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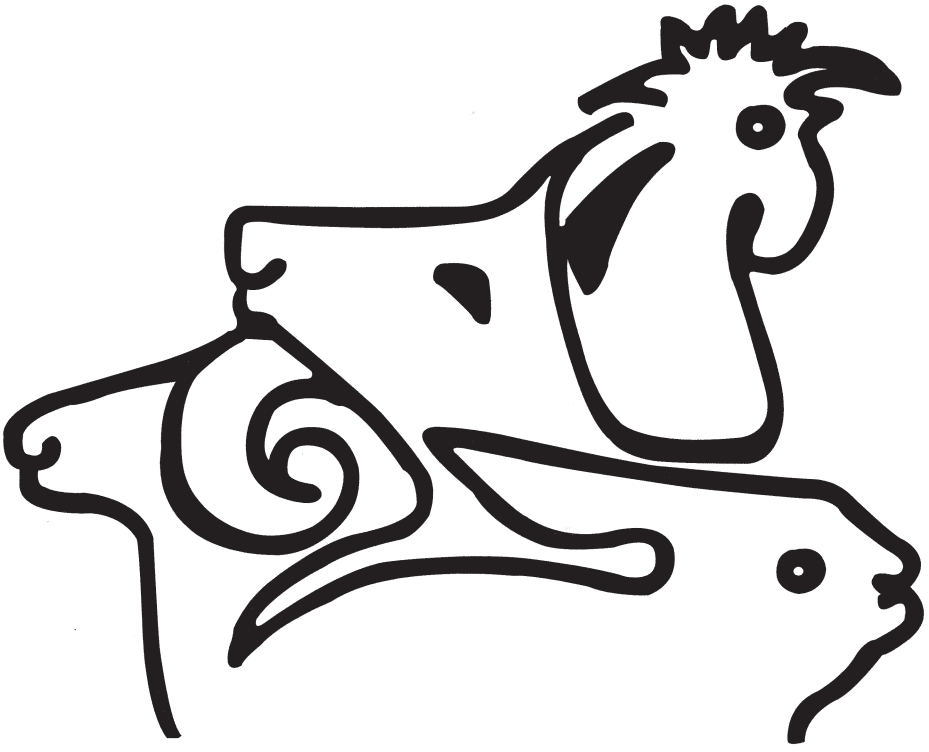

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Research Article
(Araştırma Makalesi)

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A Study on the Change in Postpartum Immunoglobulins of Goats and Kids

Keçi ve Oğlaklarda Doğum Sonrası İmmünoglobulinlerin Değişimi Üzerine Bir Araştırma

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Key Words:

Saanen goat, intensive conditions, fertility, growth traits, milk yield

ABSTRACT

Objective: In the study, the changes in the immunoglobulin levels of the Saanen goats fed with colostrum were determined during the three days after birth.

Material and Methods: The animal material of the research consists of 11 goats and 11 of their kids. Colostrum samples were taken from the goats in three repetitions (at birth, at 24th and 48th hours after birth). Changes in IgA, IgM, and IgG levels were examined individually in 33 (11 x 3) colostrum samples taken at birth and 24th and 48th hours after birth.

Results: IgA, IgM and IgG levels at birth and 24 and 48 hours after birth for Saanen goats were 0.11-1.98-1.88 mg/ml, 0.28-0.95-14.01 mg/ml and 0.25-0.96-13.53 mg/ml, respectively. The IgA, IgM, IgG levels of kids at birth, 24, and 48 hours after birth were 0.76-1.11-19.22 mg/ml, 0.58-1.02-18.42 mg/ml and 0.53-1.24-21.60 mg/ml, respectively. The effect of birth type and gender and parity on IgA, IgM, and IgG levels were not significant, while the effect of the time-dependent change was linearly and quadratically significant (P <0.01).

Conclusion: In the colostrum secreted in the postpartum period in goats, it is necessary for the immune substances to be taken as soon as possible since the rate of passage of the immune substances transferred through the intestinal epithelium by this way decreases in time.

