



## Product Quality and Safety

# Influence of Panamin Animal and Panamin Detox on milk coagulation properties of dairy cows

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**Abstract.** The aim of the study was to evaluate the differences in milk coagulation properties in three groups of dairy cows receiving the dietary supplements Panamin Animal and Panamin Detox. The present group production experiment was conducted in the experimental cattle farm of the Agricultural Institute - Stara Zagora with three groups (two experimental and one control) each comprising 11 lactating dairy cows between November 2016 and March 2017. The cows are kept freely, the milking is in a hall "Fish bone", and the groups were fed balanced rations compliant with milk yield and live body weight of cows, supplemented with 0.50 g/day of two natural dietary additives - Panamin Animal and Panamin Detox in line with recommendations of the manufacturer. The following parameters were monitored: rennet coagulation time (min) - RCT and curd firmness (mm) -  $a_{30}$ . The analysis of individual milk coagulation properties was done on 436 milk samples from cows. Individual milk samples were obtained during the morning milking without adding preservative. The analysis of milk coagulation ability was evaluated at the laboratory of the Agricultural Institute - Stara Zagora by means of Computerized Renneting Metter - Polo Trade, Italy. The obtained phenotypes were corrected for main factors influencing test-day milk yield. The used model considered each test day milk yield as independent observation and unbiased estimates of traits were obtained by a linear mixed-effects model. The supplementation of cows' ration with dietary supplements Panamin Detox and Panamin Animal had a statistically significant beneficial effect on milk coagulation properties of milk ( $p < 0.001$ ). The statistical analysis of group differences in RCT and curd firmness showed highly significant differences between Panamin Animal and control groups for both traits ( $p < 0.001$ ). There was also a highly relevant difference in curd firmness of milk from cows given Panamin Detox supplement and control cows ( $p < 0.001$ ). Data were processed with statistical software products Systat 13 and Pest (Groeneveld), and graphs were generated in MS Excel.

**Keywords:** curd firmness, Panamin Animal, Panamin Detox, rennet coagulation time, zeolite

## Introduction

The milk coagulation properties are a major factor in cheese production, especially in countries where more milk is processed into cheese (Cassandro et al., 2008; De Marchi et al., 2013). Many studies show the role of milk coagulation properties on the quality and quantity of cheese produced (O'Callaghan et al., 2002; Wedholm et al., 2006; De Marchi et al., 2008). Milk coagulation is a complex process influenced by many different factors (M'hamdi et al., 2012; Begum et al., 2014). There are many reasons for using zeolite in animal biotechnology and veterinary medicine due to detoxifying, antioxidant, haemostatic, growth-promoting and immunostimulating properties (Valpotić et al., 2017). Zeolite as dietary supplement has a wide range of effects. Its influence on milk yield and milk composition has

been studied by numerous authors (Dschaak et al., 2010; Ilić et al., 2011; Karatzia et al., 2011).

The use of absorbents (clinoptilolite + sepiolite) in the feeding of cows was studied in 52 Italian Holstein - control and experimental groups, fed with clinoptilolite supplement (Migliorati et al., 2007). The authors found no significant difference between the groups in terms of milkiness, milk fat, protein and lactose concentrations, pH and titratable acidity, both in summer and in spring. In the summer, milk coagulation time was higher in the experimental group than in the control group ( $p < 0.05$ ). The authors found that for a 12-week period, the addition of 1% non-nutrient adsorbents to the ration of lactating cows did not adversely affect milk yield, quality composition and milk coagulation ability.

The effectiveness of clinoptilolite against intoxication by mycotoxins, as well as the increased interest for the use of feed

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additives that do not have residuals on the animal products, are expected to increase the use of clinoptilolite as a feed additive (Valpotić et al., 2017; Benić et al., 2018).

The dietary supplement Panamin Detox contributes to the natural elimination of harmful substances (heavy metals, ammonia) as it binds selectively and very efficiently toxins, e.g. ammonia, formed during digestion or ingested with food (<https://panamin.bg/en/panamin-detox>).

Panamin Animal is an excellent supplement to daily ration, especially to supply of proteins and carbohydrates as it stabilises digestion and improves nutrients' utilisation. It has a protective physiological effect on the gastrointestinal tract and activates microflora (<https://panamin.bg/bg/sastav-panamin-animal>).

The aim of this study was to evaluate the differences in milk coagulation properties in cows whose ration was supplemented with different dietary supplements - Panamin Animal and Panamin Detox.

