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RESEARCH ARTICLE

Blood hematology, metabolites and hormones in newborn sheep and goat from birth to weaning

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Abstract

The neonatal period represents a transition phase from the sheltered intrauterine to the exposed extra uterine environment. Changes in hematological profile, hormones and blood metabolites were investigated in Ossimi lambs and Damascus kids. Results indicated that, with increasing age of lamb the number of white blood cells and red blood cells increased, with higher content of hemoglobin and hematocrit at 30 days after birth. Sex and age influenced the RBC, WBC values of lambs and kids. Kid's values were higher than their in lambs during experimental period. The levels of T_3, IGF-1 and Leptin were significantly higher in the first month than those of the other three months. IGF-1 level had a significant increase in lambs compared to kids. Levels of cholesterol were high during the first month either in lambs or in kids. In young kids, cholesterol levels had decrease in females than in males at birth. The same trend was observed at weaning while; the reverse trend was recorded during 90 days after birth. The concentrations of the triglyceride in the blood plasma of the lambs and kids have been increased with the advanced age. The concentrations of the total proteins and albumin in the blood plasma of the lambs and kids have been increased with the advanced age. Female lambs and kids had higher plasma Immunoglobulin's (IgG) values than their males at 30 and120 days. In young kids, IgG values were higher than in young lambs at birth. The reverse trend was observed at weaning.

INTRODUCTION

Sheep and goats are among the major economically important livestock in Egypt. There are about 5.4 million sheep and 4.3 Million goats (FAO, 2011).Sheep and goats are widely adapted to different climates and are found in all production systems. They also have lower feed requirements compared to cattle because of their small body size. This allows easy integration of small ruminants into different farming systems. In all domestic animals the first week post-partum is crucial and the newborns remain in metabolically unstable status, but in kids, neonatal mortality and morbidity seems to be relatively higher than in other farm species, in particular during the first days of life [Piccione *et al*, 2008]. This represents a transition phase from the intrauterine to the exposed extra uterine environment [Piccione *et al*. 2006, 2009]. Nearly half of all pre-weaning lambs day on the day of birth, whilst the rate of lamb losses is greatly reduced beyond the first week of life [Piccione *et al*, 2009]. Colostrum is the first source of energy that a lamb receives after birth and it supplies passive immunity via transfer of maternal immunoglobulin's to the neonatal lamb primarily during the first, and perhaps the

