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EFFECT OF ZEOLITE ON THE CHEMICAL COMPOSITION OF MILK FROM SERBIAN SPOTTED DAIRY CATTLE

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Abstract: Milk yield and milk chemical composition are largely affected by the quality of dairy cattle diet. The chemical composition of milk is dependent upon a large number of factors, including breed, diet, care, housing system, stage of lactation, etc. Milk composition is primarily a breed-specific trait. This study was conducted over a period of 15 months, involving Serbian Spotted dairy cattle. The experimental animals were assigned to three groups, each receiving different levels of supplemental zeolite. The control group comprised cows that received no zeolite supplement. Experimental Groups I and II were fed compound feeds supplemented with 4% and 2% zeolite, respectively. Milk samples were analysed for the contents of milk fat, proteins, fat-free solids and lactose, and density. The results obtained suggest that zeolite supplementation affects milk chemical composition, depending on the zeolite level present in livestock feed.

Key words: dairy cows, zeolite, milk fat, proteins, lactose

Introduction

The health status of dairy cattle and, accordingly, their production and reproduction traits are largely affected by the quality of feeds used in their diet. Natural zeolite has been successfully used in livestock production as a feed supplement for some types and categories of domestic animals.

The related studies conducted so far have suggested improvements in weight gain and feed conversion efficiency in all types of domestic animals. Moreover, zeolite-based products have been found to inhibit mould growth *(Harvey et al., 1991; Rajic et al., 1991; Neustroyev et al., 1995; Pešev, 2002).*

Studies on the effect of dietary zeolite supplementation in dairy cattle have been conducted by *Neustroyev et al. (1995)*, *Nešić, (2000), Pešev et al. (2005),* and *Ilić et al. (2007)*.

Increasing attention has been focused on the prevention of mycotoxicoses. To this end, zeolite is used as a mycotoxin absorbent.

Materials and Methods

This study involved 45 Serbian Spotted dairy cows. The test animals were assigned to 3 groups each comprising 15 animals and involving use of different levels of supplemental zeolite. The control group (C) received no zeolite supplement. Experimental group I (E-I) and Experimental group II (E-II) were fed rations i.e. compound feeds supplemented with 4% and 2% zeolite, (commerce name „Tufozel“ origin from Serbia) respectively.

The trial was conducted at a dairy farm in Veliki Šiljegovac.

The related studies conducted so far by a number of international authors suggest improvements in weight gain and feed conversion efficiency in all types of domestic animals. Moreover, zeolite-based products have been found to inhibit mould growth.

„Tufozel” is a finely micronised thermally and technologically treated feed supplement that exhibits a highly selective adsorption capacity for mycotoxins. “Tufozel” is unharmful, insoluble, non-resorptive and leaves no residue in milk.

Milk samples were analysed for milk fat, protein, non-fat solids (NFS) and lactose contents, as well as for milk density.

The objective of this study was to evaluate the effect of different levels of supplemental “Tufozel” on milk fat, protein, NFS and lactose contents, as well as on milk density.

Results and Discussion

The chemical composition of milk is dependent upon a large number of factors, including breed, diet, care, housing system, stage of lactation, etc. Milk composition is primarily a breed-specific trait in cattle. Different studies on the effect of nutrition on cow milk production and milk composition have revealed that no feed can have a role in predetermining milk composition and yield regardless of the well-known fact that cellulose-containing feedstuffs stimulate milk fat content and that quality balanced feeds affect milk production.

Milk samples collected in this study were analysed for milk fat, protein, NFS and lactose contents, as well as for milk density. Milk fat content is a breed-specific trait also dependent upon external factors, most notably diet.

Milk fat content obtained by dairy cattle is presented in Table 1.

Table 1. Average milk fat quantity in whole lactations(%)

Group	N	$\overline{X}$	$s_{\bar{x}}$	SD	CV(%)	Variations		Fexp
						min	max	
E-I	15	4.62	0.08	0.33	7.14	4.10	4.90	
E- II	15	4.26	0.11	0.38	8.91	3.60	4.70	4.31^{*}
C	15	4.28	0.28	1.07	25.06	2.50	5.70	

N.S. – P>0.05; *- P<0.05; **- P<0.01; *** - P<0.001

Table 1. shows that milk fat content was highest in E-I group cows (4.62%), followed by C group cows (4.28) and E-II group cows (4.26%). E-I group cows yielded minimum and maximum milk fat contents of 4.10% and 4.90%, respectively. Statistically significant differences in milk fat content were observed between the groups tested (P<0.05).

