The Dynamic of Immunoglobulin IgA and IgM Type Concentration in Milk Colostrum

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Abstract
The aim of the paper was to evaluate the colostrum quality and changes in composition during the first three days postpartum. Researches were carried out on five Romanian Black and White primiparous cows. Samples of colostrum were collected at calving and at 4-hour interval for three days. Samples were analyzed for immunoglobulin concentration using a ELISA test. The colostrum was analyzed in order to measure immunoglobulin type IgA and IgM concentrations. The maximum concentration of immunoglobulin Ig A in colostral milk was found as expected at the first milking 4.2 mg/ml. The concentrations of immunoglobulin type Ig M decreased in the first day after calving from 4.9 mg/ml at first milking to 4.2 mg/ml at the sixth milking. The concentrations of immunoglobulin type Ig A decreased in the third day after calving from 1.9 mg/ml at thirteenth milking to 1.5 mg/ml at the eighteenth milking. The concentrations of immunoglobulin type Ig M decreased in the second day after calving from 2.9 mg/ml at thirteenth milking to 2.1 mg/ml at the eighteenth milking.

Keywords: colostrum, immunoglobulin type IgA and IgM, Romanian Black and White breed.

1. Introduction

Administration of good quality colostrum, in the right quantity and soon after birth is the most important factor in health and survival of newborn calves of dairy breed. Costs of replacement for dairy cattle increases when the mortality increases or when the newborn calves should be given drugs to treat diseases that can be avoided [1].
At birth, the calf has a very underdeveloped immune system. Placenta does not allow transfer of antibodies, so called immunoglobulin (Ig) from mother to fetus during pregnancy. Colostrum is important as the first source of nutrients after birth [2].
Antibodies are proteins that identify the presence of some organisms likely to cause disease in calves. Typical dairy cow colostrum contains three main types of Ig (G, M, A) the percentage is 85-90%, 5-10% and 5-10% respectively [3].
All those three types of immunoglobulin have a special role in the immune system. The main role of immunoglobulin is to spot the presence of pathogens that invade and help destroy them.
The main role of Ig M is to spot the presence of bacteria entering the bloodstream and help destroy them. Regarding IgA, it is fixed on the membranes that surround the various organs, the intestines, and prevent pathogens from entering here and cause disease [4].

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2. Materials and methods

The study was carried out in the University research farm on 90 samples taken from 5 cows from Romanian Black and White breed that calved in November 2011.

Cows were milked every 4 hours during the first three days after calving and samples collected. Samples were stored in a freezer and then analyzed.

Colostrum samples were collected using a milking machine.

Samples were analyzed in order to determinate the immunoglobulin Ig A and Ig M concentrations using the ELIZA test. The principle of the test is to use microplate wells coated with polyclonal antibodies to bovine Ig A and Ig M form the capture phase of the assay. These antibodies bind uniformly to all subclasses of bovine Ig A and Ig M. Captured bovine Ig A and Ig M then reacts with detector antibody, which is a polyclonal anti-bovine Ig A and Ig M, conjugated with horseradish peroxidase. This reagent also reacts uniformly with all subclasses of bovine Ig A and Ig M. Enzyme activity in the wells is then quantified using tetramethyl benzidine as a substrate.

3. Results and discussion

The immunoglobulin Ig A and Ig M concentrations in colostrum during the first day after calving are presented in Table 1.

Table 1. Immunoglobulin Ig A and Ig M concentrations in the first day after calving (mg/ml)

Specification		Milking 1	Milking 2	Milking 3	Milking 4	Milking 5	Milking 6
IG A (mg/ml)	X±SEM	4.2±0.07	4.0±0.10	3.7±0.26	3.9±0.21	3.4±0.36	2.9±0.32
	SD	0.15	0.21	0.57	0.43	0.72	0.64
	v%	3.5	5.3	15.7	11.0	21.1	21.9
	Min.	4.0	3.8	2.7	3.4	2.4	2.1
	Max.	4.4	4.3	4.2	4.4	4.1	3.6
IG M (mg/ml)	X±SEM	4.9±0.21	4.8±0.21	4.6±0.13	4.7±0.23	4.5±0.25	4.2±0.26
	SD	0.48	0.47	0.3	0.46	0.50	0.52
	v%	9.8	9.9	6.5	9.8	11.0	12.5
	Min.	4.4	4.1	4.3	4.2	4.1	3.5
	Max.	5.6	5.2	4.9	5.3	5.2	4.7

The maximum concentration of immunoglobulin Ig A in colostral milk was found as expected at the first milking 4.2 mg/ml. Four hours later at the second milking the immunoglobulin type Ig A concentration decreased slightly to 4.0 mg/ml.

