BIOLOGICAL VALUE OF SHEEP'MILK DEPENDING ON DAY-NIGHT CYCLE

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Abstract

Taking into account the importance of milk' quality to conduct it thouroughout the technologic process, we have performed this study in which we have analyzed the sheep'milk during the first lactation period. In order to assess the milk'quality nutritionally and biologically, the phisical and chemical parameters have been taken into consideration. As for the composition of the fatty acids, 19 have been analyzed, using the gas-cromatography in gaseous stage method: saturated (SFA), mono-unsaturated(MUFA) and poli-unsaturated (PUFA). The essential fatty acids have been assessed in particular, obtaining the following values as compared to the total number of fatty acids : linolenic acid (ω6) sample Ms-2,12 and sample Md -1,31; linolenic acid (ω3) sample Ms-1,00 and sample Md-1,10 and γlinolenic acid (ω6) Ms-1,61 and sample Md -1,81.

Key words: average evening and morning, sheep milk

INTRODUCTION

Sheep'milk has a rich content of fat, consisting of fatty acids with less than 10 atoms of carbon – easily assimilated, proteins with all the essential amino-acids, oligo-sugars and minerals that determine a higher nutritional quality of the milk products and cheese.

It is well known that the sheep'milk is important not only in liver metabolic process but also because it provides the necessary amount of magnesium. Sheep milk is recommended to children who present intolerance to the cow milk, to the patients with neurodermitis, to those who fail to feed themselves properly or to elder people. In addition, sheep'milk is used in recovery processes following illness. It is known that in countries where breeding sheep is a practice,it has been registered a higher rate of life expectancy.(Lotte Hanreich and others, 2008).

It is also known that the membrane of the fat particule has an extremely complex structure. It is formed by various proteins and lipids, components with specific technological and nutritional properties. They have been isolated and characterised as being valuable ingredients to be incorporated into the new food products. New, additional quantification processesof the membrane are required, as well as the optimisation of the production processes in order to preserve and to isolate its components, in order for them to be used in food industry. (Koen Dewettinck, 2008).

Depending on the source, 25–70% of the MFGM consists of proteins (Danthine et al., 2000; Deeth, 1997; Fong et al., 2007; Walstra, Wouters, & Geurts, 2006).These membrane proteins are only present in very small amounts in other milk phases, and account for 1–2% of total milk protein (Riccio, 2004). Cytoplasmatic material can be entrained between the inner coat and the outer double membrane layer resulting in 'cytoplasmatic crescents' (Danthine et al., 2000;Evers, 2004; Michalski, Michel, Sainmont, & Briard, 2002;Rasmussen, Berglund, Pallesen, & Petersen, 2002).

Essential fatty acids are important as they cannot be syntethised by the human body but they are indispensable. Increased levels of fatty acids ω-3 and ω-6 in heart tissue are associated with the decrease of mortality rate due to heart diseases. (Nipon Chattipakorn and others 2009).Knowledge regarding cardio-protective benefits of ω-3, and PUFA have been used as nutiotional guidance in order to improve heart' state of health. (Yuriko Adkins and others, 2010). Nowadays, environment is more and more affected by noxes. Together with stress, it increases teh level of toxic substances in the body, with negative impact on health. Healthy food with an increased amount of poli-unsaturated fat acids could reduce the poisonong of the body as well as the inflamatory processes. (Lei Wang and others 2008). Food containing essential fatty acids have an impact on weight, decrease cholosterol and the level of glucose. (E. Atakisi, 2009)**.**These essential fatty acids have also a protective function at the level of hepatic cells, with impact on macrofags şi hepatocites and they also play an anti-inflamatory role in case of hepatic cells. (Wei Hao and others, 2010).The beneficial effect of those unsaturated fatty acids was also provenin case of Parkinson disease. Experiments have been performed on mice. (M. Bousquet, 2009) . It had been demonstrated that fat acids ω-3 and ω-6 have also a positive effect in case of depressions or mintal disorders. It has been performed a study on 150 individuals divided into 4 groups. In conclussion, it was stated that fatty acids are involved in various biological mechanisms through changes in membrane and modular fluids of the membrane receivers, in the enzymatic activity as well as of neuronal transmitters. (Sabine Riemer ,2010). During a diet with omega-3 and omega-6 it has been noticed a decrease of risk of cancer, which could represent an important preventive measure against this disease. (Helena Gleissman and others, 2010).

