

Comparison of Milk Production Traits by Istrian Pramenka between Conventional and Organic Systems in Slovenia

Željka KLIR¹

Klemen POTOČNIK²

Zvonko ANTUNOVIĆ¹

Dragomir KOMPAN² (✉)

Summary

The aim of the present study was to determine differences of amount and composition of milk between conventional and organic systems in Istrian pramenka breed of sheep. Sum of the data included 838 conventional and 9238 organic samples of ewes' milk. Each farm is classified as organic from the date of entering in organic production. Before that date farms didn't show characteristics of organic production, therefore they were classified as conventional. The results of the present study included higher amount of morning (353.10 g) and evening milk (361.39 g) in conventional compared to morning (342.76 g) and evening milk (345.69) in organic system, significantly influenced by number of lactation ($P < 0.001$), breeding system and breeder interaction ($P < 0.001$). Higher content of fat in conventional system was significantly influenced by breeding system ($P < 0.05$), breeding system and breeder interaction ($P < 0.001$), number of lactation ($P < 0.01$) and lactation length ($P < 0.001$). Lower protein content in conventional system was influenced significantly by breeding system and breeder interaction ($P < 0.001$), litter size ($P < 0.05$) and lactation length ($P < 0.001$). Content of lactose was higher in organic system (3.93%) compared to conventional system (3.84%) significantly influenced by breeding system ($P < 0.01$) and number of lactation ($P < 0.001$). According to results, differences between conventional and organic systems are the mostly influenced by breeder in Slovenia.

Key words

conventional system, organic system, milk composition, Istrian pramenka

¹ Faculty of Agriculture in Osijek, Kralja Petra Svačića 1d, 31 000 Osijek, Croatia

✉ e-mail: Drago.Kompan@bf.uni-lj.si

² Biotechnical faculty, Groblje 3, SI-1230 Domžale, Slovenia

Received: April 20, 2013 | Accepted: June 17, 2013

Introduction

Istrian pramenka is Croatian (Mioč et al., 2009) and Slovenian (Kompan et al., 1999) autochthonous breed of sheep. It is traditionally bred in Slovenia regions of Karst and Istria (Kužner et al., 2005) as well as in Istrian peninsula, the part of Croatia. Despite the fact that, in original, Istrian pramenka belongs to breeds of combined production (milk-meat-wool), according to aim of production, breeding goal and production traits it can be classified as typical dairy breed (Vrdoljak et al., 2012). The autochthonous breeds are well adaptable and resistant on the environmental conditions of certain area, therefore suitable for organic farming. According to Vrdoljak et al. (2012) Istrian pramenka, by efficiency of milk production, may be compared with the breeds with highest milk production in the world.

By developing of organic agriculture it is possible to reduce the negative influence of agricultural technology on environment and to improve the quality of obtained products, because of the use of pesticides, organic compounds, excitors for growing, veterinary drugs and antibiotics are restricted in organic agriculture (Zagorska and Ciprova, 2008). Results from literature showed very contradictory differences in amount and milk composition between conventional and organic farming system, although some of them showed no significant differences. Results are different from case to case. Battaglini et al. (2009) found significant ($P<0.05$) differences between milk yield of cows raised on organic pasture in comparison with cows' milk of pastures in conventional system that had lower milk yield. These authors also found significant higher milk content of protein in conventional system, but no significant differences in content of fat and lactose between organic and conventional systems. In contrary, Kastelic and Kompan (2008) found significantly ($P<0.001$) higher milk yield of ewes in conventional system compared to organic. However, Olivo et al. (2005) found significantly ($P<0.05$) higher milk yield from cows in agro-ecological system compared to conventional system. Pirisi et al. (2001) found significant ($P<0.01$) higher milk yield from ewes in organic system compared to conventional (1.44:1.12 kg). In the study by Zagorska and Ciprova (2008) the content of fat and lactose was higher in organic cows' milk samples.

According to mentioned data the aim of the present research was to determine significant differences in ewes' milk yield and milk composition of the Istrian pramenka between conventional and organic systems in farms of Slovenia from the data collected during 12 years.

Material and methods

The present research is based on the data from Slovenian selection program for sheep. Data were selected from conventional and organic dairy farms of Istrian pramenka sheep. Milk recording from conventional farms were carried out from year 2000 until 2010, while in organic farms were from 2001 until 2012 year. Each farm is classified as organic from the date of entering in organic production. Before that date, in our study, farms and the data from that time were classified as conventional. Sum of the data included 838 conventional and 9238 organic samples of ewes' milk. The basic information about farms and some dairy traits are given in table 1.