At the third milking, respectively at 8hours after calving immunoglobulin type Ig A concentration decreased to 3.7 mg/ml and then increased at the fourth milking to 3.9 mg/ml.

The concentration of immunoglobulin Ig A decreased at fifth and sixth milking to 3.4 and 2.9 mg/ml.

The concentrations of immunoglobulin type Ig M decreased in the first day after calving from 4.9 mg/ml at first milking to 4.2 mg/ml at the sixth milking.

The immunoglobulin type Ig A and Ig M concentrations in colostrum during the second day after calving is shown in Table 2.

The maximum concentration of immunoglobulin Ig A in colostral milk during the second day after calving was found at the eight milking 2.8 mg/ml and not at the seventh milking as expected when it reached 2.7 mg/ml. Four hours later at milking 9, immunoglobulin type Ig A concentration decreased slightly to 2.7 mg/ml.

At the fourth, fifth and sixth milking from the second day after calving, respectively at 40, 44 and 48 hours after calving immunoglobulin type Ig A concentration decreased to 2.5, 2.4 and 1.9 mg/ml.

The concentrations of immunoglobulin type Ig M decreased in the second day after calving from 4.1 mg/ml at first milking to 3.0 mg/ml at the sixth milking.

The immunoglobulin type Ig A and ig M concentrations in colostrum during the third day after calving is shown in Table 3.

The concentrations of immunoglobulin type Ig A decreased in the third day after calving from 1.9 mg/ml at thirteenth milking to 1.5 mg/ml at the eighteenth milking.

Table 2. Immunoglobulin Ig A and Ig M concentrations in the second day after calving (mg/ml)

Specification		Milking 7	Milking 8	Milking 9	Milking 10	Milking 11	Milking 12
IG A (mg/ml)	X±SEM	2.7±0.32	2.8±0.37	2.7±0.46	2.5±0.36	2.4±0.39	1.9±0.27
	SD	0.64	0.74	0.92	0.72	0.78	0.53
	v%	23.5	26.2	34.4	29.2	31.7	27.6
	Min.	1.9	1.8	1.4	1.4	1.3	1.3
	Max.	3.4	3.5	3.4	2.9	3.0	2.5
IG M (mg/ml)	X±SEM	4.1±0.22	3.9±0.21	3.7±0.23	3.4±0.27	3.1±0.29	3.0±0.23
	SD	0.44	0.42	0.45	0.54	0.57	0.46
	v%	10.9	10.9	12.3	15.9	18.8	15.2
	Min.	3.6	3.6	3.2	2.7	2.4	2.7
	Max.	4.6	4.5	4.3	4.0	3.8	3.7

Table 3. Immunoglobulin Ig A and Ig M concentrations in the third day after calving (mg/ml)

Specification		Milking 13	Milking 14	Milking 15	Milking 16	Milking 17	Milking 18
IG A (mg/ml)	X±SEM	1.9±0.33	1.8±0.34	1.8±0.47	1.7±0.45	1.6±0.42	1.5±0.11
	SD	0.67	0.68	0.82	0.78	0.72	0.20
	v%	33.9	36.5	45.5	46.6	45.1	13.3
	Min.	1.2	1.0	0.9	0.8	0.8	1.3
	Max.	2.8	2.6	2.5	2.3	2.2	1.7
IG M (mg/ml)	X±SEM	2.9±0.29	2.8±0.33	3.1±0.35	2.8±0.40	2.7±0.42	2.1±0.11
	SD	0.57	0.66	0.61	0.70	0.72	0.20
	v%	19.6	23.0	19.6	25.0	26.1	9.5
	Min.	2.2	2.1	2.7	2.3	2.3	1.9
	Max.	3.6	3.7	3.8	3.6	3.6	2.3

The concentrations of immunoglobulin type Ig M decreased in the second day after calving from 2.9 mg/ml at thirteenth milking to 2.1 mg/ml at the eighteenth milking.

Figure 1 and 2 presents the evolution of immunoglobulin type Ig A and Ig M concentration from colostral milk in the first three days after calving.