MATERIALS AND METHODS

For the study, it hass been taken into consideration the sheep milk collected in the month of April. It has been also considered the day-night cicle, the milk sample being obtained following morning and evening milking, as follows:

-average milk sample in the evening: about 1500 litres of milk from abour 3000 sheep;
-average milk sample in the morning : about 1000 litres of milk from about 500 sheep.

Coding of the samples is presented in table 1.1.

Tabel 1.1.

Coding of the milk samples depending on day-night cycle.

Sample	Code
Sample milk following evening milking	Ms
Sample milk following morning milking	Md

The quality of milk has been evaluated through determination of physical-chemical characteristics: tritable acidity (*S.R. ISO 6091/2008)*; fat content *(S.T.A.S. 6352/1-88*); density of the milk *(S.T.A.S. 6347-89*).
Physical-chemical determinations have been also performed electronically, using LactoStar and Ekomilk machines. LactoStar determines: % fat; % protein;% lactose: % S.U.N. (low-fat dry substance ; freezing point. Ekomilk determines: % fat, density, % low-fat dru substance % proteins; freezing point; % added water.
From the point of view of the biologic value, there have been determined unsing the gas-cromatographic method 19 fat acids, both individually and divided into groups of fat acids: saturated (SFA), mono-unsaturated (MUFA) and poli-unsaturated (PUFA)

RESULTS AND DISCUSSIONS

In what phisical-chemical analyses are concerned, the variation of those parameters are as follows:- the fat concentration of the analyzed sheep'milk is 12,7% higher in case of the milk obtained following the evening milking, than the one obtained following the morning process; the milk obtained following the evening milking has a higher concentration of low-fat dry substance, by 5,1% than the one obtained following the morning milking; higher levels of protein are to be found in milk produced by Turcan breed, fed on unfertilised hill pasture, by 3,2% than the oned fed on prodzolic soil pasture ; milk obtained following the evening milking has a level of lactosis 5,2% higher than concentration following the morning milking. (table 1.2. and figure 1.1.)

Table 1.2.

Physical – chemical parameters of the sheep'milk depending on the day-night cycle

Date	Code	Acidity		Fat %	T	$D_{20°C}$	Non fat dry%	Protein substance %	Lactose %	freezing point
		°Sh	°T		°C	g/l				
27.05.10	Ms	8	20	6,94	3	1036,0	11,71	4,42	6,35	–0,677
27.05.10	Md	8	20	6,06	29	1035,3	11,10	4,59	6,02	–0,635

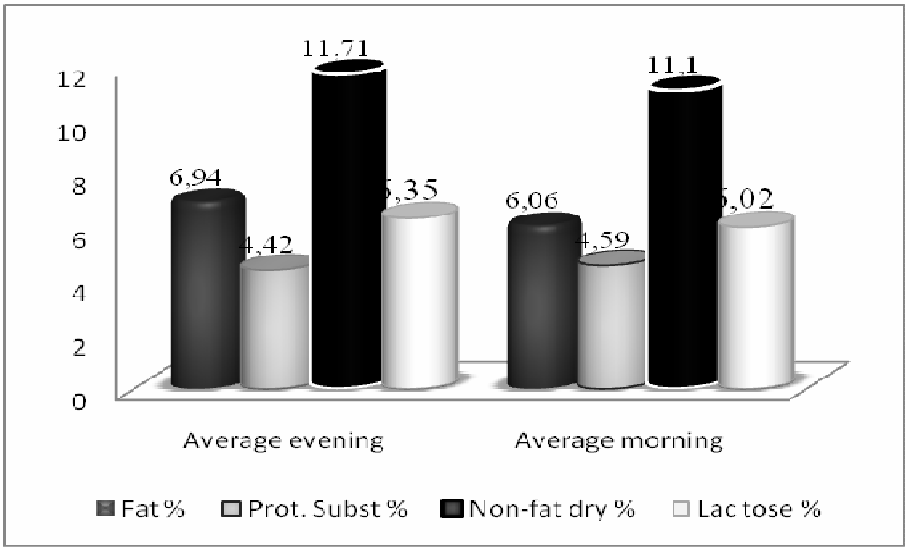

Figure 1.1. Evolution of the sheep'milk physical-chemical parameters, depending on the day-night cycle