Second day of life (Halliday, 1971). Concentration and quantity of IgG in colostrum is proportional to the passive immunity transmitted to newborn lambs (Al-Sabbagh, 2009). Limited information is available on the hematological count and characteristics of the kids in relation to their adult life. The results of various studies on age dependent dynamics of hematological variables are different (Knowles *et al,* 2000). From week 34 of intrauterine life till the first post-partum hours, all blood components and the coagulation factors are subjected to continuous changes, even after this period [Piccione *et al*, 2008]. Moreover, several changes were assessed in kids, during the first month of life, both on the hemato-chemical components and on the serum proteins profile [Piccione *et al*, 2011 in press, Zumbo *et al*, 2011]. Changes in hematological profile were earlier assessed in other species, both after the birth and during suckling period, but, since that time none or very few authors investigated the hematological profile of kids. Bornez *et al*,(2009) found in the blood of the lamb at the age of 70 days feed with concentrate and wheat straw a significantly higher number of RBC, higher content of hemoglobin and hematocrit, as well as a greater number of leukocytes unlike the suckling lamb at the age of 30 days. Zumbo *et al,* (2011) found that, during the post-partum days the does showed a significant decrease in WBC and Ht. Instead, a significant increase after the birth was observed only on PLT, which constantly increased from day 7 till day 28 after birth in the dam. The opposite trend was showed in kids, with a significant increase since day 14 after birth of RBC, WBC and an inconstant increase of PLT. Several changes were assessed in kids, during the first month of life, both on the hemato-chemical components and on the serum proteins profile [Piccione et al, 2011 in press, Zumbo et al, 2011]. Baker *et al*,(1993)found that, the IGF-1 axes plays a major role in controlling the growth and differentiation of skeletal muscles (young and even post-puberty) to increase skeletal muscles mass, as well as other tissues such as bone for development. The Insulin like growth factors (IGF), IGF-1 is known to be major growth promoting hormones of prenatal and postnatal growth. In the young of many mammalian species brown adipose tissue (BAT) is the principal site of thermoregulatory heat production involved in metabolic adaptation to the extra-uterine environment. In animals, plasma leptin levels are closely correlated with body condition score and nutritional status (Chilliard *et al*., 2001). Serum concentrations of leptin were higher in lambs fed adequately compared to lambs fed poorly (Morrison et al., 2001). From many studies in different species it would appear that, the mammalian fetal thyroid gradually develops the capacity to trap iodine and synthesize iodothyronine. The investigations reported here were directed at a sequential study of various parameters of thyroid function in the new-born lamb from birth to 39 days. Plasma thyroxin levels are high in the new-born lamb and fall steadily until the tenth to twelfth day of post-natal life; thereafter they remain reasonably constant (Nathanielsz, 1969). The level of thyroxin in the blood depends on both the rate of thyroid secretion and rate of utilization of thyroxin by the tissues. Mohamed *et al*, (2013) found that, cholesterol and triglycerides plasma levels were low at 1–12h of birth and increased over the first 3 days. Birth weight influenced neonatal physiology with heavy lambs having higher rectal temperature, glucose, cholesterol and cortisol plasma levels at 1–12h of birth than medium and light lambs. The concentrations of the total proteins and albumin in the blood serum of the lambs have been increased with the advanced age. As the age rises, the concentration of total protein in the blood of sheep increases (Bornez *et al*., 2009). The high total protein content after birth can be a result of serum immunoglobulin content growth and this demonstrates good alimentary canal absorption and has some effect on later clinical state (Baranowski et al., 2000). In the last 5 weeks of pregnancy, IgA, IgG, and IgMs are synthesized by plasma cells in the sub mucosa of the mammary gland epithelium, and at the same time IgGs taken from blood by transudation begin to concentrate in the secretions of the mammary gland by entering the gland tissue by way of pinocytosis (Selk, 1998). In many newborn animals, colostrum is the main source of immunoglobulins and other proteins, necessary for the future life (Constant *et al.,* 1994). Therefore, total proteins, both in colostrum and serum, also contribute profoundly to neonate immunity and growth, not only because of the immunoglobulin content, but possibly also due to other nutritional and physiological effects on the neonates (Chen *et al.,* 1999; Piccione *et al.,* 2007). Because in ruminants the placenta interferes with the transfer of immunoglobulins from the dam to the fetus, the consumption of colostrum by the progeny of these species holds a fundamental role in the acquisition of immunity (Arguello *et al*., 2004). Different studies showed that in kids, absorption of immunoglobulins from colostrum supplements has been reported to be poor (Constant *et al*., 1994; Zadoks et *al*., 2001).

The aim of this paper is to determine the influence of age, species and sex on blood hematology, metabolic profile and some of hormones concentration in the blood of newborn sheep and goat from birth to weaning.