Considerably high milk fat contents were produced in this study, particularly by E-I group cows receiving 4% zeolite supplement. The results obtained conform to those reported by *Pešev (2002),* as well as by *Vetuška (1996)* and *Urban et al. (1998)* in their experiments on the Czech Simmental breed. Similar results on the fat content of milk were obtained by *Ivanov (1990),* and *Gottschalk (1996)*, and somewhat lower values by *Perišić (1998), Ostojić and Orlović (2002), Orlović and Ostojić (2003), Važdić et al. (2005)* and *Petrović et al. (2006)*. Lower values were produced by *Petrović (2000)* and considerably lower by *Nešić (2000)* in Black-and-White cattle.

The protein content of cow milk is given in Table 2.

Table. 2 shows that the protein level of cow milk in this study ranged from 3.34% in E-II group cows to 3.51% in control cows. Control group cows had the highest average milk protein content, but also showed the highest variations in this trait.

Table 2. Milk protein content (%)

Group	N	$\overline{X}$	$s_{\bar{x}}$	SD	CV(%)	Variations		Fexp
						min	max	
E-I	15	3.44	0.02	0.09	2.54	3.33	3.53	
E- II	15	3.34	0.02	0.09	2.26	3.18	3.42	1.48^{NS}
C	15	3.51	0.02	1.11	3.18	3.34	3.62	

N.S. – P>0.05; *- P<0.05; **- P<0.01; *** - P<0.001

No statistically significant differences in milk protein content were observed between the test groups (P>0.05). The milk produced in this study is in agreement with EU regulations on the minimum protein content of above 2.80%.

The present results on milk protein content comply with the values reported by *Gottschalk (1996), Reeb (1996), Vetuška (1996), Ostojić and Orlović*

(2002), Orlović and Ostojić (2003), and *Petrović et al. (2006)*. The data obtained by *Nešić (2002)* show lower milk protein content in Black-and-White cattle.

Milk density or biotest involving controlled cows is presented in Table 3.

Table 3. Milk density (%)

Group	N	$\overline{X}$	$s_{\bar{x}}$	SD	CV(%)	Varia tions		Fexp
						min	max	
E-I	15	31.98	0.26	1.02	3.19	30.61	32.98	
E- II	15	31.21	0.24	0.94	3.01	29.46	31.87	6.22*
C	15	33.00	0.36	1.42	4.29	31.17	35.07	

N.S. – P>0.05; *- P<0.05; **- P<0.01; *** - P<0.001

The average values of milk density ranged from 31.21% in E-II cattle to 33.00% in control cows. As with the previous trait analysed, the lowest average value of the trait was measured in E-II cattle (31.21) which also exhibited the lowest coefficient of variation among the groups tested (3.01). Control cows had the highest milk density, but also showed the highest variations of 4.29% within the group. Statistically significant differences between the groups were observed in this trait (P<0.05).

The milk biotest results obtained by *Ostojić and Orlović (2002),* and *Orlović and Ostojić (2003)* were in agreement with the results herewith presented.

The non-fat solids content of milk is outlined in Table 4.

Table 4. NFS content of milk (%)

Group	N	$\overline{X}$	$s_{\bar{x}}$	SD	CV(%)	Variations		Fexp
						min	max	
E-I	15	9.38	0.06	0.23	2.51	9.08	9.62	
E- II	15	9.11	0.06	0.24	2.62	8.67	9.33	5.25*
C	15	9.56	0.07	0.30	3.18	9.11	9.87	

N.S. – P>0.05; *- P<0.05; **- P<0.01; *** - P<0.001

The NFS content of milk was highest in control cows (9.56%) and lowest in E-II cattle (9.11%). The highest variation in the trait was observed in control cows and the lowest in E-I cattle (2.51%).

The NFS content of milk showed statistically significant differences (P<0.05). The NFS values obtained in this study comply with EU requirements of over 8.50% for this trait.

Petrović et al. (2006) and *Petrović et al. (2006)* reported an average NFS content of 12.86% and 8.56%, respectively. Black-and-White cattle in a study by

Nešić (2000) yielded 8.55-8.71% NFS. These values are somewhat lower than the present results.

Milk lactose content is a highly important milk quality factor. European attention has been given to milk lactose content, with milk price in some European countries being formed based on milk lactose content.

