CHANGES IN THE COMPOSITION OF MARE'S MILK DUE TO THE EFFECT OF ANIMAL'S AGE (PARITY)*

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Summary

Mare's milk is traditionally used in the regions of Central Asia by nomadic people. Also, there is a long history of utilisation and processing of mare's milk. Furthermore, in recent decades, mare's milk has been researched as a functional food throughout Europe. The production of mare's milk is highly demanding. Since the composition of the mare's milk depends on various factors, the aim of the work was to determine the variability of the composition of the Lipizzaner mare's milk regarding parity. Mare's milk was collected from the 16 Lipizzaner mares bred at a stud farm in eastern Croatia. Regarding parity, the mares were classified into two groups: (A) younger (first to third lactation, n = 8) and (B) older (over third lactation, n = 8). It was found that the amount of milk fat and lactose is higher in the milk of older mares, while the amount of protein was lower in the same animals. Concerning the aspect of functional food in the human diet, protein represents the most important component of mare's milk. Therefore, it can be concluded that the milk of the younger mares is richer in protein and more recommended as a functional food.

Keywords: *mare's milk, functional food, composition*

INTRODUCTION

Mare's milk is traditionally used in the regions of Central Asia by nomadic people. Also, there is a long history of utilisation of mare's milk. Furthermore, in recent decades, mare's milk has been researched as a functional food throughout Europe. The production technology of mare's milk is highly demanding (Alatrović *et al*., 2017). Mare's milk represents a highly valued and sought-after raw material for the processing of innovative dairy products. Also, mare's milk is rich in nutrients. Furthermore, the changes in the composition of mare's milk have been poorly investigated in the production of the raw material. Components in mare's milk depend on various factors such as the stage of lactation and different environmental factors (Sonntag *et al*., 1996). The fatty acid composition of mare's milk is especially high in UFAs (unsaturated fatty acids) which

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is considered to be beneficial for consumers (Gregić *et al*., 2022). Regarding the true whey N and non-protein nitrogen (NPN) mare's milk has a similar content as human and goat's milk (Potočnik *et al*., 2011). Research done so far indicates that mare's milk could be beneficial in treating atopic dermatitis as well as in improving skin appearance (Pieszka *et al*., 2016). Furthermore, mare's milk has been proven to play a role in curing Crohn's disease, ulcerative colitis, as well as hepatitis and chronic gastric ulcers. Mare milk, along with qymyz, has been reported to have a wide range of therapeutic effects (Sabrina *et al*., 2019; Teichert *et al*., 2021; Kondybayev, 2021). The utilization of mare's milk for direct consumption, which is today in Europe sold mainly as fresh or frozen raw milk, requires the adoption of adequate facilities, equipment, and management of animals and milk to achieve products with high hygienic standards (Salimei & Park 2017). Accordingly, to Fišera *et al.* (2018) the composition of a mare's milk varies in regard to the physiological state of an animal, while the effects such as the mare's age, the number of foaling, sex of foal etc. did not affect milk nutrient composition. According to Schryver *et al*. (1986), the total solids and ash content of mare's milk varied regarding the stage of lactation, with values of 12 and 0.61% respectively, at the end of the first week of lactation, 10.5 and 0.45% at 4 weeks of lactation, 10 and 0.38% at 8 weeks of lactation and 10.2 and 0.32% at 16 weeks of lactation. Furthermore, the basic composition of the mare's milk was as follows: solids-not-fat in the amount of 84.4 g/kg, fat 15.1 g/kg, lactose 65.3 g/kg, and total protein 24.2 g/kg (combined of casein in the amount of 14.6 g/kg, and whey protein, 9.5 g/kg). Accordingly, to Teichert *et al*. (2021), the basic composition of Polish Coldblood mare's milk was as follows: solids-not-fat, 84.4 g/kg, fat 15.1 g/kg, lactose 65.3 g/kg, and total protein 24.2 g/kg (made up of casein, 14.6 g/kg, and whey protein, 9.5 g/kg). Čagalj *et al*. (2014) reported that mare's milk of Croatian Coldblood horses on average contained: 10.2 % of total solids, 1.23 % of milk fat, 1.76 % of proteins, 0.71 % of casein and 6.26 % lactose (Marchis *et al*., 2019). Furthermore, the fat content of mare's milk varies between 1.88 g/100 g (in the first lactation) and 2.17 g/100 g (in the third lactation) while the content of protein in milk varies between 1.74 g/100g (in the first lactation) and 1.92 g/100 g (in the third lactation) (Marchis *et al*., 2019). Furthermore, Pikul & Wójtowski (2008) recommended the collection of milk from mares in the period from the 4th and 5th month of lactation. The aim of the work was to determine the variability of the composition of the Lipizzaner mare's milk regarding parity.

