

Original paper

ORGANIC LAMB MEAT PRODUCTION IN SERBIA BASED ON AUTOCHTHONOUS ZACKEL BREED: OPPORTUNITIES AND CHALLENGES

Savić M.^{1*}, Beckei Z.¹, Dimitrijević B.¹, Vučković S.², Prodanović S.², Vegara M.³

¹Faculty of veterinary medicine University of Belgrade, Serbia

²Faculty of Agriculture, University of Belgrade, Serbia

³Department of International Environment and Development Studies, Norwegian University of Life Sciences, NMBU, Campus Ås, Aas, Norway

*Corresponding author: mij@beotel.net

Abstract

The global growing tendency of lamb and mutton meat production has been emphasized. The fastest growing meat production industry on a global level is lamb and mutton meat production. Lamb meat production increase is primarily based on genetic improvement of sheep breeds, reproduction management and disease reduction. The new Strategy for Agriculture and Rural Development in Serbia from 2014 to 2024 defines goals and priorities for further development of agriculture. One of priority topics is the promotion of organic production. Organic lamb production is a great opportunity for rural regions development. Botanical composition analyses, as well as plants nutrition value, have shown that natural resources of regions in Serbia have great potentials for organic lamb production.

Basic principles of organic production promote well adapted, autochthonous breeds. Various types of Zackel sheep are important genetic resources, evolutionary adapted on specific conditions and extreme climate. The study evaluated the value of various types of Zackel sheep populations in the regions where they are traditionally reared with special emphasis on some traits such as health status and robustness, important for organic production. Disease frequency analysis in different Zackel type populations has shown that gastrointestinal parasitic infections represent the main health problem in sheep farming. The introduction of veterinary medicine standards in organic sheep production is a great challenge. Considering that conventional prevention and medication are forbidden in organic production, veterinary control of parasitic infections is not satisfying. Our investigations are focused on preventive measure and genetic resistance/tolerance to parasitic infections of various types of Zackel sheep as very important for organic lamb production.

Key words: *organic sheep production, veterinary control, Zackel breed*

Introduction

The global growing tendency of lamb and mutton meat production has been evidenced. Lamb meat production increase is primarily based on genetic improvement of sheep breeds,

reproduction management and disease reduction (Deblitz, 2013). Increasing interest for lamb meat production has positive effect on development of organic sheep production. The organic ovine production is dominated by three Member States: the United Kingdom (1 161 717 heads), Italy (705 785 heads) and Spain (614 413 heads), representing together 62.7% of the entire EU organic herd (3.9 million heads), (EC 2013). The support to this production system provides scientific information that highlight differences between conventional and organic systems. Organic products are considered to be safer for human consumption, since organic production must adhere to strict regulatory measures, regarding acceptable levels of compounds harmful to human health such as synthetic fertilizers, pesticides, pharmaceutical products, or other medications. The majority of studies indicate that, in various management systems, feeding regimens have the greatest impact on the composition of nutritionally relevant components in milk and meat (Schmid et al., 2006). Animal products with a high content of polyunsaturated fatty acids, conjugated linolenic acid (CLA) and antioxidants, such as carotenoids and vitamin E, are more preferable from a nutritional standpoint. The particular consideration was given to examining fatty acid composition and CLA content in milk and meat from organic and conventional systems (Nudda et al., 2011). In many ways, these fatty acids are beneficial to human health, since they play an important role in protecting the organism from cardiovascular diseases, as well as from certain types of malignant and autoimmune diseases, such as lupus, rheumatoid arthritis, etc. (Connor, 2009). In recent years, the demand for organically produced meat has been increasing. Current studies report higher levels of nutritionally desirable compounds in meat from organic production systems compared to meat from conventional systems. Other studies have either reported no significant difference in composition between organic and conventional meat, or the results have been inconsistent. Considering that lamb is one of the most sought after animal products in the marketplace today, an extensive study was undertaken in Great Britain to determine if there were any differences in the quality of meat raised under either organic or conventional production systems (Angood et al., 2008). Results from this study recorded the nutritional quality, fatty acid composition and a sensory panel; data indicated that organic lamb had better eating quality than conventional lamb in terms of juiciness, flavor and overall liking, thus providing some evidence for the perception among consumers that organic products “taste better”. Differences in flavor were attributed to differences in fatty acid composition, in particular, the higher level of linolenic acid and total n-3 PUFA in organic meat. Bearing in mind that suckling lamb, raised exclusively on maternal milk from birth to slaughter, is an important commodity raised typically in Mediterranean areas and that it yields a high-quality product of great economic significance for this region, a comparison of the sensory characteristics of suckling lamb meat from organic and conventional production systems has been conducted and the data evaluated (Revilla et al., 2009). Results obtained show that the appearance of organic meat was more fibrous, darker, and with a lower aroma intensity than the conventional counterpart, but with no differences in homogeneity or juiciness. In grilled meat, the organic samples had less subcutaneous fat, were less marbled, had a less fibrous texture and less aroma intensity, and were less juicy as well. When ranking overall consumer satisfaction, higher scores were given to the organically produced samples.

