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The daily yield, the physico-chemical characteristics of goat milk during lactation

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ABSTRACT

Average milk yield and milk composition (fat, protein, lactose) and their changes over the lactation were studied on 156 Hungarian Milking White, 168 Hungarian Milking Brown, 106 Hungarian Milking Multicolour goats from April to October, at 4-weeks interval. Daily milk yield and milk composition were counted from the morning and evening yield and contents.Does of Hungarian Milking Multicolour started the lactation with the highest daily yield, while from the second part of the lactation, the Hungarian Milking White does had the highest average daily yield. In the course of lactation the Hungarian Milking Brown had the lowest daily yield. The fat content of the milk increased from 3.2% to 5.0%, with the highest fluctuation in Hungarian Milking Brown producing the highest fat content at the beginning and at the end of lactation. The protein content of the milk increased from 3.1 to 3.9%. In Hungarian Milking White the protein content increased persistently, however, in Hungarian Milking Brown and Hungarian Milking Multicolour the value of this quality decreased from the second period, and reincreased from the 111st day. During the milking period the lactose content of milk changed between 4.3 and 4.6%. The highest lactose content was measured in Hungarian Milking White, while the lowest in Hungarian Milking Multicolour milk.
(Keywords: goat, milk, fat, protein, lactose)

INTRODUCTION

The goats are widely used for milk production in European counties, while in Africa the meat production has important rule in human consumption. In the developed countries the lactation curves of different goat breeds and the chemical composition of milk during lactation were already analysed.

According the results of *Mellado et al.* (1991) the goats reached the peak yield at third month in the first, third and fourth lactation, while the second lactation peak yield was produced in the fourth month after kidding. The daily yield increased until 5–8th week, then decreased continuously until the end of lactation (*Schandl,* 1966). *Bodó* (1959) results showed a steady milk production and a decrease from the third-fourth month. *Claps et al.* (2007) analysed four Mediterranean goat breeds (Maltese, Red Syrian, Ionica, Gingentana) concerning chemical composition of the milk, and showed a significantly higher fat and protein content produced by Maltese than other breeds. According to *Sollberger and Schaeren* (2003) results brienz goats' milk contained more fat and protein compared to Saanen breed. *Katanos et al.* (2005) measured similar fat content in Saanen like *Bedő et al.*

(1999). *Sung et al.* (1999) compared Alpine, Nubian, Saanen and Toggenburg goat milk, where fat percentages of Alpine and Toggenburg were medium and that of Nubian was higher than the total average. Protein percentage of Nubian was also higher than in the other three breeds and that of Alpine was the lowest. According to the result of *Mimosi et al.* (2007) the fat, protein and lactose content increased during lactation. The Hungarian local goats produced less protein (3,4%) content than Alpine (3,5%) and Saanen (3,5%) (*Csapóné et al.,* 2009). The objective was to estimate the lactation curve of the Hungarian local goats, and to study the changes in fat, protein and lactose contents over the lactation.

Table 1

Milk production of Hungarian goats

Breed	Lactation milk yield (litre)	Daily milk yield (litre)	Source
Hungarian Milking White	177.4	1.3	*Pintér et al.,* 2004
Hungarian Milking White	303.6	1.8	*Kukovics,* 2005[1]
Hungarian Milking White	287.2	1.7	*Kukovics,* 2005[2]
Hungarian Milking Brown	242.2	1.7	*Pintér et al.,* 2004
Hungarian Milking Brown	268.3	1.7	*Kukovics,* 2005[1]
Hungarian Milking Brown	314.4	2.0	*Kukovics,* 2005[2]
Hungarian Milking Multicolour	222.9	1.5	*Pintér et al.,* 2004
Hungarian Milking Multicolour	278.6	1.8	*Kukovics,* 2005[1]
Hungarian Milking Multicolour	285.9	1.8	*Kukovics,* 2005[2]