Anahtar Kelimeler:

Saanen keçisi, entansif koşullar, döl verimi, gelişme özellikleri, süt verimi

ÖZ

Amaç: Bu araştırmada; doğumu izleyen üç gün boyunca kolostrumla beslenen Saanen oğlaklarında kolostrumda bulunan bağışıklık maddelerinin değişimi belirlenmiştir.

Materyal ve Metot: Araştırmanın hayvan materyalini; 11 baş saf Saanen keçisi ile bunlardan doğan 11 baş oğlak olmak üzere toplam 22 baş hayvan oluşturmaktadır. Her keçiden toplam 3 kez (doğumda ve bunu izleyen saatlerde 24. ve 48. saatte) kolostrum örneği alınmıştır. Çalışmada, doğum, 24. ve 48. saatte alınan toplam 33 (11 x 3) ağız sütü (kolostrum) örneğinde IgA, IgM, IgG düzeylerinin değişimleri bireysel olarak incelenmiştir.

Bulgular: Saanen keçilerinde IgA, IgM, IgG düzeyleri doğumda; 0.11-1.98-1.88mg/ml, 24 saat sonra 0.28-0.95-14.01 mg/ml ve 48 saat sonra 0.25-0.96-13.53 mg/ml değerleri arasında değişmiştir. IgA, IgM, IgG nin oğlak kanlarında doğum, 24 ve 48. saatlerdeki düzeyleri sırasıyla; 0.76-1.11-19.22 mg/ml, 0.58-1.02-18.42 mg/ml ve 0.53-1.24-21.60 mg/ml değerleri arasında değişmiştir. IgA, IgM, IgG düzeyleri üzerinde oğlak doğum tipi, ve cinsiyeti ile laktasyon sırasının etkisi önemsiz, zamana bağlı olarak değişimin etkisi gerek lineer gerekse kuadratik olarak önemli bulunmuştur (P<0.01).

Sonuç: Keçilerde doğum sonrası dönemde salgılanan kolostrumda yavruya bu yolla aktarılan bağışıklık maddelerinin bağırsak epitel dokudan geçiş hızı azaldığı için oğlakların bağışıklık maddelerinin en kısa sürede alması sağlanmalıdır.

INTROCUTION

In recent years, the importance placed on small ruminants has increased in comparison to other domestic animals (Lerias et al. 2014). In developing countries, small ruminant dairy farms have been applying artificial rearing methods, depending on the increase in marketable milk amount (Morales et al. 2014). There are three critical periods in the newborn ruminants' immune system development during the first two months after birth (Sherman et al. 1990), which are the colostrum-feeding period, milk-feeding period and the post-weaning period, respectively. Flock management methods applied during these periods affect the growth performance of animals (Demirören et al. 1995; Mastellone et al. 2011).

Colostrum intake time and amount during the first 72 hours are critical in the transfer of passive immune substances to ruminant farm animals, such as, cattle, sheep and goat, and in the resultant viability of the offspring (Stelwagen et al. 2009; Hernandez et al. 2014a). This is due to the hypogammaglobulinemia of the offspring. Artificially reared offspring may require bottle-feeding during the first couple of days postpartum to allow sufficient immunoglobulin intake through colostrum intake (Morales et al. 2011). However, the amount and composition of colostrum production vary depending on various factors including feeding type and the number of offspring per birth (Banchero et al. 2004). Insufficient colostrum intake in lambs and goat kids during the first hours after birth results in increased susceptibility to diseases and increased mortality (Ahmad et al. 2000; Novak and Poindron, 2006).

Colostrum feeding time is another factor affecting the immune status, considering the fact that using undernourished offspring as breeding stock may sometimes cause certain problems (Hernandez et al. 2014b). IgG levels are high in the blood during the first 12-36 hours after birth, and for ruminant animals, absorption of IgG in the body, which is transferred to colostrum, is of great importance (Chen et al. 1999). Researches on the effect of possible delays in colostrum intake on immunoglobulins in the bloodstream continue (Ahmadi et al. 2009). Two of the most important variables regarding immunoglobulins are the levels of IgG and IgM in the blood. In newborn goat kids, passive immunity is obtained through colostrum, which protects the animals that were the first to respond to any pathogen type or suspected of carrying infectious diseases (Ahmadi et al. 2009). Until the immune system of the offspring is developed, immunoglobulin level in the blood continues to increase for a certain period and increasing colostrum increases the viability of the offspring (Alves et al. 2015).

