

Age of cows, as a factor shaping the level of immunostimulating properties of colostrum

K. Puppel¹, G. Grodkowski¹, P. Solarczyk¹, P. Kostusiak¹, M. Klopčič², K. Grodkowska¹, T. Sakowski^{3*}

¹Institute of Animal Science, Warsaw University of Life Sciences, Ciszewskiego 8, 02-786 Warsaw, Poland

²Department of Animal Science, University of Ljubljana, SI-1230 Domžale Slovenia

³Department of Animal Science, Institute of Genetics and Animal Breeding, Polish Academy of Science, Jastrzębiec, Postępu 36A, 05-552 Magdalenka, Poland
*corresponding author

The aim

The quality of colostrum is variable and this variability is determined by both individual factors and environmental factors. The yield of colostrum is negatively correlated with its density and the content of its components, which means that as the quantity of colostrum produced increases, its quality decreases. A characteristic feature of the organic system of production is the lower productivity of cows. The research hypothesis assumes verification of the statement, that the organic dairy farming system has a positive impact on colostrum quality. And reports that almost 60% of colostrum samples do not have enough antibodies do not refer to the organic system. The aim of the study was to determine the effect of cow age and collecting number on the level of immunostimulating colostrum components in an organic system of production.

Materials and Method

From the basic herd specializing in organic milk production, 40 cows of the Polish Holstein-Friesian Black and White breed were selected: 10 primiparous, 10 cows in 2nd lactation, 10 cows in 4th. lactation and 10 cows in 5th lactation. The colostrum samples were collected according to the following scheme: the first one maximum of two hours after calving, the second on the same day and the third and fourth on the following day. For three consecutive days samples were taken once a day (7 colostrum samples from each cow).

The data were compiled statistically, using a multi-factor analysis of variance by the least squares method. The decomposition of bioactive components was checked with the Shapiro-Wilk test. All tests were conducted using IBM SPSS 23 [2020]. Only those interactions between factors whose influence was statistically significant were included in the study, which was determined after preliminary statistical analyses. The following statistical model was used to determine the relationship:

$$Y_{ijk} = \mu + A_i + B_j + (A_i \times B_j) + e_{ijk}$$

where: y is the dependent variable, μ is the overall mean, A_i is the fixed effect of the colostrum sample ($i = 1 - 7$), B_j is the fixed effect of the age, $A_i \times B_j$ is the interaction between subsequent colostrum sample effect and age, and e_{ijk} is the residual error.

Results

Table 1. Changes in the whey proteins values of colostrum in subsequent collecting's depending on age.

Collecting	Lactation	Whey protein		
		α -lactalbumin [g/L]	β -lactoglobulin [g/L]	Immunoglobulin [g/L]
1	1	1.18 ^{AB}	5.15 ^{ABC}	25.89 ^{ABC}
	2	3.45 ^A	6.05 ^{AD}	77.59 ^{ADE}
	4	3.78 ^B	6.06 ^{BE}	37.26 ^{BDF}
	5	3.44	8.63 ^{CDE}	67.72 ^{CEF}
2	1	0.92 ^{ABC}	2.32 ^{ABC}	14.04 ^{ABC}
	2	2.78 ^{ADE}	4.83 ^A	19.06 ^{ADE}
	4	1.75 ^{BDF}	4.81 ^B	22.03 ^{BDF}
	5	3.05 ^{CEF}	4.47 ^C	8.44 ^{CEF}
3	1	0.73 ^{ABC}	3.01 ^{abc}	6.70 ^{ABC}
	2	2.25 ^{ADE}	3.88 ^{ade}	11.43 ^{ADE}
	4	1.90 ^{BDF}	3.83 ^{bdf}	11.56 ^{BDF}
	5	2.51 ^{CEF}	3.69 ^{cef}	3.86 ^{CEF}
4	1	0.67 ^{ABC}	2.74 ^{AB}	5.52 ^{ABC}
	2	2.09 ^{ADE}	3.55 ^{ACD}	6.15 ^{ADE}
	4	0.75 ^{BDF}	3.12 ^{BCE}	8.64 ^{BDF}
	5	1.88 ^{CEF}	2.76 ^{DE}	4.40 ^{CEF}
5	1	0.73 ^{AB}	3.10 ^{AB}	5.02 ^{ABC}
	2	1.88 ^{ACD}	3.17 ^{CD}	3.72 ^{ADE}
	4	0.70 ^{CE}	2.94 ^{AEF}	7.29 ^{BDF}
	5	1.75 ^{BDE}	2.57 ^{BDF}	4.37 ^{CEF}
6	1	0.64 ^{ABC}	2.75 ^{abC}	4.57 ^{ABC}
	2	1.73 ^{ADE}	2.98 ^{ADE}	16.50 ^{ADE}
	4	0.70 ^{BD}	2.67 ^{bdf}	5.66 ^{BDF}
	5	1.59 ^{CE}	2.34 ^{CEF}	3.72 ^{CEF}
7	1	0.62 ^{ABC}	2.66 ^{ABC}	10.86 ^{ABC}
	2	1.95 ^{ADE}	3.29 ^{ADE}	1.92 ^{ADE}
	4	0.58 ^{BD}	2.50 ^{Bdf}	5.50 ^{Bdf}
	5	1.78 ^{CE}	2.61 ^{cef}	3.49 ^{CEF}

Data were presented as least squares means.

aa, AA,...Means in the same column (in collecting's) marked with the same letters differ significantly at: capitals – $p \leq 0.01$.