From the poin of view of the fatty acids depending on day-night cycle, the situation is presented as follows:lauric acid is to be found in the morning sample in a concentration higher by 4,3% than in the evening sample; in case of the myristic acid, differencies are not relevant;concentration of pentadecanoic acid as well as of heptadecanoic acid is very low as compared to the other saturated fat acids C_{12-18}, which means that it does not influence the biological value of the sheep'milk; palmitic acid has the highes percentual values from the total of the fatty acids , day-night cycle significantly influencing the concentration of the palmitic acid of the studied milk , and thus, the morning milk sample has a percentage higher by 10% that the evening sample; stearic acids decreases by half as compared to the palmitic acid, which impacts on the biological value of milk, this being regarded as a positive fact, as this acid is assimilated with difficulty by te human body and, as an effect, it increases the cholesterol level and has a negative impact on human health, and,

depending on the studied samples, the percentage of the stearic acid in the morning sample is 9,5% higher than in the evening milk. This fact is shown in table 1.2. and in figure1.1.

As for the evolution of the essential fat acids, the situation presents as follows: linoleic acid(ω6) is to be found in a concentration higher by 61% in morning milk ; if we consider the day-night cycle , in case of linolenic acid (ω3), there are no significant percentual differencies in the concentration of the essential fat acid concentration: in the morning, the concentration of γlinolenic acid (ω6) is higher by 11% than in the milk obtained following the evening milking.
This situation is shown in figure 1.2.

The results are presented in table 1.3. and figures 1.2, 1.3.

Table 1.3.

Concentration of the sheep milk'fat acids depending on day-night cycle

Fat Acid	Abreviation	Ms	Md
Butiric	4:0	0,16	0,42
Caproic	6:0	1,58	1,73
Caprilic	8:0	2,02	1,93
Capric	10:0	6,22	6,27
Lauric	12:0	3,49	3,65
Myristic	14:0	10,05	10,88
Myristoleic	14:1	0,01	0,17
Pentadecanoic	15:0	1,21	1,24
Cis-10-pentadecanoic	15:1	0,30	0,30
Palmitic	16:0	23,02	25,59
Palmitoleic	16:1	1,07	1,20
Heptadecanoic	17:0	0,87	0,93
Cis-10-heptadecanoic	17:1	0,33	0,37
Stearic	18:0	12,17	13,45
Oleic	18:1	24,16	19,11
Elaidic	18:1iso	1,12	1,61
Linoleic (ω6)	18:2	2,12	1,31
Linolenic (ω3)	18:3n6	1,00	1,10
γ-Linolenic (ω6)	18:3n3	1,61	1,81

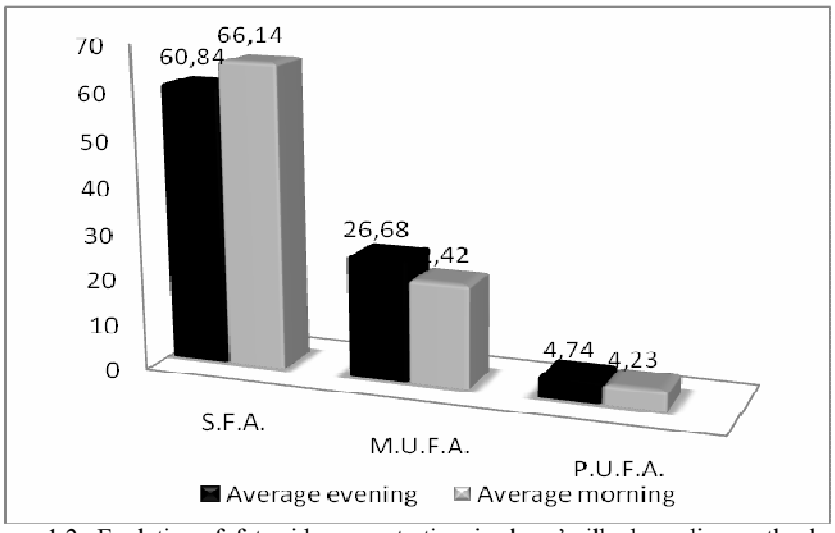

Figure 1.2. Evolution of fat acids concentration in sheep'milk, depending on the day – night cycle