In intensive goat dairy farms, goat kids are immediately separated from their mothers to avoid or minimize mother-offspring bond (Ramirez et al. 1996). However, colostrum sanitation is imperative in locations where the risk of goat disease transmission, such as, CAE (caprine arthritis encephalitis), is high (Rachman et al. 2015). It was reported that pasteurization and alternative methods used in colostrum hygiene decreased the IgG amounts in colostrum by 20-30% (Arguello, 2011; Trujilo et al. 2007) and thereby IgG concentration in either lyophilized or atomized colostrum remained unchanged (Castro et al. 2011). On the other hand, it was also reported that this recently highlighted negative condition may be avoided using certain methods. CAE virus can be neutralized through heat treatment to colostrum (Castro et al. 2011), although IgG and other colostrum components are affected by heat and immune system of animals may be hindered. For example, in a study carried out using pasteurized cow colostrum, IgG and lactoferrin density and neutrophil activity were decreased in calves (Aldomy et al. 2014). Morin et al. (2007) in their study on calves, and, Constant et al. (1994), in their study on goat kids, reported insufficient IgG absorption in colostrum. However, whether maternal and exogenous IgG have a synergetic effect on the gamma-globulin concentration of newborn goat kids is not well known. This study aimed to determine the changes in immunoglobulin levels in Saanen goats during colostrum feeding.

MATERIAL and METHOD

Animal Material

In the study, totally 22 head animals, 11 head Saanen goats, 11 heads Saanen kids were used as experimental materials.

Method

Colostrum Feeding to Goat Kids

After birth, the kids were immediately separated from their mothers and fed colostrum weighing at least 10% of their live weight with feeding bottles. During the first hour postpartum, after the umbilical cords of the goat kids were disinfected, ear tags of the goat kids were placed and their birth weights were individually measured immediately after birth (Marounek et al. 2012; Chigerwe et al. 2005).

Blood Sample Collection

To individually determine the changes in IgA, IgM and IgG levels, 2 cc blood samples were taken from the vena jugularis of the goats, starting from at least 3 days prior to birth and during the 4 days after birth, and 1 cc blood samples were taken from the goat kids during the 3 days after birth (Quantispeed goat test, QGT) (Chigerwe et al. 2005).

Determination of the Colostrum Samples and IgG

Prior to the first milk feeding to goat kids, 500-ml colostrum samples were taken from each goat; then, they were taken from each goat in every 24 hours and thereby, a total of 3 colostrum samples were collected per a goat during the trial. The changes in IgA, IgM and IgG levels were individually determined for each colostrum sample, a total of 33 samples collected at the birth, 24th and 48th hours (Quantispeed goat test, QGT) (Dale et al. 2009).

Milk Analyses

The dry matter and fat values of milk were determined in accordance with TS 1018 (Anonym, 1989); determination of lactose was carried out by using the photometric method [30]; determination of mineral matter was carried out in accordance with AOAC (2000); determination of ash was carried out by following the method proposed by Kurt et al. (2007); the Kjeldahl method was used in the calculation of protein ratio (Renner, 1993). The determined nitrogen amount was multiplied by 6.38 to calculate the percentage protein amount.

Data Analyses

In the study, Repeated Measures Factorial Analysis of Variance was used to determine the difference between birth type, gender and parity with respect to investigated properties. Among the multiple comparison tests, the Duncan test was used to determine the differences between the averages of the days in reference to the variance analysis (Gürbüz ve ark., 2003). In the calculations, SPSS 15 (2007) statistical package program was used.

RESULTS

Table 1 shows the means and standard errors of the immunoglobulin amounts in goat colostrum at birth, 24th, and 48 hours after birth.

