



Estimation of immunoglobulin-G content of colostrum and milk from whey protein content in ruminant animals

J. Csapó

email: csapojanos@sapientia.siculorum.ro,
csapo.janos@gmail.hu

Sapientia – Hungarian University of Transylvania,
Faculty of Technical and Social Sciences,
Department of Food Science
Piața Libertății 1, 530104 Miercurea Ciuc, Romania

Abstract. After the analysis of the relation between the serum protein and the immunoglobulin-G content of the colostrum and the milk of 141 cattle of various genotypes (pure-bred or cross-bred), 55 goats of various breeds and 171 sheep of various breeds, it was established that there exists a very close correlation between these two components in all three species. R values of 0.9869 for cattle, 0.9723 for goats and 0.9574 for sheep were determined. The R value calculated for the three species evaluated collectively was 0.9667. The very close relation ascertained – by means of linear regression – between serum protein and immunoglobulin-G provides justification for the application of the equations formulated in this study for the estimation of immunoglobulin-G content on the basis of serum protein content.

1 Introduction

In the past decades, there have been substantial changes in the breeds and in the composition of types of the main ruminant species kept in Hungary (cattle, sheep and goats). In the field of cattle breeding, subsequent to the cross-breeding of the Hungarian Simmental (HS) with the Holstein-Friesian (HF)

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to result in a transformation in the breed, and also following cross-breeding programmes to produce new breeds, production began with new breeds of cattle of unknown colostrum and milk composition (Csapó & Makai, 1981; Csapó *et al.*, 1981, 1982; Csapó & Csapó-né, 1983a, b; 1992). In connection with this programme of breed transformation and new breed creation, the author examined the composition of the colostrum and milk of cows of the following types: Hungarian Simmental (30), Holstein-Friesian (30), Hungarian Simmental \times Holstein-Friesian F1 (30), Hungarofries B (10, 50% Jersey, 50% Holstein-Friesian gene ratio), created by means of cross-breeding to produce a new breed, and also Holstein-Friesian sired (21, 62.5% HF, 25% J, 12.5% HS) and Jersey sired (20, 62.5% J, 31.2% HF, 6.3% HS) types, produced by alternating (criss-cross) cross-breeding based on the Holstein-Friesian and Jersey (J) breeds (Szentpéteri *et al.*, 1986; Csapó *et al.*, 1991a, b; 1992).

In sheep and goat breeding, in addition to the use of the Hungarian breeds, a number of breeds have been imported from other countries and subjected to trial. In the course of his research work, the author examined the composition of the colostrum and milk of the Hungarian Improved (10), the Hungarian Local Breed (14), the Saanentaler (17) and the Alpine (14) goat breeds (Csapó *et al.*, 1984a, b, c; Csapó *et al.*, 1986, 1987), as well as the Hungarian Combing Wool Merino (58), the Awassi (20), the Langhe (14), the Sarda (22), the Tsigai (16), the Cikta (11), the Black Racka (12), the White Racka (8), the Karakul (4), the Kent (3) and the wild sheep (3) (Csapó *et al.*, 1986). Since it was realized during the investigations that there is a substantial deviation between the first colostrum of mother animals producing twins and that of those giving birth to single progeny, the first colostrum from 32 cows calving twins and 32 giving birth to single calves on two state farms and also from 24 Hungarian Combing Wool Merino ewes dropping twins and 22 dropping single lambs at a production cooperative was collected. The composition of the colostrum and milk samples thus obtained was subjected to comprehensive chemical analysis, particular attention being paid to the immunoglobulin-G (hereafter IgG) and serum protein content of the colostrum (Csapó & Csapó-né, 1987, 1988, 1991, 1993, 1994; Csapó *et al.*, 1988, 1989, 1991; Csapó, 1991, 1995). In possession of the analysis data and in the endeavour to establish the relation between the various components, it was realized that there exists a close correlation between serum protein content and IgG. An account of this correlation is to be covered in this paper. The list of publications produced by the authors, wherefrom the 367 experimental data for serum protein and IgG originate, is contained in the list of the given literature.