MATERIALS AND METHODS

During the research milk was collected from 16 Lipizzaner mares reared on a state stud farm located in Slavonia. The body weight of selected mares was in the interval between 450 and 535 kg while wither height was between 156 and 162 cm. Furthermore, during the research mares were fed the same ration. During the research, all animals were grazing on meadow grass pasture. Additionally, 4.5 kg/day of oats and hay ad libitum was given to the selected mares. During the research, all mares were clinically healthy. The milking and sampling were performed once a day in the morning after 3 hours of

physical separation from their foals by hand from both teats of the udder. Sampled milk was analysed using a MilkoScan™ FT120 (Foss Tecator AB Hilleroed, Denmark) in the laboratory. Furthermore, the solids-not-fat, fat, lactose, casein, whey protein, and ash contents were determined in the milk samples. Selected mares were in the fourth and sixth months of lactation. Finally, regarding age, mares were classified into two groups: (A) younger (from first to third lactation, n = 8) and (B) older (over third lactation, n = 8).

Logical control of data and statistical analysis was carried out in the statistical program SAS. MS Excell was used for the graphic presentation of the data.

RESULTS AND DISCUSSION

Differences in the composition of mare's milk depending on the age of Lipizzan mares are shown in Figure 1. It can be seen that age affects the variability of individual components of a mare's milk and that the composition of a mare's milk differs in younger and older mares. Furthermore, changes in composition depend on the individual substance. The amount of fat and lactose (g/100 g) in the mare's milk is higher in older mares, while the amount of protein (g/100 g) is higher in younger animals. Furthermore, the milk of younger mares had a higher protein and ash composition. Milk fat in mare's milk is extremely interesting from a nutritional point of view in the diet and processing of mare's milk.

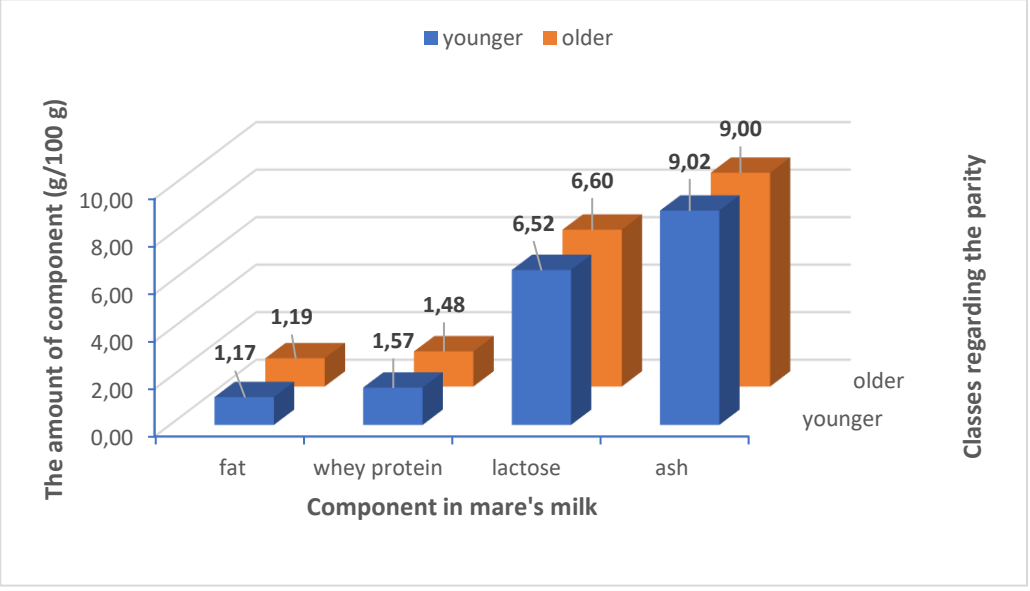

Figure 1. The amount of fat, whey protein, lactose and ash (g/100 g) in milk of Lipizzaner mares regarding the parity class (younger (n=8) and older (n=8))

Changes in the composition of mare's milk during lactation were determined by Schryver *et al*. (1986). In addition, the variability in the composition of proteins and fat in mare's milk due to the influence of the stage of lactation was determined by Marchis *et al*. (2019). Teichert *et al*. (2021) determined changes in the composition of mare's milk regarding the order of lactation both in Lipizzaner breeds and in cold-blooded heavy horse breeds. In addition, the same authors state that the milk of the Lipizzaner breed of mares is nutritionally more suitable for younger mares due to its higher protein content. Kondybayev (2021) states that the milk of older Lipizzan mares is suitable for processing into fermented dairy products due to the higher content of milk fat than in the milk of younger mares. Taking into account the overall composition and nutritional value of the milk of both young and old mares, it is recommended for consumption regardless of the number of lactations.

CONCLUSIONS

Based on the performed research it was determined that the animals' age (parity) affects the composition of milk. The amount of fat and lactose in the mare's milk was higher in older mares, while the amount of protein was higher in younger ones. The amount of ash did not vary due to the animal's age.

Concerning the aspect of functional food in the human diet, protein represents the most important component of mare's milk. Therefore, it can be concluded that the milk of the younger mares is richer in protein and more recommended as a functional food. Finally, further research on the protein composition of mare's milk should be performed.