Material and Methods

This study was carried out in the Agriculture Experimental Station, Faculty of Agriculture, and Cairo University during the period from March 2013 to June, 2013. Ten suckling Ossimi lambs and ten suckling Damascus kids aged from one day to four months (weaning) were used in this study. The lambs were categorized by four females and six males. On the other hand, the kids were categorized by seven females and three males. Lams and kids were housed in semi-shaded yards during this study. They were suckled thrice a day from their dams during the first month. After the first month, suckling was reduced to twice a day. In addition, animals were fed according to the nutritional regime in Faculty of Agriculture Research Station, Giza, Egypt. This study was determined blood hematology, metabolites and hormones of lambs and kids lived in Egypt .The plasma levels hormones (IGF-1, T_3 and Leptin) and metabolites (cholesterol, triglyceride, total protein, Albumin and IGg) during experimental period except plasma IgG was estimated at birth and weaning only. Blood samples (5 ml) were collected from all lambs and kids once a month from the jugular vein in heparin zed tubes. Determination of IGF-I (ng/ml) and T_3 (nmol) levels in the peripheral blood plasma were done by using Automatic Gamma Counter (GenesyaTM, GenniiTM, gamma counter, LTI 1005, LTI Laboratory, INC., 43W900. Rout 64 Maple Park, IL 60134, USA). Determination of leptin concentration (ng/ml) was performed by ELISA reader (BIO TEK ELX808), using Leptin ELISA kit sandwich (DRG Instruments GmbH, Germany) according to Liefers et al., and (2003). Hematocrit (Ht%)was determined by using heparin zed micro-hematocrit tubes centrifuged at 3000 r.p.m.for 15minutes,the column of hematocrit(packed cell volume) is read against a scale as a percentage of blood column length. Hemoglobin concentration (Hb) was determined by using quantitative colorimetric method according to described procedure by kits manufacturer (Stanbio laboratory, Texas, USA).Determination was done using spectrophotometer at wave length of 540nm. Red and white blood cell counted in fresh heparinized blood sample using hemocytometer and dilution method as described by Ghai (1999).Total protein of blood plasma (g/100ml) was determined quantitatively (Colorimetric Method Liquzyme) by using (STAT LAB SZSL60-SPECTRUM) according to (Cannon,1974). Albumin concentration (g/100ml) was estimated quantitatively by colorimetric method using (STAT LAB SZSL60-SPECTRUM) according to (Doumas *et al*, 1971). Cholesterol concentration (g/100ml) in plasma was determined quantity (Colorimetric Method Liquzyme) by using (STAT LAB SZSL60-SPECTRUM) according to (Finely *et al*, 1978). Estimation of Triglycerides (g/100ml) content in plasma was quantity (Colorimetric Method Liquzyme) determined by using (STAT LAB SZSL60-SPECTRUM , according to (Fassati and Prencipe 1982). The concentration (ug/ml) of IgG was estimated by using (Ovine IgG ELISA kit from WEKEA). ELISA READER (BIO TEK ELX808) was used to determine the level in blood plasma.

Statistical analysis

The data of Blood hematology, metabolites and hormones were analyzed using the general linear model procedure (SAS, 1998) to test the effects of species, sex and period of the experiment on the measured traits applying the following model:

$$Y_{ijklmno} = \mu + B_i + S_j + P_k + (B*S)_{jkl} + (B*P)_{ikm} + (S*P)_{jkn} + (B_i * S_j * P_k)_{ijko} + e_{ijklmno}$$

Y_{ijklm} = the measured trait.

μ = Overall mean.

B_i = Effect of species (sheep = 1 and goats = 2).

S_j = Effect of sex (female =1 and male=2).

P_k = Effect of Period (first month =1, second month=2, third month =3 and fourth month =4).

$(B*S)_{jkl}$ = the interaction between species and sex.

$(B*P)_{ikm}$ = the interaction between species and period.

$(S*P)_{jkn}$= the interaction between sex and period.

$(B_i * S_j * P_k)_{ijkl}$ = The interaction between species, sex and period of the experiment

$e_{ijklmno}$ = Experimental error supposed to be randomly distributed randomly distributed (0, σ^2) Probability values up to < 5% were considered significant.

Results

Blood hematology

The effect of age, species and sex on blood hematology levels in lambs and kids from birth to weaning:

Results from the present study demonstrate that, with increasing age of lamb the number of white blood cell (WBC) and red blood cell(RBC) increased, with higher content of hemoglobin and hematocrit at 30 days after birth (Table, 1). Sex and age influenced the RBC, WBC values of lambs and kids. Kid's values were higher than their in lambs during experimental period. The number of white blood cell (WBC) was higher in female kids than in male. The number of WBC were higher in kids than lambs at 30 ,60 days .These results have been attributed to the type of birth (Table 1) , single born kids were heavier than their twin born counterparts at birth in the present study. Bornez *et al*. (2009) found similar content hemoglobin and a larger number of WBC in the blood of lambs as well as a greater number of leukocytes unlike the suckling lamb at the age of 30 days. Zvonko *et al* (2012) found that, with increasing age of lamb the number of WBC and RBC as well as the blood content of hemoglobin and hematocrit significantly increased. Higher number of platelet content and mean corpuscular volume (MCV) and lower content of mean cell hemoglobin (MCH), and mean corpuscular hemoglobin concentration (MCHC) were found in the blood of the older lamb in comparison with the youngest lamb. Bornez *et al*. (2009) found in the blood of the lamb at the age of 70 days feed with concentrate and wheat straw a significantly higher number of RBC, higher content of hemoglobin and hematocrit, as well as a greater number of leukocytes unlike the suckling lamb at the age of 30 days. The same authors found even higher content of mean corpuscular volume and mean cell hemoglobin in the blood of the suckling, compared to the fattening lambs. A smaller number of RBC, similar content hemoglobin, and a larger number of WBC in the blood of lambs are found by Njwe and Ngo (1987). Egbe-Nwiyi, *et al*. (2000) revealed the influence of age and sex on hematological values of goats and sheep, age and sex had remarkable influence on the RBC counts of goats, age influenced the hemoglobin and hematocrit values, age and sex greatly influenced the mean corpuscular volume (MCV) and age influenced mean corpuscular hemoglobin concentration. Age and sex influenced neutrophil (increased with age) and eosinophil counts (gradually decreased with age and males had higher counts) in sheep. Sex and age influenced the RBC values of sheep. hematocrit and mean corpuscular hemoglobin concentration values of sheep were influenced by both sex and age. The mean corpuscular volume (MCV) was influenced by age. Sex significantly influenced the total WBC (the highest value in males and females were observed at 3 -5 years and 6-9 months respectively in goats) and monocyte counts (which was higher in males and females). Daramola *et al*. (2005) reported that, age was observed to have a significant effect on hemoglobin, RBC and mean corpuscular hemoglobin concentration of West African Dwarf goat which suggested that the oxygen carrying capacity of the blood was high in adult goats. Daramola *et al* (2005) observed that, sex had significant effect on lymphocyte and neutrophils; the male West African Dwarf goats (WAD) had increased lymphocyte values compared to the female animals, whereas the female had increased neutrophil values compared to the male animals, which was similar to observations reported for Red Sokoto goats (Tambuwal *et al*., 2002). Daramola *et al*. (2005) further documented that, the packed cell volume (PCV) values obtained for female West African Dwarf goats(WAD) in other studies were comparable to those obtained for Red Sokoto goats in Nigeria (Tambuwal *et al*., 2002) in which male animals had higher values than females. The age influenced significantly the values of all hematological variables (($p<0.05$) (Table 1).

2-Blood parameters

The effect of age, species and sex on blood parameters level in lambs and kids from birth to weaning:

A-Cholesterol and Triglyceride

1-Cholesterol

Results of this research (Table 2) revealed that plasma cholesterol levels were higher values at birth (30 days) than at 60, 90 and120 days. Levels of cholesterol were high during the first month either in lambs or in kids. In young kids, cholesterol levels had decrease in females than in males at birth. The same trend was observed at weaning while; the reverse trend was recorded during 90 days after birth. The differences between species were obvious (Table 2). Leat (1967)found that, The concentration of plasma esterifies lipids, mainly phospholipids and cholesterol esters, were very low at birth and rose to reach maximum values at about 20 days post partum before declining to adult values at weaning. These changes have been discussed in relation to diet and rumen development. Abdel-Fattah *et al* (2013) found that, cholesterol concentration gradually increased for all lambs and reached to peak in the 7 and the 8 months (September and October) during fattening period. For early weaning lambs (at 60 days) the highest values were recorded (52 and 47.5 mg/dl vs. 52.9and 47.8 mg/dl) for males and females during September and October months, respectively. For late weaned lambs (at 120 days) the highest values were recorded (52.4 and 49.7 mg/dl vs. 53.4and 49.8 mg/dl) for males and females during September and October months, respectively. The pronounced increase in males than females may be due to the physiological signals linking the puberty phenomena of males in Barki breed. The cholesterol concentration is influenced by the degree of stress. Therefore, lower cholesterol with age might be expected from stress (particularly by weaning lambs).