2 Materials and methods

Colostrum and milk samples stored in a freezer were warmed in 38-40 °C water, then homogenized, and the casein and serum protein were subsequently separated at pH 4.55. The nitrogen concentration of the serum was determined by means of a Kjel-Foss 16200 type rapid nitrogen analyser.

The immunoglobulin-G content of the colostrum and the milk was determined using the simple immunodiffusion method developed by *Mancini et al.* (1965). The cow, goat, sheep and rabbit antiserum and the cow, goat and sheep IgG standard were supplied by the Gödöllő and Budapest units of the Human Vaccine Production and Research Institute.

The relation between the serum protein and the IgG content of colostrum and milk samples taken at various time points subsequent to parturition was calculated by means of linear regression.

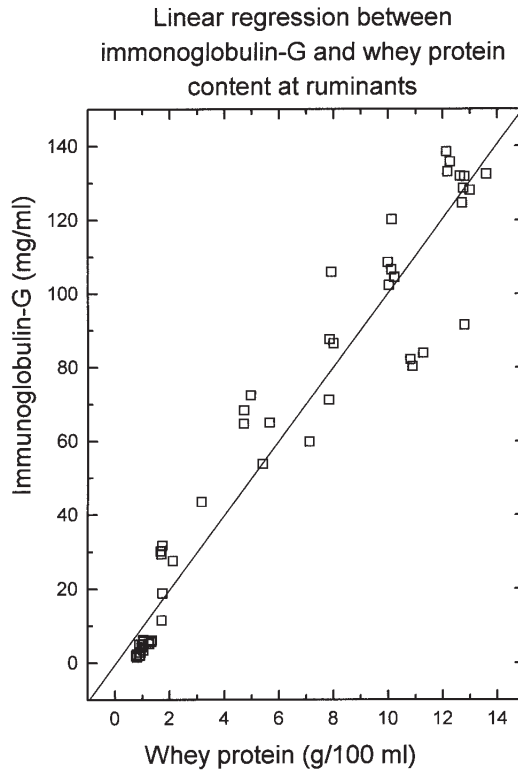
3 Results and discussion

Data relating to the analysis of the colostrum and milk of 141 cows of various breeds, 55 goats of various breeds and 171 ewes cattle of various breeds were included in the evaluation. The equations formulated by means of linear regression are presented in *Table 1*, while *Figure 1* illustrates the correlation between immunoglobulin-G and serum protein content established on evaluation of the data relating to the three species selected as appropriate.

Table 1: Linear regression parameters and statistical characteristics for immunoglobulin-G and whey protein content in cattle, goats, ewes and for the three species collectively ($Y = A + B * X$)

Parameter, statistical characteristic		Cattle whey	Goat protein	Ewe – immunoglobulin-G	Collective
A		-1.52595	-0.82282	-0.86288	-0.6742
	sd	1.8089	2.5700	3.15982	2.78457
B		10.57414	10.16312	10.03298	10.07453
	sd	0.23973	0.34565	0.41946	0.36965
SD		8.34463	118547	14.5959	12.8625
N		141	55	171	54
R		0.9869	0.97228	0.95743	0.96673
P		0.0001	0.0001	0.0001	0.0001

The data obtained for each species were evaluated separately by means of linear regression; then, subsequent to random selection of samples such that the immunoglobulin content of the samples should be evenly distributed in the 1-140 mg/ml range, the data relating to the three species were also evaluated collectively. For all three species, a very close correlation between the two components was ascertained; the R value determined for cattle was 0.9869, for goats 0.9723 and that for sheep 0.9574. The R value obtained from the data for the three species evaluated collectively was 0.9667.



The very close relation ascertained – by means of linear regression – between serum protein and immunoglobulin-G provides justification for the application of the equations formulated in this study for the estimation of immunoglobulin-G content on the basis of serum protein content.

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