ACTIVITIES OF MILK FAT GLOBULE MEMBRANE ENZYMES IN EWE'S MILK DURING LACTATION.

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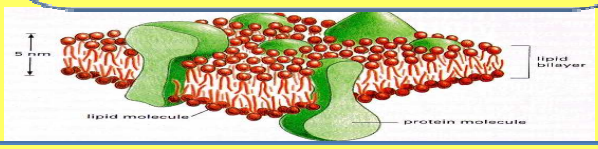
Introduction

Several components of milk fat globule membranes (MFGM) in milk have been recently identified as being beneficial for human health.

The MFGM contains several enzymes and although the enzymology for some of them is documented, their physiological role in milk is unclear.

Moreover only a few studies evaluate enzyme activities in ewe's milk fat globule membrane (Martini et al., 2010; Benboubetra et al., 2004).

With the aim of improving the knowledge about milk fat globules membranes we focused on the activities of 5 membrane enzymes: xanthine oxidoreductase (XOR), which appears in two interconvertible forms xanthine dehydrogenase (XDH) and xanthine oxidase (XO); gamma-glutamyltranspeptidase (GGT); alkaline phosphatase (AP) and ecto 5' nucleotidase (e 5'-N).



Materials and Methods

A trial was carried out on 7 Massese ewes, homogeneus in terms of parity and feed, kept indoors one week before partum. The experiment lasted 120 days, from 10 hours to 120 days post partum. 11 milk samples were taken from each individual during lactation.

MFGM was isolated from individual samples of fresh colostrum and milk. XOR, AP, GGT and e 5'-N activities and total membrane proteins (TMP) were evaluated on milk fat globule membrane protein extract by spectrophotometer UV-vis.

Statistical analysis

The statistical analysis was carried out using JMP (2002) software.

Results and Discussion

Activities of the 5 milk fat globules membrane enzymes (U/mg) and total membrane proteins (mg/ml of extract) are shown in the table 1.

As observed by Brown et al. (1995) on human milk, specific XO activity varied with time post partum, rising significantly during lactation and it reached the climax of activity on 20th day decreasing on 120th day of lactation.

On the contrary XDH activity did not significantly change. As related on previously studies about bovine colostrum and milk, GGT showed a higher activity during the first 20 days of lactation, then decreased remaining the same in the aftermath. The AP activity significantly increased as the lactation phase progressed, as observed by Chavarri et al. (1998) on ewe's milk . Moreover the membrane-bound glycoprotein, e 5'-N, showed an increasing activity after the 60th day and decreased on the 120th day. Total Membrane proteins (mg/ml) showed higher values at 10 hour post partum.

Table 1. Activities of 5 milk fat globules membrane enzymes (U/mg) and total membrane proteins (mg/ml of extract) during lactation .

		Days in Milk											SEM
		10 h	3	6	10	15	20	30	45	60	90	120	
XO	(mU/mg)	0.00C	0.50B	0.70B	1.23B	0.62B	1.81A	1.75AB	3.06A	2.78A	1.87A	0.86B	0.001
XDH	(mU/mg)	0.76	0.60	0.18	0.78	0.11	0.52	0.92	1.15	0.87	0.66	0.25	0.001
GGT	(U/mg)	2.83b	4.91a	4.90a	4.74a	3.31ab	3.00b	2.77b	2.86b	3.64ab	3.19ab	3.51ab	1.656
AP	(mU/mg)	3.79C	7.54C	21.42C	22.73C	31.79BC	72.58BC	81.37B	128.33AB	148.83A	150.56A	140.76A	0.072
e5'N	(mU/mg)	5.22B	4.77BC	9.70B	12.51B	14.42B	19.82B	20.99B	28.30AB	47.34A	34.17A	22.84B	0.015
TMP	(mg/ml)	4.23A	2.56B	2.15BC	3.10B	2.16B	1.92C	2.06C	2.18B	2.04C	2.32B	2.69B	0.771

1) XO: xanthine oxidase; 2) XDH: xanthine dehydrogenase; 3) GGT: gamma-glutamyltranspeptidase; 4) AP: Alkaline phosphatase 5) e 5'-N: ecto 5'-nucleotidase; 6) TMP: total membrane proteins; A, B: P<0.01; a, b: P<0.05.

Conclusions

In this study, five specific enzymatic activities of MFGM enzymes in ewes' milk and colostrum were evaluated. All specific enzymatic activities except the xanthine dehydrogenase activity significantly changed during the lactation phase. As a regards of total membrane protein, colostrum showed the higher values.

References: Benboubetra, M., Baghiani, A., Atmani, D., Harrison, R. (2004). Physicochemical and kinetic properties of purified sheep's milk xanthine oxidoreductase. Journal of Dairy Science, 87, pp. 1580-1584; Brown A.-M., Benboubetra M., Ellison M., Powell D., Reckless J.D., Harrison R. (1995). Molecular activation-deactivation of xanthine oxidase in human milk. Biochimica et Biophysica Acta - General Subjects, 1245 (2), pp. 248-254; Cha´varri F., Santistebam A., Virto M. and de Renobales M. (1998). Alkaline phosphatase, acid phosphatase, lactoperoxidase and lipoprotein lipase activities in industrial ewe's milk and cheese. Journal of Agricultural and Food Chemistry, 46, pp. 2926–2932; Martini M., Salari F., Pesi R., Tozzi M.G. (2010). Relationship between activity of some fat globule membrane enzymes and the lipidic fraction in ewes' milk: preliminary studies International Dairy Journal; 20, pp. 61-64.

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