The new Strategy for Agriculture and Rural Development in Serbia from 2014 to 2024 defines goals and priorities for further development of agriculture. One of the priority topics is the promotion of organic production. Organic lamb production is a great opportunity for rural regions development.

Botanical composition analyses, as well as plants nutrition value, have shown that natural resources of hilly-mountainous regions in Serbia have great potentials for organic lamb production. Grasslands in Serbia represent natural resource and great production potential in development and improvement of livestock production, especially in hilly-mountainous regions which have not been exploited to the full extent so far (Lazarević et al., 2010; Vučković et al., 2010; Simić et al., 2011).

In the field of organic farming the knowledge transfer is particularly important since this type of farming is an example of an innovation system (Niggli et al., 2008). The specific characteristics of organic production models based on the use of local resources can have a significant impact on promoting development of individual regions themselves.

Materials and methods

The study was performed on a total of 100 sheep (aged 12 to 18 months), on strains of autochthonous Zackel sheep breed (Sjenica and Lipe sheep) in regions where they are traditionally reared (Sjenica-Pešter plateau and in the region of Lipe village in lower Morava valley). Investigations were performed on the farms included in the program of conversion from conventional to organic meat production, according to the standards regulated by the Law on organic production (the Official Gazette of the Republic of Serbia 30/10).

Health status and robustness, important for organic production, were examined by clinical and laboratory investigations. Body condition score (BCS) has proved to be an important practical tool in assessing sheep body condition. Scoring was performed in sheep using a BCS ranging from 1.0 to 5.0.

Sampling of feces for parasitological tests was performed during the course of three days, in the morning and in the evening. The distribution of parasites in sheep was evaluated using the native smear coprological technique, by sedimentation and flotation methods. The degree of infection intensity per sheep was quantitatively established by the method of McMaster (modified by Zajiček). The results were statistically processed using the program GraphPad Prism.

Results and discussion

Basic principles of organic production promote well adapted, autochthonous breeds. They are evolutionary adapted to specific conditions and have a higher tolerance to bacterial pathogens and viral and parasitic infections, which is very important for organic production (Karrow et al., 2014). Various types of Zackel sheep are valuable genetic resources (Savić et al., 2011, and 2012; Savić et al., 2013a and 2013b). Most of them are included in the process of conservation of animal genetic resources (Food and Agriculture Organization, FAO 2010).

According to the preliminary results, opportunities for organic lamb production are in the favorable fatty acid profile and sensory characteristics obtained in some types of Zackel sheep, included in the process of conversion from conventional to organic meat production in traditional habitat.

Body condition score (BCS) is a simple indicator of available fat reserves used by animals in periods of high energy demands, stress, or suboptimal nutrition. In tested populations of Sjenica and Lipe sheep the average BSC was determined.

