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BLOOD SERUM CONCENTRATIONS OF THYROID HORMONES, TOTAL PROTEIN AND AMINOTRASFERASE DURING PREGNANCY, PARTURITION AND POSTPARTUM IN EGYPTIAN BALADI GOATS

(With 2 Tables and 2 Figures)

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تركيز هرمونات الغدة الدرقية والبروتين الكلي والإنزيمات الناقلة لمجموعة الأمين في سيرم الدم أثناء فترات الحمل والولادة وبعد الولادة في الماعز البلدي المصري

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استخدم في هذه الدراسة عينات دم من ١٣ ماعز بلدي لتقدير مستويات هرمونات الغدة الدرقية والبروتين الكلي والإنزيمات الناقلة لمجموعة الأمين لهذه الحيوانات طبقاً لنوع الحمل (فردي وتوأم) خلال فترة الحمل وحتى الأسبوع الثالث بعد الولادة. أوضحت النتائج المتحصل عليها انخفاض معنوى في مستويات الهرمون ثلاثي اليود من يوم التلقيح وحتى الأسبوع الرابع من الحمل – ثم اتبع ذلك زيادة غير معنوية حتى الأسبوع العاشر من الحمل. ثم أظهرت النتائج بعد ذلك انخفاض معنوي عند يوم الولادة.. وبالنسبة للهرمون رباعي اليود. أوضحت النتائج أن الهرمون يزيد زيادة غير معنوية من يوم التلقيح حتى الأسبوع ١٨ من الحمل. وانخفض بعد ذلك انخفاضاً معنوياً عند الولادة. كما أوضحت النتائج أنه لا يوجد اختلاف في مستوى تركيز هرموني الدرقية بين الماعز الحوامل في مفرد أو توأم. بعد الولادة لوحظ زيادة طفيفة غير معنوية في هرموني الدرقية. وبالنسبة للبروتين الكلي فقد أوضحت النتائج انخفاض في البروتين عند الولادة، وأنه لا يوجد اختلاف معنوي في تركز البروتين الكلي بين الحيوانات الحوامل في فرد أو توأم. بعد الولادة حدث زيادة في البروتين الكلي لكنها غير معنوية أما بالنسبة للإنزيمات الناقلة لمجموعة الأمين. أوضحت النتائج زيادة في تركز هذه الإنزيمات بتقدم الحيوانات في الحمل، كما حدث انخفاض في يوم الولادة. بعد الولادة حدث تذبذب في مستوى الإنزيمات حتى الأسبوع الثالث. وأوضحت الدراسة أنه لا يوجد اختلاف معنوي بين الإنزيمات الناقلة لمجموعة الأمين للماعز الحوامل في مفرد أو توأم.

SUMMARY

Seurm triiodothyronine (T_3), thyroxine (T_4), total proteins and aminotrasnferase were measured during pregnancy, parturition and postpartum periods in the serum of 13 Baladi goats carrying single and twin. Serum T_3 levels significantly decreased ($P<0.05$) from day of mating to 4 weeks of gestation, thereafter, T_3 slightly increased at the 10^{th} week, then significant decreased ($P<0.05$) at day of Kidding. Serum T_4 level was no significantly different between day of mating and 18^{th} week. Thearafter, serum T_4 levels decreased significantly ($P<0.01$) at the day of kidding. No significant differences were observed both in T_3 and T_4 values during post partum period. No significant changes were recorded between goats bearing singles and twins. Serum total proteins decreased ($P<0.01$) with advancing pregnancy. No significant difference in total protein concentration was noticed between goats delivering singles and twins. After parturition, serum proteins significantly ($P<0.05$) increased at one week post peartum, followed by a gradual significant ($P<0.05$) decrease till the 3^{rd} week after parturition. Serum AST and ALT increased ($P<0.05$) with advancing pregnancy and reached the maximum level during the 20^{th} week of gestation, then they decreased towards parturition. After parturition, the AST and ALT concentration fluctuated. Differences in AST and ALT were not significant between goats bearing single and twin foetuses throughout the pregnancy period.