2-Triglyceride

The data show that, the concentrations of the triglyceride in the blood plasma of the lambs and kids have been increased with the advanced age. The values of triglyceride were higher in kids than in lambs during experimental period. The values of triglyceride were higher in male than in female at 30 days, the reverse trend was recorded during 60, 90,120 days after birth (Table 2).

B-Total protein and Albumin

Results from the present study demonstrate that, the concentrations of the total proteins and albumin in the blood plasma of the lambs and kids have been increased with the advanced age. As the age rises, the concentration of total protein in the plasma of lambs and kids increases (Table 2). The total proteins level slightly decreased in kids than level in lambs. Female lambs and kids had higher total proteins values than their males during experimental period. Results of albumin level in lambs and in kids showed a non significant difference in this study. The differences between male and female were not significant (Table, 2). This is probably due to the metabolic pathways typical during the postnatal age. In fact, protein metabolism plays an important role in the regulation of physiological functions during pregnancy and lactation (Diogenes *et al*., 2010). Albumin started to constantly increase with the beginning of the 3rd week of life until the end of monitoring. This trend, according to previous study on kids (Piccione *et al*., 2011), reflects the albumin's medium half-life that ranges from 14 to 16 days in ruminants, after which period the liver is responsible for albumin synthesis (Kaneko, 1997; Thrall., 2004). (Bornez *et al*., 2009; San Sampelayo *et al*., 1998) found that, the concentrations of the total proteins and albumin in the blood serum of the lambs have been increased with the advanced age. As the age rises, the concentration of total protein in the blood of sheep increases. The high total protein content after birth can be a result of serum immunoglobulin content growth and this demonstrates good alimentary canal absorption and has some effect on later clinical state (Baranowski *et al*., 2000).

C-Immunoglobulins IgG

The results presented in Table (2) indicated that, female lambs and kids had higher plasma Immunoglobulins (IgG) values than their males at 30 and120 days. In young kids, IgG values were higher than in young lambs at birth (30 days). The reverse trend was observed at weaning (Table 2). Selk, (1998) found that, in the last 5 weeks of pregnancy, IgA, IgG, and IgMs are synthesized by plasma cells in the sub mucosa of the mammary gland epithelium, and at the same time IgGs taken from blood by transudation begin to concentrate in the secretions of the mammary gland by entering the gland tissue by way of pinocytosis. In many newborn animals, colostrum is the main source of immunoglobulins and other proteins, necessary for the future life (Constant *et al*., 1994). The degree of passive immunization after colostrum feeding depends not only on the intestinal capacity to absorb large molecules, but also on the availability of colostrum and its immunoglobulin concentration. These factors are subject to a lot of individual variation and may be affected by time and mode of delivery, breed and parity of the mother. Detailed information on this can be obtained from other sources (Weaver *et al*. 2000). The degree of passive immunization may be low however, because intestinal macromolecule absorption is greatly influenced by the composition of the fluid in which the immunoglobulins are dissolved (Jensen *et al*. 2001). Some factors may directly affect the passive immune status of young ruminants, such as birth BW, litter size, sex, suckling duration, colostrum quantity, colostrum quality, and delay in colostrum feeding. Many of these factors have been previously studied in goat kids (Argüello *et al.*, 2004; Castro *et al.*, 2005, 2007); whereas others, such as birth weight (BW), litter size, sex, and suckling duration have not yet been closely examined. Chen *et al*. (1999) reported a peak blood serum IgG concentration of 33 mg/m at 24 h after birth following ingestion of colostrum. O'Brien and Sherman (1993) have defined failure of passive transfer in the goat kid as a serum IgG concentration of <12 mg/mL using a spectrophotometric zinc sulfate turbidity assay. In addition, Argüello *et al*. (2004) found an IgG blood concentration of <5 mg/mL at 48 h postpartum in kids dying during the first month of life. Castro *et al.* (2007) reported no significant effects of birth body weight on IgG blood serum concentrations in kids, but there was a tendency for IgG concentrations to increase when the birth weight was between 2.5 and 3.2 kg. Chen *et al*. (1999) observed lower concentrations of IgG in the blood of single-born kids than for twins. O'Brien and Sherman (1993) and Chen *et al*. (1999) observed no significant relationship between kid sex and serum IgG concentrations after the ingestion of colostrum. Previous research (Argüello *et al*., 2004; Castro *et al*., 2005, 2007) recommended the removal of kids from their dam at birth in dairy goat herds for 2 main reasons: to prevent a strong mother-kid link (Ramírez *et al.*, 1996) and to reduce the risk of viral transmission by colostrum of caprine arthritis encephalitis virus (Guerrault, 1990). However, some farmers are still reluctant to remove kids at birth and allow the kids to stay with their dams for a few days postpartum to permit prolonged ingestion of colostrum. It is not clear how much time is necessary for goat kids to stay with their dams to provide sufficient passive transfer of immunity.