Table 1. Least square means and standard errors of the immunoglobulins in goat colostrum

Çizelge 1. *Keçi kolostrumundaki bağışıklık maddelerine ait en küçük kareler ortalamaları ve standart hataları*

Sampling Time	Investigated Properties	N	Mean (mg/ml)	Standard Error
At birth	IgA	11	0.1105	0.179
	IgM	11	1.9870	0.025
	IgG	11	1.8850	0.041
24 hours after birth	IgA	11	0.2850	0.078
	IgM	11	0.9580	0.031
	IgG	11	14.0160	0.027
48 hours after birth	IgA	11	0.2535	0.435
	IgM	11	0.9640	0.017
	IgG	11	13.5395	0.089

IgA: Immunoglobulin A,
IgM: Immunoglobulin M,
IgG: Immunoglobulin G

Immunoglobulin levels in goat colostrum showed that IgM had the highest level in the colostrum at birth, followed by IgG, while IgA had the lowest level. At the 24th hour after birth, the IgG level increased and reached 14.016 ml, followed by IgM with 0.958 ml. At the 48th hour after birth, immunoglobulin levels in colostrum followed a similar trend to those at the 24th hour; in other words, IgG had the highest level. Table 2 shows the means and standard errors of the immunoglobulin levels determined in the bloods of goat kids at birth and during the hours following birth.

Table 2. Least square means and standard errors of the immunoglobulins in goat kid bloods

Çizelge 2. *Oğlak kanlarındaki bağışıklık maddelerine ait en küçük kareler ortalamaları vestandart hataları*

Sampling Time	Investigated Properties	N	**Mean** (mg/ml)	Standard error
At birth	IgA	11	0.7664	0.253
	IgM	11	1.1191	0.050
	IgG	11	19.2295	0.025
24 hours postpartum	IgA	11	0.5895	0.591
	IgM	11	1.0295	0.046
	IgG	11	18.4282	0.026
48 hours postpartum	IgA	11	0.5314	0.535
	IgM	11	1.2482	0.038
	IgG	11	21.6091	0.026

IgA: Immunoglobulin A IgM: Immunoglobulin M IgG: Immunoglobulin G

In the blood samples of the goat kids, IgA level at birth was 0.76 mg/ml and decreased to 0.58 mg/ml 24 hours after birth and reached 0.53 mg/ml 48 hours after birth; in other words, initially, it rapidly

decreased and after 48 hours, its decrease nearly come to a standstill. On the other hand, the IgM level first showed a decreasing trend after 24 hours and, then, showed a tendency to increase around the 48th hour. IgG level in the blood samples of the goat kids firstly decreased until the 24th hour after birth and then, by contrast with other immunoglobulins, increased by almost 50% around the 48th hour after birth.

Table 3 shows the significance levels and least square average and standard error of the significance levels of some of the factors affecting the investigated properties of the blood samples obtained from the goats. Among the investigated properties, effects of birth type, kid gender and parity were not significant, whereas the effect of time-dependent changes was both quadratically and linearly significant (P<0.01).

Table 4 shows the means and standard errors of some factors, which were considered to affect the immunoglobulins in goat kid blood. Among the investigated factors, only the effect of time-dependent changes was significant (P<0.01); the effects of birth type, kid gender and parity were not significant. The changes in immunoglobulin levels in kid blood samples from birth to postpartum were both quadratically and linearly significant (P<0.01).