[1]data from 2003, [2]data from 2004

Table 2

Fat, protein and lactose content of goat milk

Breed	Fat (%)	Protein (%)	Lactose (%)	Source
Saanen	3.90	3.40	4.70	*Bedő et al.,* 1999
Red Syrian	3.47	3.34		*Claps et al.,* 2007
Girgentana	3.97	3.13		*Claps et al.,* 2007
Ionica	4.30	3.66		*Claps et al.,* 2007
Maltese	4.70	3.91		*Claps et al.,* 2007
Damascus	5.06	3.25	4.64	*Katanos et al.,* 2005
Saanen	3.82	3.14	4.51	*Katanos et al.,* 2005
Saanen×Alpine	3.88	3.14	4.66	*Katanos et al.,* 2005
Saanen×local Greek	4.79	3.56	4.73	*Katanos et al.,* 2005
(Saanen×local Greek)×Saanen	3,95	3.47	4.63	*Katanos et al.,* 2005
Payoya	4.91	3.73		*Mena et al.,* 2007[1]
Payoya	4.25	3.54		*Mena et al.,* 2007[2]
Payoya	4.53	3.68		*Mena et al.,* 2007[3]
Payoya	5.53	4.09		*Mena et al.,* 2007[4]
Camosciata	3.52	3.40		*Mimosi et al.,* 2007[5]
Camosciata	3.45	3.34		*Mimosi et al.,* 2007[6]
Saanen	3.07	2.69		*Sollberger and Schaeren,* 2003
Oberhalsi-Brienz	3.31	2.82		*Sollberger and Schaeren,* 2003
Alpine	3.40	3.08	4.37	*Sung et al.,* 1999
Nubian	4.48	4.23	4.16	*Sung et al.,* 1999
Saanen	2.55	3.25	4.56	*Sung et al.,* 1999
Toggenburg	3.54	3.21	4.16	*Sung et al.,* 1999

[1] Jan., March; [2] Apr., June; [3] July-Sept; [4] Oct-Dec; [5] early lactation; [6] end of lactation

MATERIALS AND METHODS

Five goat herds, three small and two bigger farms were including in a test day milk recording program. Does were belonging to 3 breeds, like Hungarian Milking White (HMW, n=156), Hungarian Milking Brown (HMB; n=168), Hungarian Milking Multicolour (HMM, n=106). Individual milk yield was measured and individual milk samples were taken twice a day, morning and evening, at 4-weeks intervals from April to October. The length of lactation was separated into 7 intervals (51–80th, 81–110th, 111–140th, 141–170th, 171–200th, 201–230th, 231–260th days after kidding). The physico-chemical properties of milk were determined by reference and standard methods, by an official raw milk laboratory (Livestock Performance Testing Ltd. in Gödöllő, Hungary). The fat, protein and lactose content (%) were measured by Milkoscan 600 instrument. The morning and evening yields were summarized. The daily fat, protein and lactose content were counted as follows:

$$\text{daily fat}\,\% = \frac{(\text{MY}\cdot\text{MF})+(\text{EY}\cdot\text{EF})}{\text{MY}+\text{EY}} \quad (1)$$

$$\text{daily protein}\,\% = \frac{(\text{MY}\cdot\text{MP})+(\text{EY}\cdot\text{EP})}{\text{MY}+\text{EY}} \quad (2)$$

$$\text{daily lactose}\,\% = \frac{(\text{MY}\cdot\text{ML})+(\text{EY}\cdot\text{EL})}{\text{MY}+\text{EY}} \quad (3)$$

Where:

MY=morning yield (litre);
EY=evening yield (litre);
MF=morning fat%;
EF=evening fat%;
MP= orning protein%;
EP=evening protein%;
ML=morning lactose%;
EL=evening lactose%.