Table 1. Basic farm differences and some dairy traits between breeding systems

Indicators	Breeding system	
	Conventional	Organic
Number of sheep	116	885
Number of farms	3	4
The year of dairy control	2000-2010	2001-2012
Average lactation length (days)	213.97	197.30
Average number of lactation	2.21	3.15
Farm number	Number of samples per farm	
252	566	1879
417	245	293
325	27	-
289	-	6353
312	-	713
Total number of samples	838	9238

The farms had season production, and lambing in the beginning of year. Lambs were suckling 60-90 days followed by machine milking. During winter ewes were in barn while in organic system ewes had also fenced outlet near barn. Feeding for all ewes was based on the hay except a month before lambing when they were fed with 0.5-0.6 kg of concentrates. In organic production feedstuffs were organic origin. In the beginning of milking all the ewes were on the pastures in the Slovenian Karst area at the altitude of 300-1000 m. Milking was conducted two times per day (morning and evening milking) from April until July, and once per day in the August. After that, rams were placed in the herd of ewes for the mating.

Two organic farms were conventional before entering in organic production. After transfer from conventional to organic system farms used organic concentrates in the diets of ewes, and used the mineral fertilizer for the feed production, as well as treatment against parasites according to criteria of the Council Regulations of the European Union.

Studied traits were: yield of morning milk, yield of evening milk, content of fat, protein and lactose in every sample of milk. Morning milk yield (MM), evening milk (NM), content of fat (F), content of protein (P) and content of lactose (L) were analysed with a linear statistic model (GLM procedure, SAS, 9.3) using breeding system (S), S*B (breeding system*breeder), number of lactation (NL), litter size (LS) and lactation length (LL) as fixed variables. We estimated the LSMEAN of the investigated variables.

Results and discussion

The results from the present research are presented in table 2. The amount of milk, both morning and evening samples were not influenced by breeding system which is in accordance with Martinez et al. (2009). Amount of milk was higher in conventional system, significantly influenced by number of lactation ($P<0.001$), breeding system and breeder interaction ($P<0.001$). In conventional system 92% of ewes were from 1st to 4th lactation compared to animals from organic system where there were 76% animals in mentioned number lactation. Gabiña et al. (1993.) observed that milk yield of ewes increase from 1st to 4th

Table 2. Number of milk samples and mean values between conventional and organic breeding systems, with significance level influenced by breeding system, breeding system and breeder interaction, number of lactation, litter size, and lactation length on the composition and amount of milk

Indicators	Breeding system				Effects (Significance)						R ²
	Conventional		Organic		S	S*B	NL	LS	LL	LL*LL	
	N	LSMean	N	LSMean							
MM (g)	835	353.10	9114	342.76	NS	***	***	NS	NS	NS	0.083
NM (g)	832	361.39	8401	345.69	NS	***	***	NS	NS	NS	0.081
F (%)	832	7.72	8852	7.48	*	***	**	NS	***	***	0.083
P (%)	833	6.06	8852	6.13	NS	***	NS	*	***	***	0.047
L (%)	822	3.84	8849	3.93	**	NS	***	NS	NS	NS	0.957

MM-morning milk; NM-evening milk; F-fat content; P-protein content; L-lactose content; N-number of samples; S-breeding system; B-breeder; NL-number of lactation; LS-litter size; LL-lactation length; NS-not significant;***P<0,001; **P<0,01; *P<0,05

lactation progressively and after that milk yield is decreasing, which agrees with results from our study. Breeding systems and breeder interaction significantly ($P<0.001$) influenced the amount of morning and evening milk, as well as content of fat and protein. The reason for this is the fact that organic farms differed in many aspects from the conventional systems, although there were considerable individual differences in farm management (Bloksma et al. 2008).

Fat content was 7.72% and 7.48% in conventional and organic system, respectively. Higher content of fat was significantly influenced by breeding system ($P<0.05$) which is in accordance with results obtained in cows' milk by Olivo et al. (2005) and Slots et al. (2009). Higher content of fat in conventional system was also influenced significantly ($P<0.01$) by number of lactation which is in accordance with results of Kremer et al. (1996) that observed increasing fat content of sheep with increase of age or number of lactation. Ewes from conventional system, in our study, were in a lactation in average for 213.97 days compared to ewes from organic system that were in lactation period for 197.30 days that means more milk and lower content of fat and protein. Although, results from our research showed higher content of fat in conventional milk where amount of milk was higher. It may be due to feeding cause content of proteins and fats are influenced by feeding the most (Toledo et al., 2003).

Higher amount of milk is in negative correlation with content of protein that was observed by Vrdoljak et al. (2012) in Istrian pramenka. Ewes in organic system had significantly ($P<0.001$) higher protein content influenced by shorter lactation length. Pacinovski et al. (2007) observed higher content of protein in Awassi ewes with shorter length of lactation.

Content of lactose was higher in organic system (3.93%) compared to conventional system (3.84%). There was a significant ($P<0.01$) influence of breeding system on the content of lactose which is in accordance with Kastelic and Kompan (2008) and Olivo et al. (2005). Significant influence of number of lactation on the lactose content was may be due to higher number of ewes that were in 5th to 11th lactation. Mentioned ewes had lower content of milk fat compared to conventional ewes. In our research lactose content was in opposite connection with fat content. Antunović et al. (2001) observed negative correlation between content of milk fat and content of lactose.