Table 3. Least square means and standard errors of birth type, gender, parity and time-dependent immunoglobulin changes in goat bloods

Çizelge 3. *Keçi kanlarındaki bağışıklık maddelerinin doğum tipi, cinsiyet, laktasyon sırası ve zamana bağlı olarak değişimine ait en küçük kareler ortalamaları ve standart hataları*

Effects	**n**	**IgA** (mg/ml)	**IgM(**mg/ml)	**IgG(**mg/ml)
Birth Type		**NS**	**NS**	**NS**
Single	5	0.176 ± 0.026	1.358 ± 0.048	9.597 ± 0.374
Twins	6	0.264 ± 0.025	1.283 ± 0.046	9.799 ± 0.361
Gender		**NS**	**NS**	**NS**
Male	5	0.182 ± 0.034	1.387 ± 0.062	10.261 ± 0.485
Female	6	0.259 ± 0.040	1.254 ± 0.074	9.134 ± 0.563
Parity		**NS**	**NS**	**NS**
2	3	0.182 ± 0.032	1.162 ± 0.059	9.311 ± 0.462
3	3	0.114 ± 0.048	1.414 ± 0.048	9.381 ±0.689
4	5	0.165 ± 0.044	1.385 ± 0.080	10.581 ± 0.623
Time(hour)				
0	11	0.111 ± 0.020	1.978 ± 0.039	1.820 ± 0.072
24	11	0.295 ± 0.027	0.953 ± 0.019	13.730 ± 0.534
48	11	0.255 ± 0.017	1.029 ± 0.069	13.543 ± 0.232
Linear		**	**	**
Quadratic		**	**	**
Overall Mean	11	0.220 ± 0.018	1.320 ±0.032	9.698 ± 0.250

**: (P<0.01) NS: Not Significant

Table 4. Least square means and standard errors of birth type, gender, parity and time-dependent immunoglobulin changes in goat kid bloods

Çizelge 4. *Oğlak kanlarındaki bağışıklık maddelerinin doğum tipi, cinsiyet, laktasyon sırası ve zamana bağlı olarak değişimine ait en küçük kareler ortalamaları ve standart hataları*

Effects	**n**	**IgA(mg/ml)**	**IgM(mg/ml)**	**IgG(mg/ml)**
Birth Type		**NS**	**NS**	**NS**
Single	5	0.586 ± 0.111	1.141 ± 0.041	19.295 ± 0.961
Twins	6	0.649 ± 0.073	1.124 ± 0.035	20.009 ± 0.818
Gender		**NS**	**NS**	**NS**
Male	5	0.586 ± 0.111	1.134 ± 0.053	18.382 ± 1.240
Female	6	0.650 ± 0.126	1.131 ± 0.060	20.922 ± 1.409
Parity		**NS**	**NS**	**NS**
2	3	0.681 ± 0.106	1.091 ± 0.051	19.999 ± 1.185
3	3	0.554 ± 0.140	1.163 ± 0.067	19.905 ± 1.568
4	5	0.618 ± 0.142	1.146 ± 0.068	19.052 ± 1.586
Time(hour)				
0	11	0.751 ± 0.059	1.111 ± 0.032	19.209 ± 0.683
24	11	0.575 ± 0.056	1.027 ± 0.032	18.319 ± 0.642
48	11	0.527 ± 0.047	1.259 ± 0.030	21.429 ± 0.618
Linear		**	**	**
Quadratic		**	**	**
Overall Mean	11	0.618 ± 0.054	1.133 ± 0.026	19.652 ± 0.598

NS: Not Significant **: (P<0.01)

Properties of Goat Milk

Table 5 shows descriptive statistics on the changes in the chemical composition of goat milk occurring after birth. Dry matter, fat, protein, casein, lactose, ash and specific weight values of goat colostrum were determined. The average dry matter value of goat colostrum was 24.28%; dry matter values after 24 hours and 48 hours were 17.26% and 13.24%, respectively. As can be seen in Table 5, dry matter values steadily decreased after birth. Fat values in goat colostrum at birth and 24 and 48 hours after birth were 8.27%, 6.76% and 5.59%, respectively. Average protein values of goat colostrum were 10.55%, 6.09%, and 4.23% at birth, 24 hours after birth and 48 hours, respectively. Protein values decreased by 50% after 48 hours postpartum. Since changes in casein amounts are directly proportionate to changes in protein amounts, casein amount also decreased after birth. The average lactose amount in goat colostrum was 4.86% at birth, whereas it was 3.37% and 2.81% at the 24th hour and 48th hour after birth, respectively. Lactose levels also steadily decreased after birth. At birth, ash value in goat colostrum was 1.18%; at the 24th hour after birth, it was 0.90, and at the 48th hour after birth, it was 0.84%. The difference between the changes in the specific weight values of goat colostrum at birth and in the period after birth was not significant.