RESULTS AND DISCUSSION

The does of Hungarian Milking Multicolour started the lactation with the highest daily yield, while from the second part of the lactation, the Hungarian Milking White does had the highest average daily yield. In the course of lactation the Hungarian Milking Brown had the lowest daily yield. The Hungarian Milking White and the Hungarian Milking Multicolour does had the peak daily yield (1.6 litre) in the period of 81–110 days, while the Hungarian Milking Brown the peak daily yield (1.5 litre) was in the period of 111–140 days. At the beginning of the milking season the daily milk yield was between 1.4 and 1.5 litres, but in the second period the yield increased to 1.5 and 1.6 litre in all three breeds. The yield stayed at the same level in the Hungarian Milking White and the Hungarian Milking Multicolour breeds, and from the period of 171–200 days the yield decreased to 1.0 litre at the end of lactation. The milk production of the Hungarian Milking Brown decreased after the peak yield to 0.9 litres. During lactation, in the period of 171–200th days, there was significant difference ($P \leq 0.05$) found between Hungarian Milking White and Hungarian Milking Brown (*Figure 1*).

The fat content of the milk increased from 3.2% to 5.0%, with the highest fluctuation in Hungarian Milking Brown producing the highest fat content at the beginning and at the end of lactation. The Hungarian Milking Multicolour does produced 3.4% milk fat until the 170th day, then it strongly increased. The tendencies were similar in other two breeds, however, the fat content increased from 3.3 to 3.5% in Hungarian Milking White, then it was stable until the 200th day, and then intensive increase was observed. Significant differences ($P \leq 0.05$) were found in the period of 111–140th days between Hungarian Milking White and Hungarian Milking Brown (*Figure 2*).

The protein content of the milk increased from 3.1 to 3.9%. In Hungarian Milking White its value increased persistently, however, in Hungarian Milking Brown and Hungarian Milking Multicolour the protein content decreased from the second period, and reincreased from the 111st day. In the course of the lactation the differences among breeds changed, until the 140th day the protein yield was the highest in Hungarian Milking Multicolour does, but in the further period, in the Hungarian Milking Brown breed. The differences between breeds were not significant during lactation (*Figure 3*).

During the milking period the lactose content of milk changed between 4.3 and 4.6%. The highest lactose content was measured in Hungarian Milking White, while the lowest in the milk of Hungarian Milking Multicolour does, which differences were significant in almost all, except the periods of 81–110 days. In the two last periods of lactation the lactose content of milk produced by Hungarian Milking White and Hungarian Milking Brown does were significantly different (*Figure 4*).