Health control in Sjenica sheep population has shown a contagious bacterial footrot disease and infectious keratoconjunctivitis in summer period.

Parasitic infections are of great significance for animal welfare and for economics. Economical harms due to parasitic infections in sheep include emaciation, reduced fertility and low milk and meat yield.

Coprological examinations revealed various extensivities and intensities of parasitic infections in strains of autochthonous Zackel sheep in the studied farms. Parasitic infections in the Sjenica sheep population were detected as follows: *Trichostongylidae*, *Nematodirinae*, *Protostrongylidae*, *Trichuris* spp, *Anoplocephalidae* and *Eimeria* spp. A high percent of sheep (60%) was simultaneously infected by three parasitic infections *Trichostongylidae*, *Protostrongylidae* and *Anoplocephalidae*, while 15% of sheep were simultaneously infected by four parasitic infections *Trichostongylidae*, *Protostrongylidae*, *Trichuris* spp and *Anoplocephalidae*. In the examined population 20% percent of sheep were simultaneously infected by two parasitic infections *Trichostongylidae*, *Protostrongylidae*.

The results of testing the intensity of parasitic infection have shown the mild intensity of *Trichostongylidae* (438±304) and *Trichuris* spp (28±9), moderate intensity of *Protostrongylidae* (101±34), moderate (81±19) and high intensity (156±25) of *Anoplocephalidae* and mild (67±32), moderate (432±154) and high intensity (640±33) of *Nematodirinae*.

Parasitic infections in the Lipe sheep population were detected as follows: *Trichostongylidae*, *Trichuris* spp and *Strongyloides papillosus*. Analyses of extensivity of parasitic infections in the Lipe sheep population have shown that 70% of sheep were negative for the presence of parasitic infections. The results of testing the intensity of parasitic infections have shown a mild intensity of *Trichostongylidae* (55±46), *Trichuris* spp (11±3) and *Strongyloides papillosus* (41±2) infections.

The disease frequency analysis in autochthonous Zackel types (Sjenica and Lipe sheep) has shown the presence of infections by parasites *Trichostongylidae*, *Nematodirinae*, *Protostrongylidae*, *Trichuris* spp, *Anoplocephalidae* and *Eimeria* spp., the fact that requires intensive treatment (Dimitrijević et al., 2013).

Conclusion

From the veterinary aspect of animal health there are many problems in organizing organic sheep production. Considering that conventional prevention and medication are forbidden in organic production, veterinary control of parasitic infections is not satisfying. New methods of nematode control include several methods, such as biological agents, biological antihelminths and strategic grazing management, the methods that have not yet been efficient enough. Our investigations showed that, in our conditions, preventive measures and strategic grazing management must be focused on in the process of conversion. The selection of breed of choice for organic production is a very important decision. The attention in organic breeding must be based on BCS-traits, considering that sheep with fat score 3 are less susceptible to worm

infections. Genetic improvement based on genetic resistance/tolerance to parasitic infections is of great importance for animal health and organic lamb production. Therefore, our investigations are directed towards using SOD 1 as a biomarker of parasitic infections intensity in sheep (Dimitrijević et al., 2013).

Acknowledgements

This study was supported by the Ministry of Education, Science and Technological Development of the Republic of Serbia, Grant No. TR 31085 and the Norwegian Programme in Higher Education, Research and Development in the Western Balkans 2010-2014. HERD/Agriculture Project 09/1548, 332160 UA.