Table 5. Some descriptive statistics on the chemical composition of goat milk

Çizelge 5. *Keçi sütünün kimyasal bileşimine ait bazı tanımlayıcı istatistikler*

Period/time	Investigated Property	N	Minimum	Maximum	Mean	Standard Error
At birth	Dry matter (%)	11	18.88	29.08	24.28	0.95
	Fat (%)	11	5.70	9.85	8.27	0.43
	Protein (%)	11	7.04	15.32	10.55	0.78
	Casein (%)	11	4.76	12.14	7.80	0.67
	Lactose (%)	11	3.79	5.83	4.86	0.20
	Ash (%)	11	0.82	2.07	1.18	0.10
	Specific weight (**g**)	11	1.029	1.074	1.04	0.01
24 hours postpartum	Dry matter (%)	11	13.76	23.07	17.26	0.77
	Fat (%)	11	5.30	8.75	6.76	0.37
	Protein (%)	11	3.81	8.72	6.09	0.43
	Casein (%)	11	3.08	6.91	4.70	0.14
	Lactose (%)	11	2.58	4.30	3.37	0.03
	Ash (%)	11	0.82	1.14	0.90	0.01
	Specific weight (**g**)	11	1.024	1.040	1.030	0.25
48 hours postpartum	Dry matter (%)	11	12.33	14.83	13.24	0.26
	Fat (%)	11	3.20	7.50	5.59	0.43
	Protein (%)	11	2.76	5.06	4.13	0.22
	Casein (%)	11	2.72	4.01	3.31	0.13
	Lactose (%)	11	2.29	3.79	2.81	0.14
	Ash (%)	11	0.70	1.07	0.84	0.04
	Specific weight (**g**)	11	1.022	1.034	1.026	0.01

DISCUSSION and CONCLUSION

A general review of the results shows that IgG, IgM and IgA levels determined in our study are in agreement with the results reported in the relevant literature (Singh, 2010; Berry and Broughan, 2007; Keskin ve ark., 2007; Rodrigez et al. 2008, 2009). The source of IgM and IgA in colostrum is not well known. In a study on human colostrum (Moro et al. 1985), researchers reported that phagocytes transferred these immunoglobulins. Some researchers (Islam et al. 2006) reported the presence of plasma cells in human colostrum and determined that these cells produced IgM and IgA. However, it is difficult to adapt these results to ruminants because, in addition to differences among species in terms of colostrum composition, pre-birth immunoglobulin transfer to offspring is quite hard (Langer, 2009; Moreno et al. 2012b).

Another measure of the immune system development in animals is the time of first colostrum feeding to offspring, which also affects the future productivity of adult animals (Pakkanen and Aalto, 1997). For ruminant animals, the first 12-36 hours postpartum is of great importance in terms of IgG intake from colostrum (Castro et al. 2011). A delay in

this period results in decreased viability and increased susceptibility to diseases (Hernandez et al. 2011).

Colostrum intake is of great importance in the viability and passive immunity development in new-born animals (Stelwagen et al. 2009; Hernandez et al. 2014a,b). Therefore, especially artificially reared animals should receive a sufficient intake of colostrum (Morales et al. 2011, 2014). However, the amount and composition of colostrum produced by mothers are affected by a variety of environmental factors including feeding and number of offspring per a birth (Besser and Gay, 1994). Another important issue is the decreased viability due to insufficient colostrum intake during the first couple of hours after birth, which may cause increased death rates (Quigley and Drewry, 1998). Therefore, supplying the most appropriate colostrum source is of great importance. Some studies have focused on using cow milk as the colostrum source in lamb and goat kid rearing (Quigley et al. 2000,2002); however, the most important risk in here is posed by iron deficiency, which may result in anemia (Rodriguez et al. 2009). Therefore, for the easy transfer of immunoglobulins to offspring, species-specific colostrum should be provided to each species (Korhonen, 1998). The most important change in immunoglobulin levels occur in IgG and IgM. Goat kid mortality is closely associated with the IgG level in blood (Moreno et al. 2012a). In addition to optimum colostrum intake amount and composition, optimum temperature, humidity and hygiene conditions should also be provided.