Key words: *Pregnancy parturition, postpartum, triiodothyronine, thyroxine, proteins, aminotransferase, goats.*

INTRODUCTION

During pregnancy, a female will undergo stress of sustaining the fetus in its well – controlled and protected intrauterine environmental, while the fetus derives most of its nutritional and other requirements from maternal blood. These fetal demands are met by remarkable changes in the edocrinological and biochemical milieu of the dam (Agrawal *et al.*, 1992). After parturition for the formation of colostrums; at the beginning of lactation there is heavy load upon the blood constituents (Hafez, 1980). To meet these needs, the dam attempts to re-set up its endocrine function, including that of thyroid gland (Riis and Madsen, 1985).

Triiodo thyroxine (T_3) and thyroxine (T_4) are hormones which affect the metabolic pools of nitrogen and available energy necessary for the reproduction system and the developing embryo. Therefore abnormal decrease in thyroid hormones may interfere with normal pregnancy (Hafez, 1980). Thyroid hormones have been observed to decrease in several species during late pregnancy in goats (Riis and Madesn, 1985, Khan and ludri, 2002 and Leela *et al.* 2003), sheep (Sutherland and Irvine, 1974, Okab *et al.*, 1993 and Sen and Irmak, 2003), cattle (Boots *et al.*, 1969) and camel (Agarwal *et al.*, 1992).

Pregnancy and parturition, as well as lactation bring in farm animals due to the reproductive function (Herz and Hod, 1969). Plasma total proteins have an important role as a constituent of plasma (Harper, *et al.*, 1977) and serve as indication of amino acids pool for protein synthesis in the liver. Serum aminotransferase activity is considered as index for the diagnosis of tissue necrosis, hepatic injury and muscular degeneration (Kuttler and Marble, 1958 and Cornelius, 1960). Stress predisposes gluconeogenesis with associated rise in circulatory transminases (Kaushik and Bugalia, 1999). The present study was undertaken to deterimine the changes is surm triiodothyronine (T_3) and thyroxine (T_4), proteins and Aminotransferase at various stages of pregnancy, parturition, postpartum and their variations between single and twins pregnancy in Egyptian baladi goats.

MATERIALS and METHODS

Experimental animals: The present study was carried out on 13 pregnant Egyptian baladi goats aged 2-3 years with weight range of 20-32kg, located at the sheep and goats, experimental station belonging to the Department of Animal production, Faculty of Agriculture, Al-Azhar university. Animals were fed ad-Libitum on pelleted concentrate mixture containing 61% TDN and 13% digestible protein plus Egyptian clover (Trifolium alexandrinum) in winter and clover hay in summer. Animals were allowed to drink fresh water twice daily. All animals were kept in semi-open pens exposed to the external environmental conditions. After kidding, the goats were classified into two groups depending on litter size (single or twins).

Blood sampling: Blood samples were taken via jugular venipuncture early in the morning and were allowed to clot, then centrifuged and the serum was obtained and stored at 20°C. Samples

were obtained after mating, at 2 weeks intervals throughout pregnancy and weekly after kidding till the third week postpartum.

Assay: Blood serum Triiodothyronine (T_3) and thyroxine (T_4) concentrations were estimated using the solid-phase radioimmunoassy technique with no-extraction as adopted by Larson (1972) and Chopra (1972) for the two hormones, respectively. RIA kits (Diagnostic Products Corporation, Los Angeles, CA, USA) were used. Serum total proteins and aminotransferase were colorometrically determined by kits according to Weichselbaum (1946) and Ritman and Frankel (1957).

Data analysis: Analysis of variance was followed to test the significant differences between serum hormone levels and serum constituents in pregnant and postpartum does using GLM Procedure of SAS (1988). Student T test was used to test the effect of type of birth (single and twins). Least square method was used to compare weekly means of different serum constituents.

RESULTS

Triiodothyronine (T_3) and Throxyine (T_4): The changes in concentration of serum T_3 and T_4 during pregnancy, parturition and postpartum periods are shown in table (1) and figure (1). Gestation had a significant effect on T_3 and T_4 concentration. In pregnant goats serum T_3 level significantly decreased ($P< 0.05$) from day of matin to 4 weeks of gestation. After, 4 weeks of gestation, peripheral serum T_3 steadily increased ($P< 0.05$) and reached the maximum level during the 10^{th} week of gestation. This was followed by a gradual but significant ($P< 0.05$) decrease on the day of kidding.