## Material and methods

### Object of study

The present group production experiment was conducted in the experimental cattle farm of the Agricultural Institute with three groups (two experimental and one control) each comprising 11 lactating dairy cows between November 2016 and March 2017. The cows are kept freely, the milking is in a hall "Fish bone", and the groups were fed balanced rations compliant with the milk yield and live body weight of cows, supplemented with 0.50 g/day of two natural dietary additives - Panamin Animal and Panamin Detox in line with recommendations of the manufacturer - Panamin, Bulgaria, <https://panamin.bg/en/application-panamin-animal> (Table 1).

**Table 1.** Chemical composition of Panamin Animal and Panamin Detox

Chemical composition, %			
Panamin Animal	Panamin Detox		
CaO	30.50	SiO <sub>2</sub>	67.50
SiO <sub>2</sub>	19.00	AlO <sub>2</sub>	13.54
MgO	3.27	MgO	0.55
K <sub>2</sub> O	0.65	K <sub>2</sub> O	3.12
Fe <sub>2</sub> O <sub>3</sub>	0.50	CaO	3.55
Na <sub>2</sub> O	0.35	Na <sub>2</sub> O	1.24

Source: [www.panamin.bg](http://www.panamin.bg)

### Investigated parameters

Throughout the experiment, the following parameters of milk coagulation properties were monitored: rennet coagulation time (min) - RCT and curd firmness (mm) -  $a_{30}$ .

The analysis of individual milk coagulation properties was done on 435 (average 145 from each group) milk samples from cows reared at the Agricultural Institute cattle farm - Stara Zagora. Individual milk samples were obtained during the morning milking without adding preservative.

The analysis of milk coagulation ability was evaluated at the laboratory of the Agricultural Institute – Stara Zagora by means of Computerized Renneting Metter – Polo Trade, Italy. The chymosin

used is Naturen Plus 215/0.8L - animal rennet manufactured from the extract of the fourth stomach (vells) of either calves or lambs with milk coagulation activity - 215 IMCU/ml. Milk samples (10 ml) were pre-warmed (35°C) before analysis.

### Statistical analysis

The obtained phenotypes were corrected for main factors influencing test-day milk yield. The used model considered each test day milk yield as independent observation and unbiased estimates of traits were obtained by a linear mixed-effects model.

- observation vector of individual test-day rennet coagulation time and curd firmness;
- fixed effects vector – group, number of lactation (parity), age (days) to the respective test-day, days in lactation to the respective test-day of the respective lactation of the cow.

$$Y_{ijklm} = \text{Group}_i + \text{Par}_j + \text{Testdim}_k + \text{Age}_l + e_{ijklm}$$

Where:

$Y_{ijklm}$  –  $m^{\text{th}}$  observation of a trait;

$\text{Group}_i$  – fixed effect of the  $i^{\text{th}}$  group;

$\text{Par}_j$  – fixed effect of the  $j^{\text{th}}$  parity;

$\text{Testdim}_k$  – random regression effect of  $k^{\text{th}}$  days in lactation to the respective milk test-day of the respective lactation;

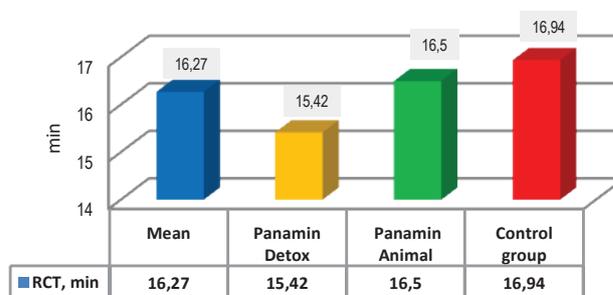
$\text{Age}_l$  – effect of  $l^{\text{th}}$  age of calving;

$e_{ijklm}$  - random effect of unobserved factors.

The data were processed with statistical software products Systat 13 and Pest /Groeneveld/, and graphs were generated in MS Excel.