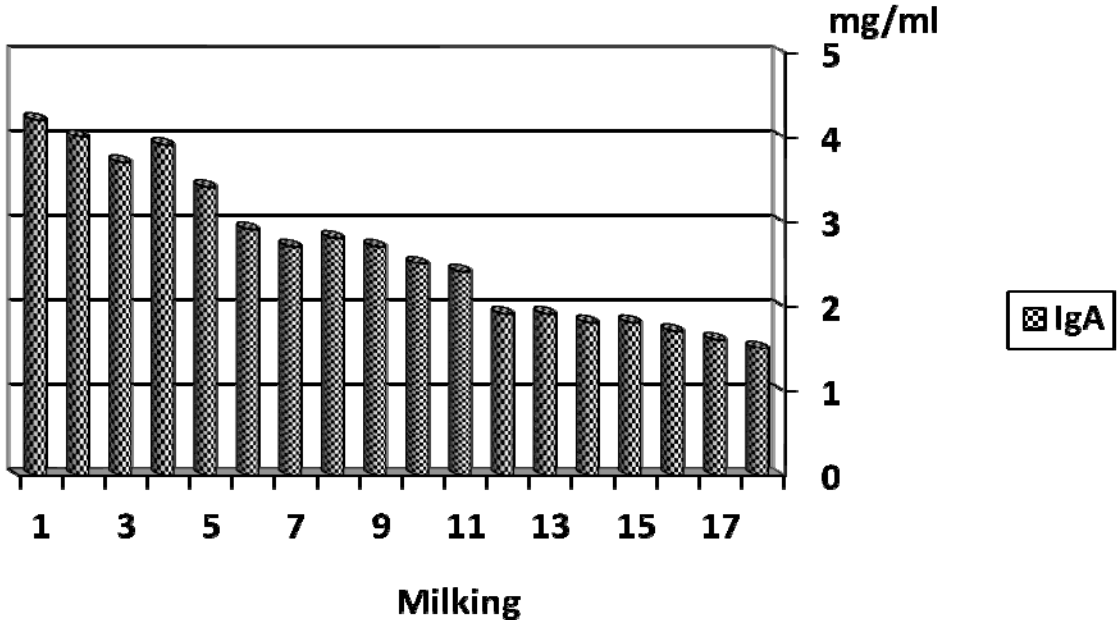

Figure 1. Immunoglobulin Ig A concentrations in the first three days after calving (mg/ml)

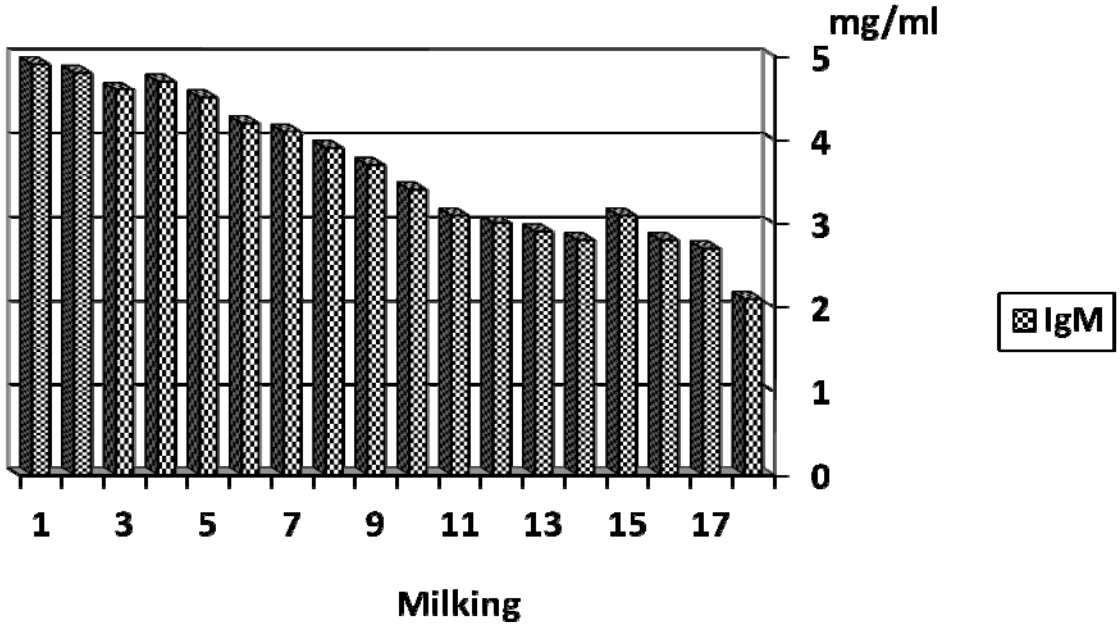

Figure 2. Immunoglobulin Ig M concentrations in the first three days after calving (mg/ml)

4. Conclusions

The maximum concentration of immunoglobulin Ig A in colostral milk was found as expected at the first milking 4.2 mg/ml.
The concentrations of immunoglobulin type Ig M decreased in the first day after calving from 4.9 mg/ml at first milking to 4.2 mg/ml at the sixth milking.
The concentrations of immunoglobulin type Ig A decreased in the third day after calving from 1.9 mg/ml at thirteenth milking to 1.5 mg/ml at the eighteenth milking.
The concentrations of immunoglobulin type Ig M decreased in the second day after calving from 2.9 mg/ml at thirteenth milking to 2.1 mg/ml at the eighteenth milking.

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