As shown in Table (1) and Figure (1), no significant changes were noticed in blood serum T_4 concentration in pregnant goats between conceptiond and 18^{th} week of pregnancy (Figure 1). Serum T_4 slightly increased and attained a peak at 12 week of gestation. Thereafter, serum T_4 steadily decreased with the advancement of gestation and the reduction was significant ($P<0.01$) at the day of delivery. As shown in Table (1), the mean T_3 an T_4 concentration did not differ significantly between goats delivering single and twin kids.

The changes in the serum total proteins during pregnancy, at parturition and postpartum period are presented in Table (2) and Figure (2). A gradual decrease in the serum proteins concentration was noticed between day of mating and the 16^{th} week, although the changes were slight and not significant in most cases. After the 16^{th} week, serum

proteins decreased continued (P<0.01) till the day of kidding. Serum total protein during the first week after parturition increased significantly (P<0.05). This was followed by a gradual but insignificant decrease till the 3rd week after parturition (Table 2). As shown in (Table 2), there were no significant difference between goats carrying single or twin fetuses.

Aspartate aminotransferase (AST) and alanine aminotransferase (ALT). Serum AST and ALT during gestation, at parturition and post partum periods are illustrated in Table (2) and Figure (2). Gestation had a significant effect on the AST and ALT concentrations. As shown in Table (2), no significant changes were obtained in blood serum AST and ALT concentration in pregnant goat between day of mating and 10th week of gestation.

After, the 10th week, serum AST and ALT increased (P< 0.01) with advance in gestation and reached the maximum levels during the 20th week of gestation, then they decreased towards parturition (Table 2).

After parturition, the AST and ALT concentration fluctuated with differences being non significant.

Table 1: Blood serum concentrations of triiodothyronine (T3) and thyroxine (T4) during pregnancy, at parturition and postpartum period in Egyptian Baladi goats.

Weeks	Triiodothyronine (T_3) (ng/dL)			Thyroxine (T4) (ug / dL)		
	Single (8)	Twin (5)	Overall mean (13)	Single (8)	Twin (5)	Overall mean (13)
(0) mating	66.60±3.90a	67.58±6.52a	66.97±3.30h	6.28±0.49a	6.18±0.86a	6.24±0.45a,b,c
2	78.73±5.71a	72.84±4.32a	76.53±3.54d,e,f,g	6.20±0.56a	6.18±0.74a	6.17±0.42a,b,c
4	75.21±3.67a	75.18±4.98a	75.66±2.67e,f,g	6.36±0.56a	6.22±0.75a	6.30±0.43a,b,c
6	84.84±6.58a	82.30±3.24a	83.40±3.91b,c,d,e	6.53±0.49a	6.42±0.77a	6.49±0.41a,b
8	99.87±4.82a	91.60±4.29a	96.76±3.14a	6.81±0.55a	6.62±0.68a	6.74±0.41a
10	102.26±4.22a	92.74±3.59a	98.61±3.14a	6.95±0.54a	5.56±0.69a	6.80±0.4a
12	91.38±5.30a	87.36±2.64a	89.84±3.36a,b,c,d	7.30±0.57a	6.72±0.69a	7.08±0.48a
14	93.84±3.23a	90.77±2.85a	90.78±2.85a,b,	7.01±0.59a	6.98±0.92a	6.99±0.48a
16	89.95±2.99a	80.86±5.28a	86.45±2.90b,c,d	6.28±0.40a	6.18±0.86a	6.24±0.39a,b,c
18	68.14±3.34a	70.28±5.87a	68.96±2.91f,g,h	5.97±0.54a	5.60±0.61a	5.83±0.39a,b,c
20	64.68±3.81	63.98±4.80a	64.80±2.85h	5.32±0.41a	5.10±0.38a	5.24±0.35b,c
delivery	63.26±3.72a	65.54±5.41a	64.14±2.97h	5.11±0.39a	4.93±0.42a	5.01±0.29c
+ 1	66.03±3.85a	66.85±5.84a	66.43±3.24h	5.21±0.40	4.96±0.46	5.11±0.29c
+ 2	66.71±4.01a	64.18±4.98a	65.18±3.22h	5.30±0.39	5.06±0.39	5.21±0.28b.c
+ 3	67.80±2.42a	65.36±4.34	66.14±3.37h	5.32±0.41	5.01±0.38	5.24±0.28b,c

Figures with similar superscripts do not differ significantly from each other.