SFA- saturated fat acids
MUFA-mono-unsaturated fat acidsacizi graşi mononesaturați
PUFA-poli- unsaturated fat acids

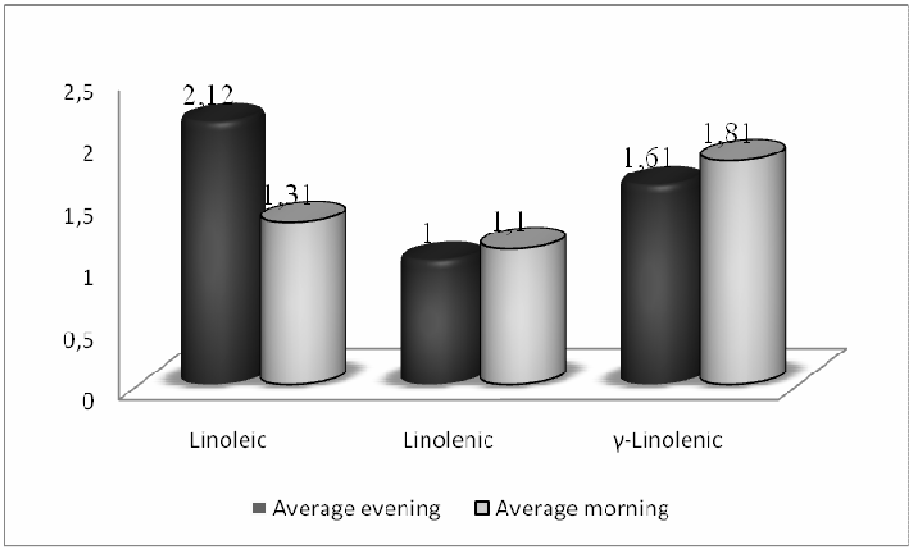

Figure 1.3. Evolution of essential fat acids concentration in sheep'milk, depending on the day – night cycle.

CONCLUSSIONS

As a conclussion, the best quality of the sheep milk – considering the chemical composition – is obtained following the evening milking, except for the proteic content that is higher in case of the morning milking. It has also been noticed the positive effect of sheep' rest on the linoleic acid (ω6) the concentration being higher following the morning milking process.Linolenic (ω3) and γlinolenic (ω6) acids have a higher concentration in the milk obtained following the evening milking. This demonstrates that the rest is less important than the feeding method, in case of the last two fat acids that have been assessed.

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REFERENCS

1. Atakisi E., O. Atakisi, H. Yaman, I. Arslan, 2009, *Omega-3 fatty acid application reduces yolk and plasma cholesterol levels in Japanese quails*, Food and Chemical Toxicology 47 2590–2593.
2. Bousquet M., C. Gibrat, M. Saint-Pierre, C. Julien, F. Calon, F. Cicchetti, 2009 *Modulation of brain-derived neurotrophic factor as a potential neuroprotective mechanism of action of omega-3 fatty acids in a parkinsonian animal model*, Progress in Neuro-Psychopharmacology & Biological Psychiatry 33 1401–1408.
3. Borda D. 2007, *Tehnologii în industiia laptelui-Aplicații ale presiunii înalte-pag*.2 - 72,Editura Academica Galați.
4. Chintescu G., Grigore Șt., 1982, *Îndrumător pentru tehnologia produselor lactate*, pag.33-40,59-76,181-207, Editura teehnică Bucureşti.
5. Chintescu G., Grigore Șt., 1982, *Îndrumător pentru tehnologia produselor lactate*, pag.33-40,59-76,181-207, Editura teehnică Bucureşti.
6. Danthine, S., Blecker, C., Paquot, M., Innocente, N., & Deroanne, C., 2000, *Progress in milk fat globule membrane research*: A review. Lait, 80, 209–222.
7. Deeth, H. C., 1997, *The role of phospholipids in the stability of milk fat Globules,* Australian Journal of Dairy Technology, 52, 44–46.
8. Fox P. F., 1998, *Dairy and Bichemisty*, pag. 21-237, 317-333, 379-428, Thomson Science.
9. Fong, B. Y., Norris, C. S., & MacGibbon, A. K. H., 2007, *Protein and lipid composition of bovine milk-fat-globule membrane*, International Dairy Journal, 17, 275–288.
10. Evers, J. M., 2004, *The milkfat globule membrane-compositional and structural changes post secretion by the mammary secretory cell*, International Dairy Journal, 14, 661–674.