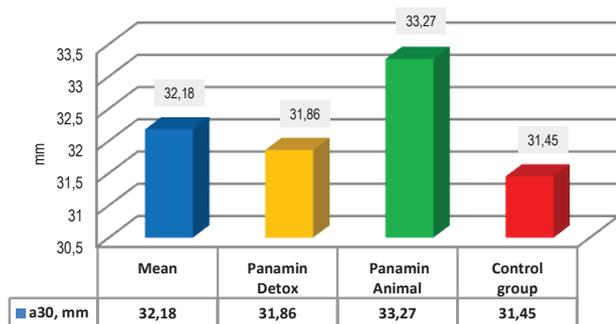
## Results and discussion

With regard to the first trait characterizing milk coagulation properties – rennet coagulation time (RCT), it was the shortest in cows supplemented with Panamin Detox – 15.42 min (Figure 1). The milk produced by animals in the other two groups in this study was outlined with more prolonged RCT. The control group of cows produced milk, which coagulated for 16.94 min. A similar result is indicated by Cassandro et al. (2008). The authors found that the time for coagulation of Holstein milk was 16.9 min. Longer milk coagulation time - 18.25 min was found by Yordanova (2015) in a study conducted with Holstein cows raised in different flocks. De Marchi et al. (2008) indicated that Brown Swiss cows had superior coagulation traits, including faster RCT (16.3 vs. 18.1 min) and greater curd firmness ( $a_{30}$  23.9 vs. 19.4 mm) than milk from Holstein cows.



**Figure 1.** Effect of Panamin Animal and Panamin Detox dietary supplement on rennet coagulation time (RCT)

The hardest coagulum is characterized by the milk of animals receiving the food supplement Panamin Animal - 33.27 mm (Figure 2). In the case of milk from animals in the group receiving the Panamin Detox supplement and the control group, very close as well as lower values of the indicator were reported - 31.86 and 31.45 mm, respectively. Toffanin et al. (2012) analyzed the coagulation ability of 436 dairy herds (Holstein-Friesian cows). The results obtained for the parameters describing the coagulation ability of milk are - coagulation time - 18.83 min, curd firmness - 26.97 mm. The average curd firmness for both groups - 32.18 mm is higher than that established by Yordanova (2015) - 30.31 mm. A much lower value is indicated by Vallas et al. (2009), which establishes a coagulum hardness of 27.2 mm.



**Figure 2.** Effect of Panamin Animal and Panamin Detox dietary supplements on curd firmness ( $a_{30}$ )

The statistical analysis of group differences in RCT and curd firmness showed highly significant differences between Panamin Animal and control groups for both traits ( $p < 0.001$ ) – Tables 2 and 3. A significant difference was found between the groups receiving the supplements Panamin Animal and Panamin Detox ( $p < 0.05$ ) and between the group receiving the food supplement Panamin Detox and the control group ( $p < 0.05$ ) - Table 2. There was also a highly relevant difference in curd firmness of milk from cows given Panamin Detox supplement and control cows ( $p < 0.001$ ) - Table 3. Similar results are reported by Migliorati et al. (2007). The authors found that for a 12-week period, the addition of 1% non-nutrient adsorbents to the ration of lactating cows did not adversely affect milk yield, quality composition and milk coagulation ability.

**Table 2.** Mean differences and reliability between experimental and control groups for RCT, min

Variable	Mean Difference	p-Value
RCT - Panamin Detox- Group 1	-1.666	0.010*
RCT - Panamin Animal - Group 2	1.663	0.028*
RCT - Panamin Detox - Group 1	3.366	0.000***
RCT - Control group - Group 3		
RCT - Panamin Animal - Group 2		
RCT - Control group - Group 3		

RCT- rennet coagulation time (min);  
\*:  $p < 0.05$ ; \*\*:  $p < 0.01$ ; \*\*\*:  $p < 0.001$ .

**Table 3.** Mean differences and reliability between experimental and control groups for curd firmness –  $a_{30}$ , mm

Variable	Mean Difference	p-Value
$a_{30}$ - Panamin Detox - Group 1	1.273	0.430
$a_{30}$ - Panamin Animal - Group 2	7.347	0.000***
$a_{30}$ - Control group - Group 3	6.161	0.000***
$a_{30}$ - Panamin Animal - Group 2		
$a_{30}$ - Control group - Group 3		

\*\*\*:  $p < 0.001$

In conclusion, it can be stated that the effect of the application of such an organic supplement in dairy cows can be established after a complete physiological cycle of the herd life of cows - dry period, pregnancy, lactation. This process can be influenced by various genetic and environmental factors that affect the productivity of animals and their coagulation ability of milk.

## Conclusion

It was found: 1) The supplementation of cows' diet with dietary supplements Panamin Animal and Panamin Detox had a highly pronounced beneficial effect on milk coagulation traits ( $p < 0.001$ ). 2) The statistical analysis of group differences in rennet coagulation time (RCT) and curd firmness ( $a_{30}$ ) showed highly significant differences between Panamin Animal and control groups for both traits. 3) Additionally, more prolonged investigations are necessary to evaluate the effect of the tested organic supplement on the coagulation ability of the cows milk.

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