Table 2: Blood serum concentrations of total protein, aspartate aminotransferase (AST) and Alanine aminotransferase (ALT) during pregnancy, at parturition and after parturition in Egyptian Baladi goat.

Weeks	Total proteins (gm / 100ml)			Aspartate aminotransferase (AST "U/L")			Alanine aminotransferase (ALT "U/L")		
	Single (8)	Twins (5)	Overall mean (13)	Single (8)	Twins (5)	Overall mean (13)	Sirgle (8)	Twins (5)	Overall mean (13)
0	9.62±0.41a	9.60±0.42a	9.61±0.28a	24.95±1.58a	25.82±1.95a	25.28±1.04e	21.82±0.89a	22.48±1.66a	22.07±0.80d
2	9.41±0.31a	9.50±0.53a	9.45±0.26a,b	24.8±1.36a	26.08±1.44a	25.29±0.98e	21.64±0.82a	22.48±1.45a	21.96±0.72d
4	9.47±0.28a	9.43±0.14a	9.45±0.14a,b	24.88±1.30a	25.88±1.99a	25.36±1.07c	22.01±0.87a	21.74±1.20a	21.91±0.68d
6	9.43±0.32a	9.12±0.52a	9.31±0.27a,b,c	25.11±1.37a	26.28±1.13a	25.56±0.95c	22.51±0.80a	22.02±1.34a	22.32±0.68d
8	9.32±0.25a	9.10±0.31a	9.24±0.18a,b,c	28.23±1.98a	28.14±1.50a	28.20±1.30d,e	23.52±0.65a	22.74±1.51a	23.22±0.67d
10	9.16±0.31a	8.98±0.43a	9.09±0.26a,b,c	30.04±2.13a	29.96±2.48a	29.98±1.64c,d,e	23.78±1.14a	23.56±1.70a	23.70±0.91d
12	9.91±0.48a	9.70±0.44a	9.77±0.28a	31.60±2.15a	31.80±2.53a	31.73±1.61b,c,d	27.05±0.78a	25.62±1.37a	26.50±0.70c
14	9.04±0.24a	8.78±0.44a	8.91±0.21a,b,c	33.81±1.74a	34.94±2.69a	34.19±1.36b,c	28.90±0.69a	26.06±2.06a	27.81±0.93b,c
16	8.84±0.33a	8.64±0.17a	8.76±0.21a,b,c	35.99±1.95a	36.24±2.21a	36.09±1.41b	28.07±1.16a	26.78±2.20a	27.57±0.93b,c
18	8.03±0.33a	7.62±0.18a	7.87±0.30d,e	40.67±2.11a	41.24±2.56a	40.89±1.56a	30.09±1.77a	28.64±1.99a	29.53±1.29b
20	7.53±0.55a	6.86±0.61a	7.27±0.41e	44.80±1.92a	45.18±2.71a	44.94±1.51a	32.77±1.54a	32.42±2.39a	32.63±1.25a
Delivery	7.48±0.49a	6.83±0.53a	7.21±0.32e	40.66±2.60a	41.62±2.11a	40.17±1.73a	29.04±2.14a	30.16±1.32a	29.52±1.75a
+1	8.92±0.51a	8.42±0.43a	8.73±0.35a,b,c	43.52±2.26a	40.02±2.54a	41.71±1.63a	30.50±1.42a	29.82±2.38a	30.21±1.22a
+2	8.77±0.56a	8.14±0.52a	8.53±0.39b,c,d	42.50±2.65a	43.16±2.11a	42.75±1.67a	31.85±0.91a	31.08±2.39a	31.80±1.03a
+3	8.65±0.49a	7.98±0.51a	8.39±0.36c,d	41.11±1.95a	41.11±2.18a	41.53±2.19a	31.90±1.02a	30.85±2.29a	30.78±1.03a

Figures with similar superscripts do not differ significantly from each other.