11. Gleissman Helena, John Inge Johnsen, Per Kogner, 2010, *Omega-3 fatty acids in cancer, the protectors of good and the killers of evil?* Experimental cell research 316 - 13 65–1373.
12. Grecu Gheorghe, 2003, *Cercetări cu privire la dinamica maturării brânzeturilor cu pastă filată fabricate din lapte de bivoliță* ,Teză de doctorat.
13. Guzun, V., A., 1998, *Tehnologia laptelui şi a produselor lactate. Lucrări practice şi de laborator,* Ed. Civitas, Chişinău.
14. Hanreich Lotte, Edith Zeltner, 2008, *Brânzeturi pentru casă şi piață*, pag. 17-19, Editura Zeltner, trad. :Ina MINTICI, Editura M.A.S.T., Bucureşti.
15. Hao Wei 1, Olive Y. Wong, Xuelai Liu, Puiyan Lee, Yan Chen, Kenneth K.Y. Wong, 2010*, ω-3 fatty acids suppress inflammatory cytokine production by macrophages and hepatocytes*, Journal of Pediatric Surgery 45, 2412–2418.
16. Koen Dewettincka,_, Roeland Rombauta, Natacha Thienponta,b, Thien Trung Lea,Kathy Messensb, John Van Campc, 2008, *Nutritional and technological aspects of milk fat globule membrane material*, International Dairy Journal 18 436–457.
17. Lei Wang, Gudrun Reiterer, Michal Toborek, Bernhard Hennig, 2008, *Changing ratios of omega-6 to omega-3 fatty acids can differentially modulate polychlorinated biphenyl toxicity in endothelial cells*, Chemico-Biological Interactions 172 27–38.
18. Michalski, M. C., Michel, F., Sainmont, D., & Briard, V., 2002, *Apparent zeta-potential as a tool to assess mechanical damages to the milk fat globule membrane*, Colloids and Surfaces B-Biointerfaces, 23, 23–30.
19. Nipon Chattipakorna, Jongkolnee Settakornc, Petnoi Petsophonsakula,b, Padiphat Suwannahoid, Pasuk Mahakranukrauhd, Somdet Srichairatanakoole, Siriporn C. Chattipakornb, 2009, *Cardiac mortality is associated with low levels of omega-3 and omega-6 fatty acids in the heart of cadavers with a history of coronary heart disease*, Nutrition Research 29 696–704.
20. Rasmussen, J. T., Berglund, L., Pallesen, L. T., & Petersen, T. E., 2002, *Proteins from the milk fat globule membrane*.], Poster at the 26th IDF World Dairy Congress, September 24–27, Paris, France.
21. Riccio, P., 2004, *The proteins of the milk fat globule membrane in the Balance*, Trends in Food Science and Technology, 15, 458–461.
22. Riemer Sabine, Michael Maes, Armand Christophe, Winfried Rief, 2010, *Lowered ω-3 PUFAs are related to major depression, but not to somatization syndrome*, Journal of Affective Disorders 123 173–180
23. Yuriko Adkins, Darshan S. Kelley, 2010, *Mechanisms underlying the cardioprotective effects of omega-3 polyunsaturated fatty acids*, Journal of Nutritional Biochemistry 21, 781–792
24. Walstra, P., Wouters, J. T. M., & Geurts, T. J., 2006, *Dairy science and Technology*, Boca Raton, FL, USA: CRC Press.