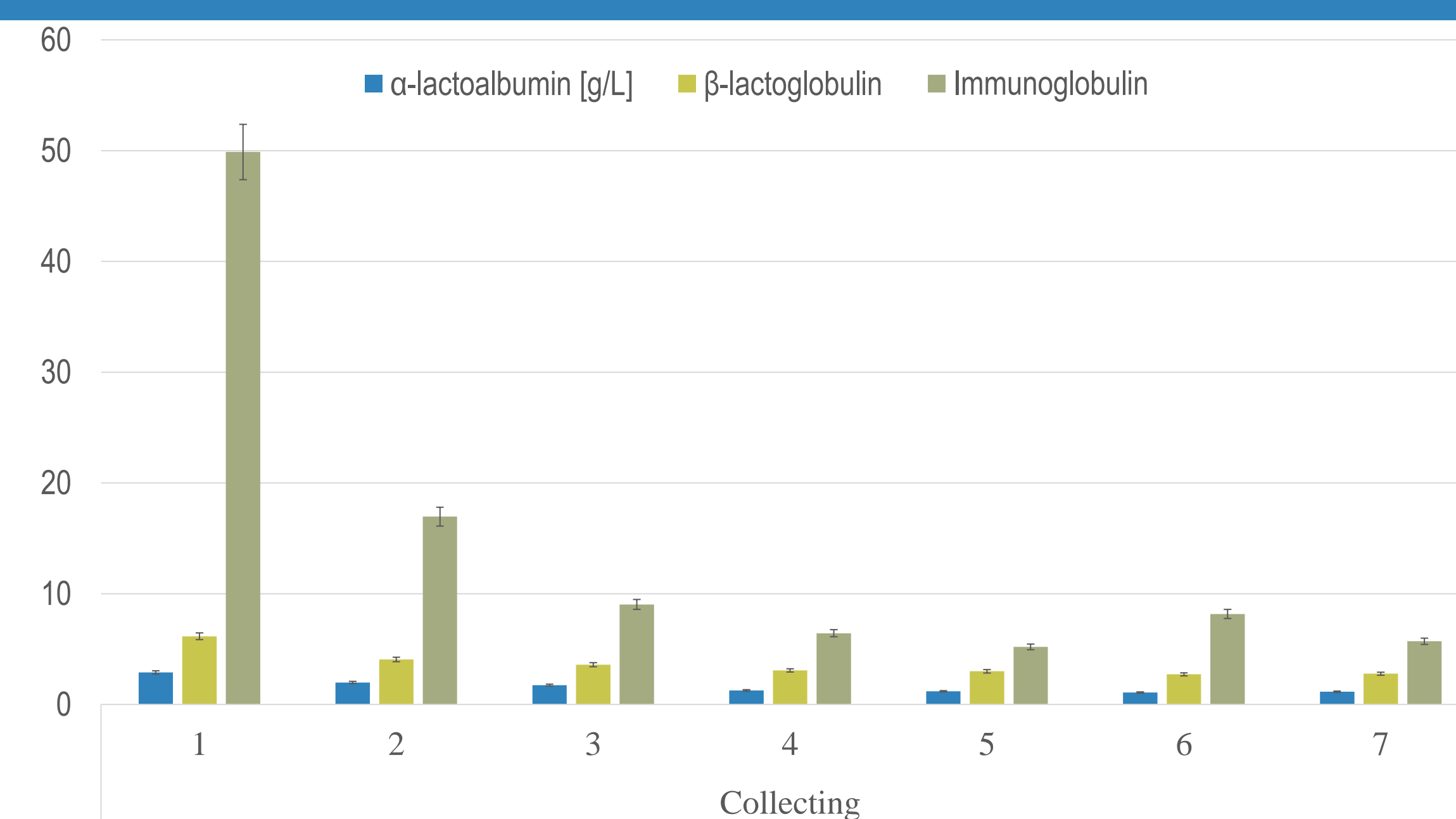
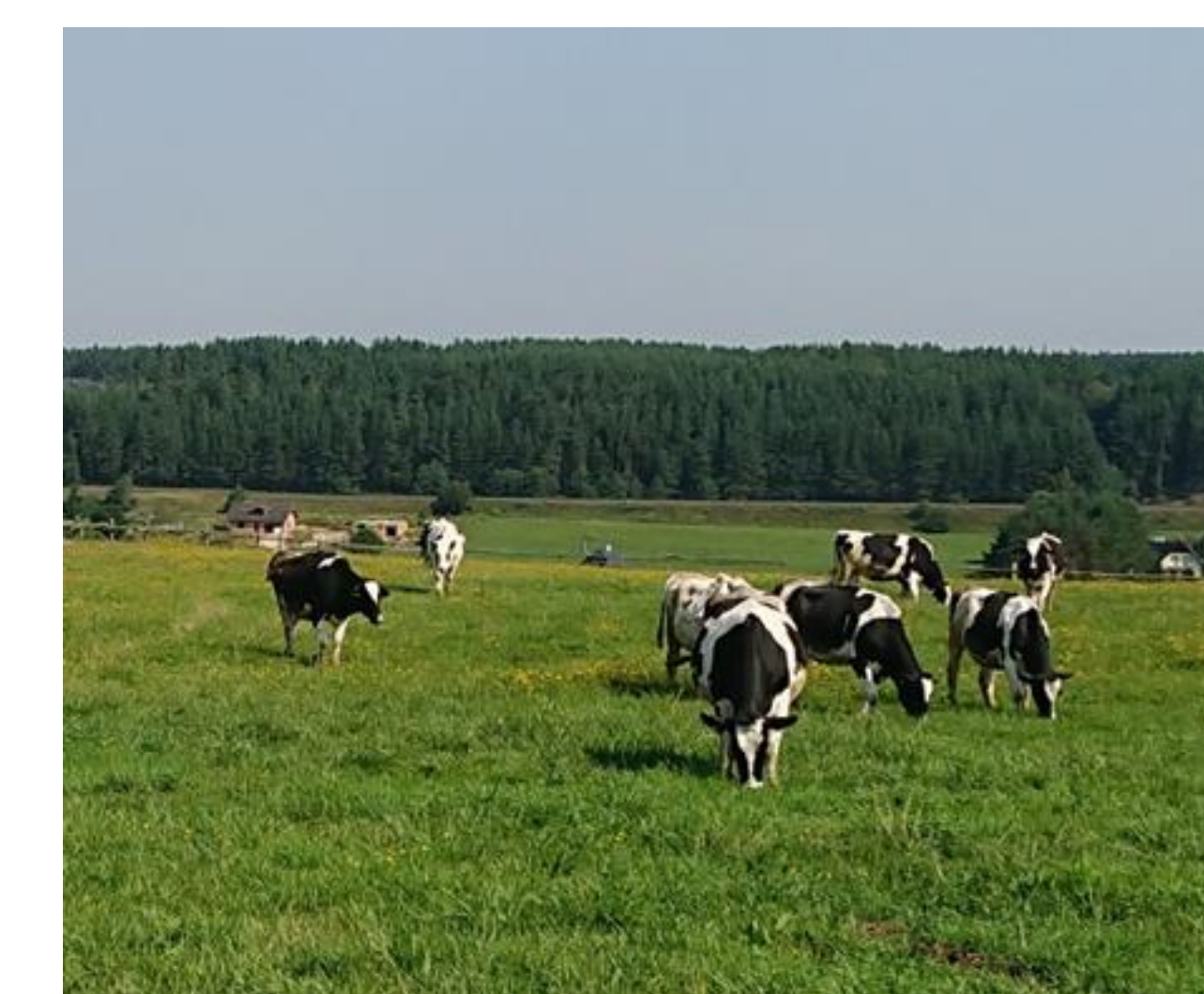


Figure 1. Changes in the whey proteins values of colostrum from subsequent colostrum sample

- ✓ Statistically significant differences in the level of bioactive components of colostrum with immunostimulating properties has been shown due to the time of intake from calving and significant differences in the level of these components due to the age of cows.
- ✓ Multiparous cows synthesized colostrum with a higher content of total protein, casein and non-fat dry matter than the primiparous.
- ✓ Variability of the immunoglobulin content of colostrum obtained in 1st and in the 2nd collecting after calving was higher in multiparous cows than in primiparous cows.
- ✓ In addition, a high impact of the interaction of cow age x intake number on the level of components with colostimulating properties has been demonstrated.
- ✓ Furthermore, it has been shown that there was a clear correlation between the quality of colostrum and the age of cows. In conclusion, a high impact of the interaction of age of cows x intake number on the development of colostrum stimulating ingredients in the organic production system has been demonstrated.



The partners of the ProYoungStock consortium gratefully acknowledge the financial support for this project provided by the CORE Organic Co-fund 2016/17 Funding Bodies (project ID 727495).