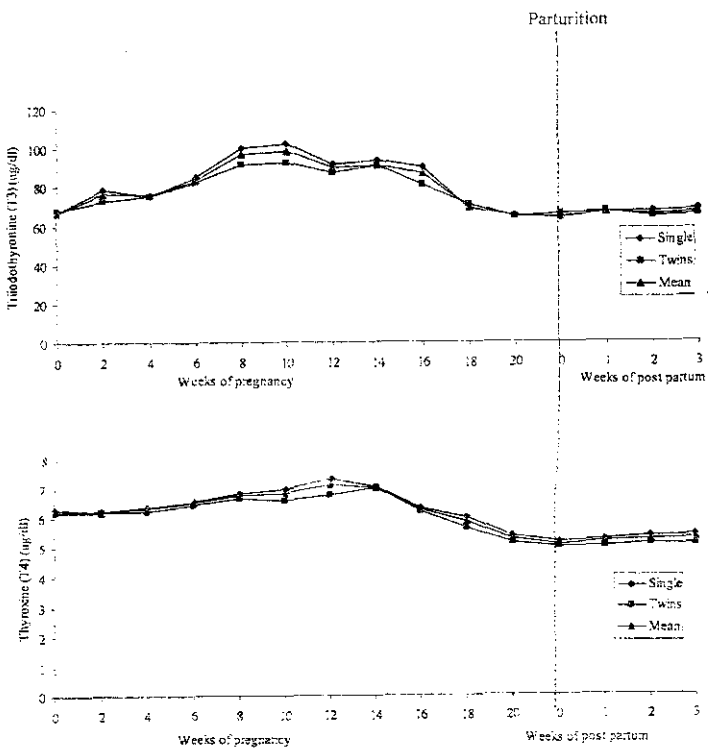

Fig. 1: Blood serum concentration of triiodothyronine (T3) and thyroxine (T4) during pregnancy, at parturition and post partum in goats.