REFERENCES

Alatrović, I., Gregić, M., Baban, M., Bobić, T., Ramljak, J., & Gantner, V. (2017). The production technology of the mare's milk. In 10th International Scientific/Professional Conference, Agriculture in Nature and Environment Protection, 5-7 June 2017, Vukovar, Croatia (45-49).

Čagalj, M., Brezovečki, A., Mikulec, N., & Antunac, N. (2014). Sastav i svojstva kobiljeg mlijeka pasmine hrvatski hladnokrvnjak. Mljekarstvo: časopis za unaprjeđenje proizvodnje i prerade mlijeka, 64(1), 3-11.

Fišera, M., Valášek, P., Kráčmar, S., Kubáň, V., Burešová, P., Velichová, H., & Fišerová, L. (2018). Influence of composition of feed and lactation period on mineral composition of mare's. Potravinarstvo Slovak Journal of Food Sciences.

Gregić, M., Mijić, P., Baban, M., Aladrović, J., Pađen, L., Gantner, V., & Bobić, T. (2022). Changes in the Fatty Acid Composition of Milk of Lipizzaner Mares during the Lactation Period. Metabolites, 12(6), 506.

Kondybayev, A., Loiseau, G., Achir, N., Mestres, C., & Konuspayeva, G. (2021). Fermented mare milk product (Qymyz, Koumiss). International Dairy Journal, 119, 105065.

Pieszka, M., Łuszczyński, J., Zamachowska, M., Augustyn, R., Długosz, B., & Hędrzak, M. (2016). Is mare milk an appropriate food for people? A review. Annals of Animal Science, 16(1).

Pikul, J. & Wójtowski, J. (2008). Fat and cholesterol content and fatty acid composition of mares' colostrums and milk during five lactation months. Livestock Science, 113(2-3), 285-290.

Potočnik, K., Gantner, V., Kuterovac, K., & Cividini, A. (2011). Kobilje mlijeko: sastav i frakcije proteina u usporedbi s drugim vrstama mlijeka. Mljekarstvo: časopis za unaprjeđenje proizvodnje i prerade mlijeka, 61(2), 107-113.

Sabrina, A., Halima, Z. K., & Nour-Eddine, K. (2019). Selection of Lactobacillus strains newly isolated from Algerian camel and mare fermented milk for their in vitro probiotic and lipolytic potentials. African Journal of Biotechnology, 18(30), 882-894.

Salimei, E., & Park, Y. W. (2017). Mare milk. Handbook of Milk of Non-Bovine Mammals, 369-408.

Schryver, H. F., Oftedal, O. T., Williams, J., Soderholm, L. V., & Hintz, H. F. (1986). Lactation in the horse: the mineral composition of mare milk. The Journal of nutrition, 116(11), 2142-2147.

Sonntag, A. C., Enbergs, H., Ahlswede, L., & Elze, K. (1996). Inhaltsstoffe in der Stutenmilch in Abhängigkeit vom Laktationsstadium und verschiedenen Umweltfaktoren. Pferdeheilkunde, 12(3), 220-222.

Teichert, J., Cais-Sokolińska, D., Bielska, P., Danków, R., Chudy, S., Kaczyński, Ł. K., & Biegalski, J. (2021). Milk fermentation affects amino acid and fatty acid profile of mare milk from Polish Coldblood mares. International Dairy Journal, 121, 105137.

Marchis, Z., Longodor, A.L., Codea, R.A., Balta I. & Coroian, A. (2019). Influence of lactation on composition of mare's milk. Scientific Bulletin. Series F. Biotechnologies, Vol. XXIII, ISSN 2285-1364, 226-229.

PROMJENE U SASTAVU KOBILJEG MLIJEKA USLIJED UTJECAJA DOBI ŽIVOTINJE (PARITETA)

Rezime

Kobilje mlijeko tradicionalno koriste nomadski narodi u središnjoj Aziji. Također, duga je povijest korištenja i prerade kobiljeg mlijeka. Nadalje, posljednjih se desetljeća kobilje mlijeko istražuje kao funkcionalna hrana diljem Europe. Proizvodnja kobiljeg mlijeka je vrlo zahtjevna. Budući da sastav kobiljeg mlijeka ovisi o različitim čimbenicima, cilj ovoga rada bio je utvrditi varijabilnost sastava mlijeka lipicanskih kobila s obzirom na paritet. Kobilje mlijeko prikupljeno je od 16 kobila uzgojanih na ergeli u istočnoj Hrvatskoj. S obzirom na paritet, kobile su razvrstane u dvije skupine: (A) mlađe (od prve do treće laktacije, n = 8) i (B) starije (iznad treće laktacije, n = 8).

Utvrđeno je da je količina mliječne masti i laktoze veća u mlijeku starijih kobila, dok je količina proteina manja kod istih životinja. S aspekta funkcionalne hrane u ljudskoj prehrani, proteini predstavljaju najvažniji sastojak kobiljeg mlijeka. Stoga se može zaključiti da je mlijeko mlađih kobila bogatije bjelančevinama i preporučljivije kao funkcionalna hrana.

Ključne riječi: *kobilje mlijeko, funkcionalna hrana, sastav*