Milk lactose content in this study is presented in Table 5.

Tabele 5. Milk lactose (%)

Group	N	$\overline{X}$	$s_{\bar{x}}$	SD	CV(%)	Variations		Fexp
						min	max	
E-I	15	5.16	0.03	0.13	2.54	4.99	5.19	
E- II	15	5.01	0.03	0.13	2.59	4.77	5.13	4.26*
C	15	5.26	0.04	0.17	3.21	5.01	5.43	

N.S. – P>0.05; *- P<0.05; **- P<0.01; *** - P<0.001

The milk lactose content produced in this study ranged from 5.01% in E-II group cows to 5.26% in control cows. The lactose content of E-I group cows was between the values obtained by the two other groups.

Statistically significant differences in milk lactose content were observed between the groups (P<0.05).

Nešić (2000) obtained a lactose content of 4.75 to 4.89% in Black-and-White cattle.

Conclusion

Milk fat content was highest in E-I group cows (4.62%), followed by C group cows (4.28) and E-II group cows (4.26%). Statistically significant differences in milk fat content were observed between the groups tested (P<0.05).

The protein level of cow milk in this study ranged from 3.34% in E-II group cows to 3.51% in control cows. Control cows had the highest average milk protein content, but also showed the highest variations in this trait. No statistically significant differences in milk protein content were observed between the test groups (P>0.05).

The average values of milk density ranged from 31.21% in E-II group cows to 33.00% in control cows. As with the previous trait analysed, the lowest average value of the trait was measured in E-II group cows (31.21) which also exhibited the lowest coefficient of variation among the groups tested (3.01). Statistically significant differences between the groups were observed in this trait (P<0.05).

The NFS content of milk was highest in control cows (9.56%) and lowest in E-II group cows (9.11%). The highest variation in the trait was observed in

control group cows and the lowest in E-I group cows (2.51%). The NFS content of milk showed statistically significant differences (P<0.05).

The milk lactose content produced in this study ranged from 5.01% in E-II group cows to 5.26% in control cows. The lactose content of E-I gropu cows was between the values obtained by the two other groups. Statistically significant differences in milk lactose content were observed between the groups (P<0.05).

Zeolite ("Tufozel") supplementation was found to affect the chemical composition of milk in dairy cattle.

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Uticaj zeolita na hemijski sastav mleka kod krava muzara domaće šarene rase

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Rezime

Najveći sadržaj mlečne masti u mleku je izmeren kod krava I-O grupe 4,62%, zatim kod K-grupe 4,28% i najmanji kod II-O grupe 4,26%. Statistički signifikantnih razlika u sadržaju mlečne masti među grupama je bilo (P<0,05).

Nivo proteina u mleku krava bio je u intervalu od 3,34% kod krava II-O grupe do 3,51% kod krava kontrolne grupe. Krave K-grupe imaju najveći prosečni sadržaj proteina u mleku ali i najveće varijacije u ovoj osobini. Na osnovu sadržaja proteina u mleku statistički značajnih razlika između grupa nije bilo (P>0,05).

Prosečne vrednosti gustine mleka bile su u opsegu od 31,21% kod krava II-O grupe do 33,00% kod krava K-grupe. Kao i kod prethodne osobine i ovde je najmanja prosečna vrednost merene osobine bila kod krava II-O grupe (31,21), sa isto tako, najmanjim koeficijentom varijacije među grupama (3,01). Kod ove osobine uočene su statistički značajne razlike među grupama (P<0,05).

Najveći sadržaj SMBM u mleku imale su krave K-grupe sa iznosom od 9,56%, a najmanju krave II-O grupe 9,11%. Najveće variranje ove osobine je kod krava K-grupe, a najmanje kod krava I-O grupe sa iznosom od 2,51%. Sadržaj SMBM u mleku pokazao je statistički značajne razlike (P<0,05).

Sadržaj laktoze u mleku krava bio je u intervalu od 5,01% kod krava II-O grupe do 5,26% kod krava K-grupe. Krave I-O grupe imale su količinu laktoze

koja se nalazila između ove dve grupe. Sadržaj laktoze u mleku krava između grupa pokazao je statistički značajne razlike ($P<0,05$).

Dodavanje zeolita ("Tufozel") imalo je uticaja na hemijski sastav mleka kod ispitivanih krava muzara.

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