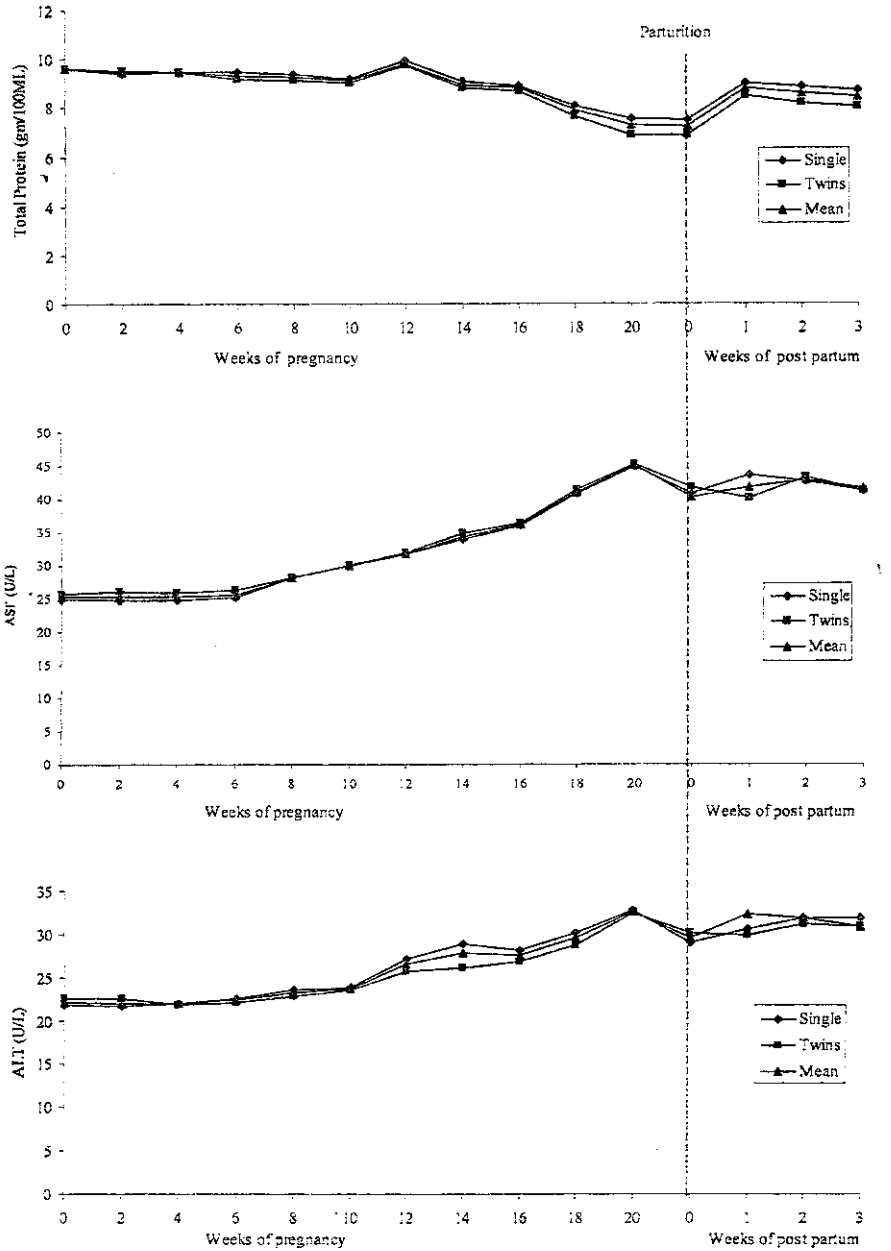

Fig. 2: Serum concentrations of total protein, aspartate aminotransferase (AST) and alanine aminotransferase (ALT) in goats during pregnancy, at parturition and post partum.

DISCUSSION

The changes in concentration of serum T_3 and T_4 in pregnant goats in the present study are similar to those reported by (Riis and Madsen, 1985, Khan and Ludri, 2002 and Leel *et al.,* 2003), sheep (Sutherland and Irvine, 1974, Jacob and Vadoria 2002 and Sen and Irmak, 2003) and camel (Agarwal *et al.* 1992). Increased T_3 and T_4 concentration during early and mid pregnancy was observed. Similarly, Okab *et al.,* (1993) and Sen Irmak (2003) found that the levels of T_3 and T_4 in ewes were significantly lower late pregnancy than in early and mid pregnancy.

The increase in serum T_3 and T_4 activity at early and mid pregnancy may be attributed to the increase in metabolic process during these stages. Avruskin *et al.,* (1976) indicated that the rise in thyroidal activity at early and mid pregnancy may be due to the influence of newly synthesized placental estrogenes.

The decline in serum T_3 and T_4 concentrations during late pregnancy could be attributed to the inhibitory effect of glucorticoids, which rise before parturition on pituitary thyroid axis (klein *et al.,* 1978).

The decrease in T_3 and T_4 levels during late pregnancy can also be attributed to a placental transfer of these hormones to the fetus (Khurana and Madan, 1986 and Sen and Irmak 2003). Additionally the rise in blood volume particularly during late pregnancy would cause the dilution of thyroidal hormones and thus contribute to the decline in serum T_3 and T_4 (Okab *et al.*, 1991 and Sen and Irmak, 2003).

The reduction in thyroidal activity at late pregnancy could be defense mechanism of the organism to reduce metabolic demands in situations where catabolic functions are high (Blum and Kunz, 1981 and Gerloff *et al.*, 1986). Chen and Walfish (1978) suggested that the high levels of estrogen may modulate the secretion rate and dynamic action of thyroid hormones. Riis and Madsen (1985) found that the level of thyroxine concentrations in the goat decreased 1-2 days before parturition, perhaps as a result of nutrient redistribution to the mammary gland in preparation for lactation.

In the present study, serum T_3 and T_4 did not differ significantly between goats delivering single and twin. This was similar to those previously obtained by Khan and Ludri (2003). It can be concluded that the number of fetuses did not significantly influences the hormone profile during pregnancy and postpartum.