3- Blood hormones

The effect of age, species and sex on blood hormones levels in lambs and kids from birth to weaning:

Growth hormone (GH) and the insulin like growth factor -I (IGF-I) are two of the main regulators of postnatal growth: GH and IGF-I deficiencies are associated with prenatal and postnatal growth failure (Baker *et al*., 1993). Growth hormone acts mainly through IGF-I that induces mtogenesis in target tissues (Louveau and Gondret, 2004). The main growth regulatory hormones are the insulin-like growth factors (IGFs), the thyroid hormones and possibly leptin. These hormones interact extensively in the control of fetal growth and development, both metabolically and via regulation of their own cellular bioavailability.

A-Thyroid hormone (T3)

Levels of T3 (nmol/L) were significantly ($p < 0.05$) high during the first month either in lambs or in kids (Table, 3). In young lambs and kids, T3 levels had a significant decrease in females than in males. The same trend was observed at weaning, while the reverse trend was recorded during 90 days after birth. The differences between species were not significant. Dwyer and Morgan (2006) found that, Plasma thyroid hormone levels were highly correlated with lambs birth-weight and were lower in lambs separated from their mothers just after parturition than in those maintained with their mothers.

B-Insulin like growth factor-I

Results from the present study demonstrate that, plasma IGF-1 concentrations were higher in lambs than kids during experimental period. The values in females were higher than males at all stages (Table 3). The differences between species were significant. Greenwood *et al*, (2000) found that, at birth, low-birth-weight lambs are less mature than their high-birth-weight counterparts with respect to some aspects of endocrine. Transition from fetal to postnatal life is characterized by a decline in Somatotropin (ST) and an increase in IGF-I concentrations in plasma (Gluckman *et al*., 1999). Therefore, the higher ST and the lower IGF-I levels observed at birth in the low-birth-weight lambs suggest that the ST/IGF axis is less mature at birth in these animals. This notion is reinforced by the continuation of higher plasma ST and lower IGF-I in the low-birth-weight lambs during the first week or so of postnatal life.

C-Leptin

Female lambs had lower leptin values than their males at birth and weaning while female kids had lower values in all stages except at 30 days (Table 3). The differences between species were not significant. Clarke *et al* (1997) demonstrate that although the amount and activity of uncoupling protein (UCP) is high in lambs at birth there is the potential for these to increase further. The amount of uncoupling protein (UCP) was maximal at 4 days and coincided with a peak in the total thermogenic activity of brown adipose tissue (BAT) .This occurred 2 days after colonic temperature was observed to be at a basal value of 39 .3 °C and plasma T3 concentrations increased to a maximal mean value above 10 nm. They observed a critical interaction between plasma thyroid hormones, BAT function and thermoregulation in premature, neonatal and postnatal lambs. Kulcusar (2007) found that, on day 92-94 after lambing the plasma leptin levels were only about half of those found in late pregnancy .The twin lambing formerly hyper-ketonaemic. Ewes had significantly lower leptin levels than the other. At that time the circulating leptin was positively related to plasma glucose, Insulin and IGF-1. Thyroid hormones appear to have a critical role in maintaining heat production within brown adipose tissue because low plasma thyroid hormone concentrations during early postnatal life are associated with an increased reliance on shivering thermo-genesis and unexpected death.