Conclusion

The results of the research showed higher amount of milk in conventional compared to organic system. Differences between conventional and organic systems in amount of milk, fat and protein content were mostly influenced by breeder and it differs from farm to farm in Slovenia. Breeding system had influence only on the content of fat and lactose resulting in decrease of fat and increase of lactose in organic milk.

References

- Antunović Z., Steiner Z., Senčić Đ., Mandić M., Klapac T. (2001). Changes in ewe milk composition depending on lactation stage and feeding season. *Czech J Anim Sci* 46: 75-82
- Battaglini L. M., Renna M., Garda A., Lussiana C., Malfatto V., Mimosi A., Bianchi M. (2009). Comparing milk yield, chemical properties and somatic cell count from organic and conventional mountain systems. *Ital J Anim Sci* 8: 384-386
- Bloksma J., Adriaansen-Tennekes R., Huber M., P. L. Van de Vijver L., Baars T., de Wit J. (2008). Comparison of organic and conventional raw milk quality in Netherlands. *Biological Agriculture and Horticulture* 26: 69-83
- Gabiña D., Arrese F., Arranz J., Beltran de Hereida I. (1993). Average milk yields and environmental effects on Latxa sheep. *Journal of Dairy Science* 76: 1191-1198
- Kastelic M., Kompan D. (2008). Milk production of bovska sheep in conventional and organic farming system. *Acta agriculturae Slovenica* 2: 41-46
- Kompan D., Birtic D., Drobic M., Pogacnik M. (1999). Autochthonous sheep breeds: Bovec and Istrian Pramenka, Jezersko-Solcava Sheep and Bela Krajina Pramenka. *Sodobno kmetijstvo* 32: 309-312
- Kremer R., Rosés L., Rista L., Barbato G., Perdigon F., Herrera V. (1996). Machine milk yield and composition of non-dairy Corriedale sheep in Uruguay. *Small Ruminant Research* 19:9-14
- Kužner J., Koral L., Nemeč M., Borko Č., Marc I., Pogačnik M., Eržen N. K., Flajs V. C. (2005). Tolerance of therapeutic doses of abamectin and doramectin in Istrian pramenka sheep. *Journal of Veterinary Medicine A* 52: 525-528
- Martínez-Fernández A., Vicente F., Morales-Almaráz E., Soldado A., de la Roza Delgado B., Argamentería A. (2009). Effects of conventional versus organic management system on perennial ryegrass-white clover rotational grazing pastures: grass allowance, milk yield and quality of grass and milk. *Irish Journal of Agricultural and Food Research* 48:264

- Mioč B., Vnučec I., Prpić Z., Pavić V., Antunović Z., Barać Z. (2009). Effect of breed on mineral composition of meat from light lambs. *Italian Journal of Animal Science* 8: 273-275
- Olivo C. J., Beck L. I., Mossate Gabbi A., Santini Charão P., Sobczak M. F., Gomes Uberty L. F., Dürr J. W., Araújo Filho R. (2005). Composition and somatic cell count of milk in conventional and agro-ecological farms: a comparative study in Depressão Central, Rio Grande do Sul state, Brazil. *Livestock Research for Rural Development* 17 (6), downloaded from <http://www.lrrd.org/lrrd17/6/oliv17072.htm>, 19.11.2012
- Pacinovski N., Eftimova E., Gievski M. (2007). Comparison of milk production ability between Awassi and East Friesian sheep in Macedonia. *Proceedings of the III Symposium of livestock production with international participation, Ohrid, 12-14 September, 2007*, pp 65-72
- Pirisi A., Piredda G., Sitzia M., Fois N. (2001). Organic and conventional systems: composition and cheese-making aptitude of Sarda ewes' milk. In: *Organic meat and milk from ruminants*. EAAP publication No. 106 Athens, Greece, 4-6 October 2001. 143-146
- Slots T., Butler G., Leifert C., Kristensen T., Skibsted L. H., Nielsen J. H. (2009). Potentials to differentiate milk composition by different feeding strategies. *J. Dairy Sci.* 92:2057-2066
- Toledo-Alonzo P. (2003). *Studies of Raw Milk from Sustainable Organic Production Systems. Licentiate thesis*. Uppsala: Swedish University of Agricultural Sciences, pp. 16-26
- Vrdoljak J., Špehar M., Pavić V., Mioč B., Barać Z. (2012). The influence of environmental factors on daily milk yield and fat and protein content in Istrian sheep. *Mljekarstvo* 62: 192-199
- Zagorska J., Ciprova I. (2008). The chemical composition of organic and conventional milk in Latvia. *3rd Baltic Conference on Food Science and Technology Conference Proceedings, Foodbalt, Jelgava*, pp 10-14

acs78_47