The gradual decrease in the level of serum proteins with progress of pregnancy has been observed in goats (Olssen *et al.*, 1982, Hassanin *et al.* 1996, Ashour 1998 and Kaushik and Bugalia, 1999), in sheep (Abdel – Bary, 1990 Mahmoud, 1993), in cattle (Larson and Kendall, 1957) and in Friesian cows (Fahmy *et al.*, 2004).

The increased serum proteins at 12th week of gestation, could be attributed the increase in protein retention at this stage. This was similar to the results previously reported (Mahmoud, 1993). Bayoumi *et al.* (1986) referred the increase in protein requirement for the growing embryo. The decrease in serum total proteins as the animals approach parturition may be due to the storage of proteins in the liver or other organs or being utilized under the stress of pregnancy (Larson and Kendall, 1957). The same authors reported that the drop in serum protein at parturition was caused by a loss of immune β2 and δ1 globulins and some globulins from the blood. This coincided with the time the colostrums began formation in the mammary gland. Also, the utilization of maternal amino acids by the foetus to synthesize its own tissue may reduce maternal serum protein (Jainudeen and Hafez, 1980). The fell in plasma protein at late pregnancy appears to be due to utilization of immunoglobulins for cholesterol synthesis (Kaushik and Bugalia, 1999). El-Naggar and Abdel-Raouf (1971) reported that reduction in serum proteins in late gestation coincide with the rapid increase in the uterine weight and contents, namely the foetal fluids and the foetal membranes. Khalil *et al.* (1986) observed that the reduction in serum proteins in late gestation was attributed to the decrease in both albumin and globulin.

In the present study, serum total protein did not differ significantly between goats delivering single and twins. These results are in agreement with those reported by Abd El-All *et al.* (1990) and Kaushik and Bugalia (1999) who found no significant differences in plasma total protein in goats carrying single and twin foetuses.

Serum total protein increased at the first week after kidding. Similar observations was recorded in goats (Hassnin, 1993) in buffaloes (Badr *et al.* 2002) and in Freisian cows (Fahmy *et al.* 2004). Rowland *et al.* (1975) and (Hassan *et al.*, 1986) reported that, high milk yield was associated with low total proteins in the blood. Fahmy *et al.* (2004) found that the total protein increased at the first week after birth, which they referred to the increase in both albumin and globulin.

The trend of change in AST and ALT concentration in the present study are in accordance with those reported on goats (Sarma and Ray, 1985 and Kaushik and Bugalia, 1999) in cattle (Boots *et al.* 1969)

and in buffaloes (Badr *et al.*, 2002). Kaushik and Bugalia (1999) observed that the plasma AST and ALT activities in pregnant goats registered significant ($P<0.05$) increase with of advancement of pregnancy. However, pervious study on sheep (Okab *et al.*, 1993) Showed that the highest overall mean values for AST and ALT were noted after mid pregnancy, but values dropped shortly before parturition and in the postpartum period.

In the present study, serum AST and ALT did not differ significantly between goats delivering single and twin. Similarly, Kaushik and Bugalia (1999) found no significant differences between goats giving singles and twins.

Increased AST and ALT concentration during late pregnancy was observed. Hafez, *et al.* (1983) showed that AST and ALT activity increased in late pregnancy, reaching the maximum one week pre-partum. This increase in the enzyme activity was attributed to the increasing requirements of the foetus for syntehesis of new tissues where both enzymes are necessary for accelerating the rate of metabolism and protein biosynthesis needs for foetal growth. The present results indicated that AST and ALT activities were highly affected by advanced pregnancy and physiological status at parturition and postpartum period.

Bugalia *et al.* (1986) observed elevated AST level during prepartum compared to postpartum period. They suggested that extended uterus, due to pregnancy and increased cellular permeability due to stress induced transfer of aminotransferase from uterine and placental tissues blood circulation evidencing prepartum rise in plasma AST and ALT. In addition, elevated catecholaminess during stress due to pregnancy induced gluconeogosis and raised AST level (Kaushik and Bugalia, 1999).

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