References

1. Angood KM, Wooda JD, Nute GR, Whittington, FM, Hughes SI and Sheard PR 2008. A comparison of organic and conventionally-produced lamb purchased from three major UK supermarkets: Price, eating quality and fatty acid composition. *Meat Science* 78(3), 176-184.
2. Connor WE 2009. Importance of n-3 fatty acids in health and disease. *The American Journal of Clinical Nutrition* 71(1), 171-175.
3. Deblitz C 2013. Global meat production, drivers and challenges, Beef and Sheep Conference, June 13-20, York, England, 10 pp.
4. Dimitrijević B, Borozan S, Jović S, Bacić D, Katić Radivojević S, Stojanović S and Savić M 2013. The effect of the intensity of parasitic infection with *Strongyloides papillosus* and *albendazole* therapy on biochemical parameters in sheep blood. *Acta veterinaria* 63,581-601.
5. European Commission 2013. DG Agriculture and Rural Development, Facts and figures on organic agriculture in the European Union. pp 1/46
6. FAO 2010 Breeding strategies for sustainable management of animal genetic resources. FAO Animal Production and Health Guidelines No.3.
7. Karrow N, Goliboski K, Stonos N, Schenkel F and Peregrine A 2014. Review: Genetics of helminth resistance in sheep. *Canadian Journal of Animal Science* 94,1, 1-9.
8. Lazarević D, Dajić Z, Vučković S and Terzić D 2010. Production of livestock food on natural and sown grasslands, *Biotechnology in Animal Husbandry* 26, 219-234, 2010.
9. Niggli U, Slabe A, Schmid O, Halberg N. and Schluter M 2008. Vision for an organic food and farming research agenda to 2025 organic knowledge for the future, IFOAM EU Group.
10. Nudda A, McGuire MK, Battacone G, Manca MG, Boe R and Pulina G 2011. Documentation of fatty acid profiles in lamb meat and lamb-based infant foods. *Jurnal of Food Sciences* 76, 43-47.
11. Ramírez-Retamal J, Molares R, Martínez E and de la Barra R 2014. Effect of the type of pasture on the meat characteristics of chilote lambs. *Food and Nutrition Sciences* 5, 635-644.
12. Revilla I, Luruena-Martinez MA, Blanco-Loprz MA, Vivarquintana AM, Palacios C and Severiano-Perez P 2009. Comparison of the sensory characteristics of suckling lamb meat: organic vs conventional production. *Czech Journal of Food Sciences*, 267-270.
13. Savić M, Dimitrijević B, Borozan S, Katić-Radivojević S and Jovanović S. 2012. The determination of the preferable sheep breed for organic production in the hilly mountainous

- region of Sjenica. 27th World Buiatrics Congress, Lisbon, 3 - 8 June 2012. Abstract book, pp 252-53.
14. Savić M, Vegara M, Vučković S, Prodanović S and Dimitrijević B 2013b. Importance of Zackel sheep for conservation of biodiversity at Sjenica-Pester plateau, 64th EAAP Annual Meeting, Nantes, France, 26-30 August 2013 b Abstract book, pp 384.
15. Savić M, Jovanović S, Trailović R, Dimitrijević V and Dimitrijević B 2011. Autochthonous breeds as livestock potential in sustainable farming in Serbia. In: Proceedings of the 19th International Congress of Mediterranean Federation of health and production of ruminants, 25-28 May, Belgrade, pp 16-22.
16. Savić M, Aleksić S and Živković D 2013a. Breeds of choice in organic production systems. Proceedings of the 10th International Symposium Modern Trends in Livestock Production 298-306, Invited paper, 2-4. October, Belgrade
17. Schmid A, Collomb M, Sieber R and Bee G 2006. Conjugated linoleic acid in meat and meat products: A review, Meat Science 73, 29-41.
18. Simić A, Vasiljević S, Vučković S, Tomić Z, Bjelić Z and Mandić V 2011. Herbage yield and botanical composition of grass-legume mixture at different time of establishment. 3rd International congress "New Perspectives and Challenges of Sustainable Livestock Production", 5-7th October 2011, Belgrade.
19. Zajiček D 1978. Comparison of the efficiency of two quantitative ovoskopie methods. Veterinarni Med. 23, 275-280.
20. Vučković S, Simić A, Čupina B, Krstić Đ and Duronić G 2010. Effect of mineral fertilization on yield of *Agrostidetum vulgaris* – type meadows in mountainous grasslands in Serbia. Biotechnology in Animal Husbandry 26, 389-394.