Table (1): Means ± S.E the effect of age, species and sex on hematological values in lambs and kids from birth to weaning.

Age (Days)	Species	Sex	RBC(10^6) /ml^3	WBC (10^3) /ml^3	Hb (g/100ml)	Ht %
30	Lamb	Male	2.3±1.8^a	2.7±0.9^b	12.2±1.1^a	39.7±1.7^a
		Female	2.4±1.9^a	3.8±0.8^b	11.99±1.5^a	36.5±2,7^a
	Kid	Male	1.8±3.8^a	3.33±1.21^b	10.7±0.4^a	26.0±1.7^a
		Female	1.8±1.7^a	4.3±1.09^b	9.1±0.5^a	26.7±2.2^a
60	Lamb	Male	2.7±0.34^a	4.o±8.4^a	10.1±1.3^a	30.5±3.5^b
		Female	2.21±2.8^a	4.82±73.2^a	11.2±0.7^a	34.5±3.0^b
	Kid	Male	2.51±0.54^a	140.7±4.1^a	6.7±1.1^a	20.7±3.5^b
		Female	2.43±0.29^a	106.1±28.8^a	6.9±0.4^a	21.4±2.0^b
90	Lamb	Male	2.8±0.70^a	14.2±3.16^b	14±0.8^b	34.2±1.8^b
		Female	2.68±0.27^a	14.4±2.99^b	12.4±0.7^b	34.3±3.3^b
	Kid	Male	3.10±0.53^a	13.0±3.28^b	6.5±0.1^b	18.0±0.6^b
		Female	3.18±0.27^a	12.42±1.8^b	7.7±0.6^b	23.0±2.0^b
120	Lamb	Male	3.1±0.33^a	12.25±3.83^b	10.4±0.7^b	34.5±1.8^a
		Female	2.68±0.27^a	15.63±1.9^b	10.9±0.6^b	34.0±1.8^a
	Kid	Male	3.1±0.53^a	11.33±1.65^b	7.2±0.8^b	32.0±3.5^a

Female	3.30±0.26 [a]	11.43±1.31[b]	6.5±0.6 [b]	28.1±2.4 [a]

[a ,b] Means within rows with group with different superscript differ significantly (p< 0.05).

Table (2): Means ± S.E the effect of age, species and sex on blood metabolites value in lambs and kids from birth to weaning.