Figure 1

Daily milk yield during lactation

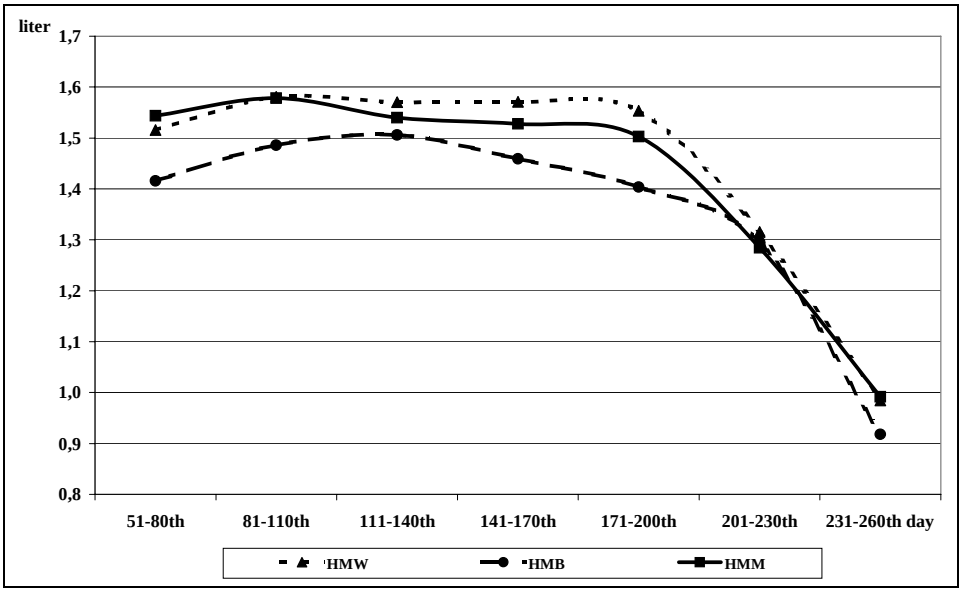


Figure 2

Daily fat content during lactation

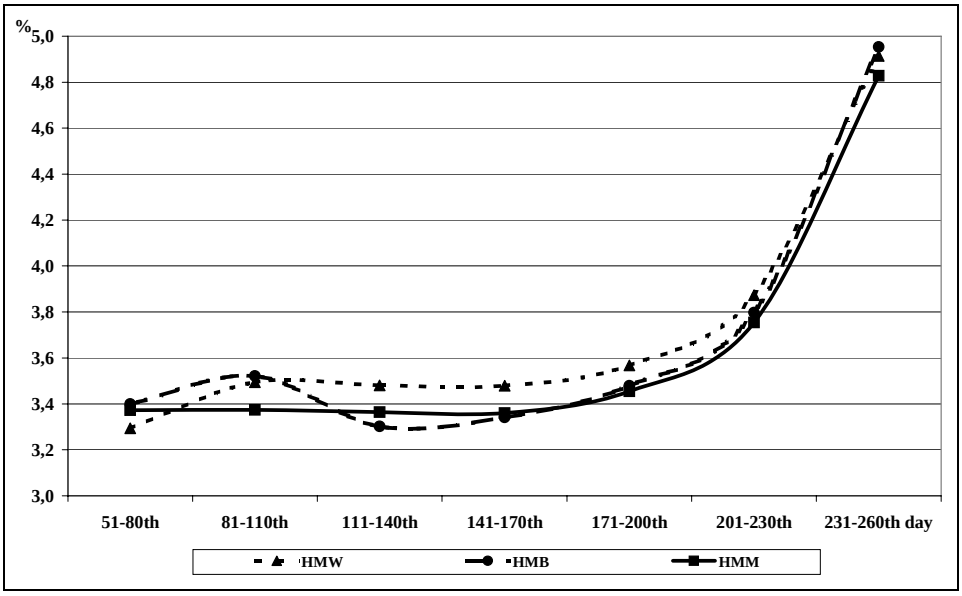


Figure 3

Daily protein content during lactation

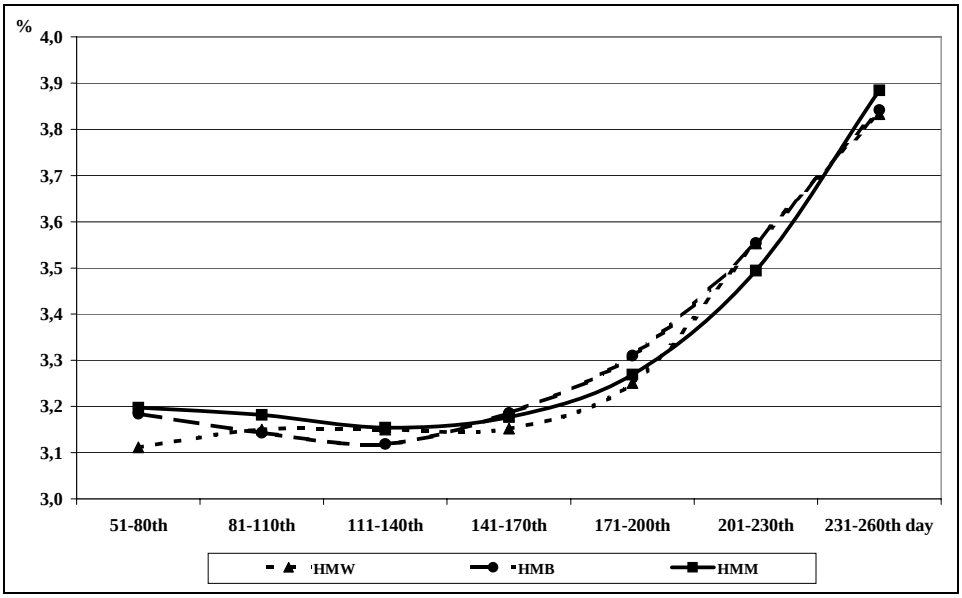
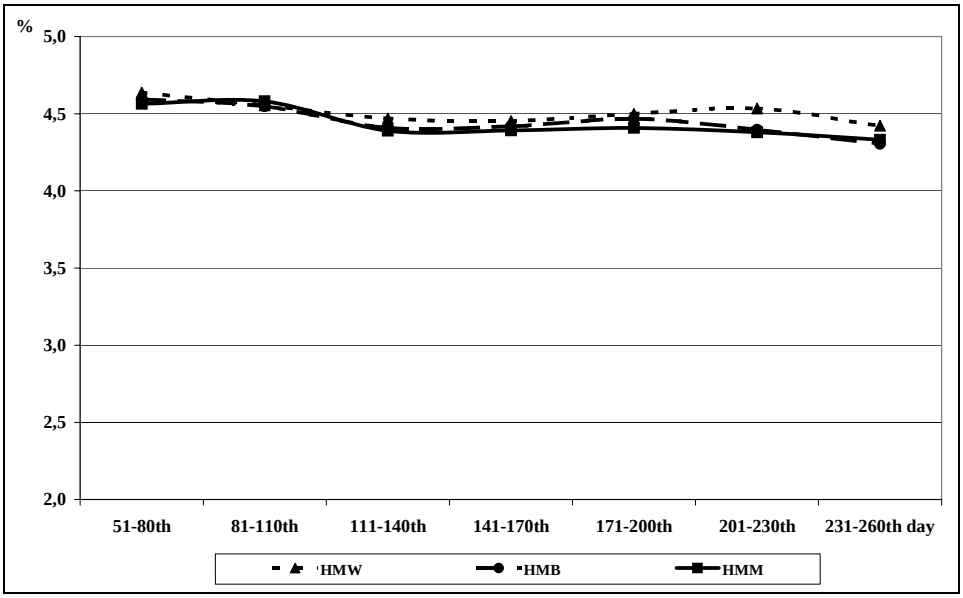


Figure 4

Daily lactose content during lactation



CONCLUSIONS

The average daily yield (1.4 litre) of Hungarian Milking White does were higher than published by *Pintér et al.* (2004), but lower than the results of *Kukovics* (2005). In the Hungarian Milking Brown and Hungarian Milking Multicolour breeds *Pintér et al.* (2004), and *Kukovics* (2005) showed higher daily yield than 1.3 and 1.4 litres.

According to our results the fat content of milk changed between 3.2 and 5.0%, like in the study of *Mimosi et al.* (2007). *Mena et al.* (2007) also showed an important increase in fat content from April to December. *Kukovics et al.* (2009) and *Katanos et al.* (2005) published similar fat content to our results (3.7%) in all three Hungarian breeds.

The changes in protein content (from 3.1 to 3.9%) during lactation did agree with the results of *Mena et al.* (2007). The average daily protein content during lactation (3.3%) was similar to *Claps et al.* (2007) in Red Syrian, *Mimosi et al.* (2007) in Camosciata, *Bedő et al.* (1999) in Saanen breeds.

The changes in lactose content (between 4.3 and 4.6%) were in average 4.4–4.5% for the whole lactation like the data published by *Katanos et al.* (2005).

It could be proposed to start the milking period as soon as possible after the kidding, and finish or starting the dry season after 200 days, because of high decrease of milk yield even if the fat and protein content increases.

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