	49 ^{a*}	62a	53a	44a
	60	50a	71a	54a	48a
80	30	85b	87b	81b	80b
	60	97c	100b	95b	96b

Cephapirin, Cephacetrile, Cephuroxime and Cephoperazone were the antibiotics that presented greater instability with temperature. Degradation between 44 - 62% (63 ° C, 30min) and more than 85% with the application of 80°C.

Degradation of Tetracyclines in milk at different heating times and temperatures.

T (° C)	Time (min.)	Degradation (%)		
		Oxytetracycline	Tetracycline	Doxycycline
63	30	23 ^{a*}	43a	24a
	60	30 a b	44a	26a b
80	30	37b	45a	29b
	60	67c	66b	51c

The greatest degradation in 63°C, 30 min was presented by tetracycline (43%) In all tetracyclines the greatest degradation was at applying 80 ° C, 60 min

* a - d Different superscripts in the same row indicate significant differences (P <0.05). Values are means of triplicate analysis.

CONCLUSIONS

La utilización de heat treatments de pasteurization lenta (63 °C, 30 min) presentaron una baja degradación (< 30%) de residuos de antibioticos en leche cruda en 13 de los 18 antibioticos estudiados; los 5 restantes presentaron una degradación entre 43 y 62%.

Degradaciones mayor al 80% se encontró al aplicar 80 °C, 30 min en Cephacetrile, cephapirin, Cephuroxime y Cephoperazone.

Knowledge of the effects of different heat treatment conditions on antibiotic residues in milk are relevant for the development of tools and possible strategies that minimize risks to the environment and food safety.



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TEAM

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Daniela Escobar, Ronny Pelaggio, Sebastian Moreno
Gonzalo Cardozo, Fabiana Rey, Elena De Torres Laura
Olazabal



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Gracias



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