Age (days)	Breed	Sex	Cholesterol (mg/100ml)	Triglyceride (mg/100ml)	Total protein (g/100ml)	Albumin (g/100ml)	IgG (µg/ml)
30	Lamb	Male	178.1±14.7 [a]	85.6±22.1 [b]	4.9±0.3 [b]	4.3±0.1 [b]	5.8±0.3 [b]
		Female	175.7±21.7 [a]	69.7±9.3 [b]	5.1±0.2 [b]	4.8±0.4 [b]	6.6±0.4 [b]
	Kid	Male	172.2±22.2 [a]	86.9±22.6 [b]	4.6±0.4 [b]	4.4±0.1 [b]	7.4±0.1 [b]
		Female	163.2±16.8 [a]	79.6±15.3 [b]	5.5±0.4 [b]	4.3±0.1 [b]	6.9±3.0 [b]
60	Lamb	Male	149.5±18.6 [a]	69.7±5.9 [b]	5.4±0.4 [ab]	4.4±0.1 [b]	-
		Female	166.3±33.1 [a]	74.1±8.0 [b]	6.3±0.3 [ab]	4.4±0.1 [b]	-
	Kid	Male	131.4±25.9 [a]	75.0±6.4 [b]	4.3±0.3 [ab]	4.4±0.2 [b]	-
		Female	180.8±18.4 [a]	106.6±11.2 [b]	5.6±0.3 [ab]	4.3±0.1 [b]	-
90	Lamb	Male	173.1±22.5 [a]	80.6±10.4 [ab]	6.7±0.1 [a]	4.4±0.2 [a]	-
		Female	144.8±22.7 [a]	95.5±14.5 [ab]	5.7±0.3 [a]	4.7±0.4 [a]	-
	Kid	Male	132.3±15.0 [a]	89.5±14.7 [ab]	4.9±0.4 [a]	5.5±0.1 [a]	-
		Female	175.1±21.8 [a]	99.5±18.5 [ab]	5.9±0.5 [a]	4.8±0.2 [a]	-
120	Lamb	Male	110.6±2.3 [a]	99.4±7.2 [a]	5.4±0.4 [ab]	4.9±0.1 [a]	12.7±1.7 [a]
		Female	118.1±5.6 [a]	106.0±9.8 [a]	5.8±0.5 [ab]	4.9±0.1 [a]	17.5±3.0 [a]
	Kid	Male	183.5±23.8 [a]	128.2±12.6 [a]	5.6±0.7 [ab]	4.8±0.1 [a]	8.6±0.8 [a]
		Female	181.3±14.7 [a]	99.1±8.4 [a]	5.5±0.4[ab]	4.6±0.1 [a]	12.9±2.4 [a]

a ,b Means within rows with group with different superscript differ significantly (p< 0.05).

Table (3): Means ± S.E the effect of age, species and sex on blood hormones level in lambs and kids from birth to weaning.

Age (days)	Breed	Sex	$T_{3(nm/L)}$	IGF-1(ng/ml)	Leptin (ng/ml)
30	Lamb	Male	7.2±1.3[a]	204.5±48.7[a]	7.6±2.5[a]
		Female	6.6±0.8[a]	260.5±51.2[a]	3.5±0.7[b]
	Kid	Male	6.2±1.6 [a]	44.0±5.0 [cb]	5.9±3.7[b]
		Female	5.0±0.6 [ab]	92.7±14.6 [a]	8.9±2.0[a]
60	Lamb	Male	4.6±0.5[ab]	98.3±20.8[cb]	2.0±0.2 [b]
		Female	5.7±1.9[ab]	132.3±35.5[b]	3.1±0.6 [b]
	Kid	Male	2.6±0.1[cb]	20.8±3.5[c]	1.9±0.2[c]
		Female	4.7±1.5 [cb]	26.2±3.2[cb]	1.8±0.1 [c]
90	Lamb	Male	2.4±0.3[b]	48.0±13.7 [c]	2.1±0.3 [b]
		Female	2.4±0.6[b]	54.9±16.5 [c]	2.5±0.6 [b]
	Kid	Male	1.8±0.4 [c]	12.5±0.3[d]	2.1±0.2 [c]
		Female	1.8±0.3 [c]	17.6±2.2[cd]	1.7±0.1 [c]
120	Lamb	Male	2.1±0.3[b]	51.8±8.4 [cb]	2.0±0.2 [b]
		Female	1.6±0.1[b]	82.9±14.4 [cb]	1.9±0.2 [b]
	Kid	Male	2.4±0.8 [cb]	36.2±13.8 [cb]	2.6±0.4 [c]
		Female	2.3±0.2 [cb]	41.3±10.2 [cb]	2.4±0.2 [c]

[a ,b,c,d] Means within column with group with different superscript differ significantly (p< 0.05).

Conclusion:

The data show that, the neonatal period represents a critical stage in development of physiological functions. During this phase, known as the adaptive period, the changes necessary to adapt to the extra-uterine life take place in newborn animals. Adaptation in some body systems is slower than in others .The present study show that, there are some variations between neonatal species during the first 120 days of life. The variations occurred in plasma T3, IGF-1 , leptin, metabolites and hematological parameters in newborn lambs and kids. Data recorded the interactions between age ,sex ,species and blood hematology, metabolic profile and hormones.

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