In goat kids, there is a correlation between birth weight and IgG level in blood (Rodriguez et al. 2008). IgG levels in the animals with birth weights below 2.5 kg are especially low during the 12-84 hours after birth (Arguello et al. 2005). Arguello et al. (2004) determined that the effect of birth weight on feeding with colostrum was not significant, whereas, in 1979, Halliday and William (Halliday and Williams, 1979) and, in 2003, Christley et al. (2003) reported that birth weight significantly affected the IgG levels in the blood of the lambs of low-colostrum-producing sheep. In a study on goat kids of French Alpine, researchers reported that IgG levels in death goat kids were below 75.1 mg/ml and thereby showed the importance of IgG levels in blood (O'Brien and Sherman, 1993) in healthy goat kids, IgG levels was over 143 mg/ml, while these levels were below 75 mg/ml in dead goat kids.

It was observed that the effect of postpartum period on the chemical composition of goat colostrum was significant. In 1995, in their study on goat colostrum, Hadjipanayiotou (1995) determined that dry matter value at birth was 13.20% and the fat content, protein content and ash content of the goat milk used in the study were 4.26%, 4.90%, and 0.83%, respectively. Marounek et al. (2012) carried out a study on goat colostrum and investigated the properties of goat colostrum during the 30 days after birth. Fat content of the colostrum used in this study varied between 3.48% and 5.67%. The highest fat content was determined at birth in that study. Decreases and increases in the fat content of colostrum were distinguished during the 30-day observation. Rachman et al. (2015) studied the colostrum and dry matter amounts in the milk of Peranakan Etawah, Saanen and Jawarandu goat genotypes and determined that dry matter amount in Peranakan Etawah colostrum was 38.96% at the first day and it was 37.49% in Jawarandu colostrum and 47.09% in Saanen goats colostrum. In general, dry matter amount in colostrum decreases as the time after birth passes.

In goats, colostrum production and protein ratio in its composition are proportionate to the size of the mammary, in addition to varying depending on species (Marnet and Komara, 2008). Another important issue is the tension occurring due to the secretion level of the alveolar cells in mammary glands and the resultant increase in the time spent to remove the remaining colostrum from the mammary glands. Capote et al. (1992) reported that the size of mammary at the first three hours after birth was close to the size of the mammary of Tinerfena genotype goats at the fourth week of lactation. However, in their study on cow colostrum, Ontsouka et al. (2011) reported that protein levels in the mammary glands were higher than those in colostrum. This is attributed to the high levels of IgG in total protein. The immunoglobulin levels found in our study (IgG, IgM, IgA) are in agreement with the results reported in the relevant literature. Linzell and Peaker (1974) and Arguello et al. (2006a, 2008) reported that the fat content of colostrum increased after 24 hours postpartum and attributed this to the higher levels of fat in the remaining milk as a result of the high amounts of milk removed from mammary glands. The change in the lactose content of colostrum is similar to the change in fat and protein contents. This change is in agreement with the results reported by Hadjipanayiotou (1995), Arguello et al. (2004), Moreno-Indias et al. (2012a,b) and Piccone et al. (2011b).

In conclusion, the immunoglobulin levels in the blood do not change with changing birth weight, colostrum source and first colostrum intake time, whereas, during the days following the birth, the amount of immunoglobulin intake per live weight is significant. In other words, feeding goat kids with 80 mg/ml IgG-containing colostrum or milk substitute feeds will have double the effect of feed containing low levels of IgG. For this purpose, flock management applications after birth should be improved and the offspring should immediately receive sufficient amounts of immunoglobulins. In the rearing of newborn goat kids, colostrum intake minimum 10% of the birth weight should be immediately fed to kids.

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