Effect of Strategic Feed Supplementation during Gestation on Intake, Blood-biochemical Profile and Reproductive Performance of Goats

Ankur Rastogi, Narayan Dutta* and K. Sharma

Centre for Advanced Studies in Animal Nutrition, Indian Veterinary Research Institute, Izatnagar-243 122, India

ABSTRACT : Effect of strategically supplemented pregnancy allowance was ascertained during different phases of gestation on the reproductive performance of does. Gravid does (18) were allotted to 3 dietary treatments HH, HL and LH in a completely randomized block design. All does were provided wheat straw *ad libitum* and supplemented with concentrate mixture at the rate of 20 g/kg$W^{0.75}$ from 0-60 days post-mating. Subsequently, HH group was given concentrate at the rate of 40 g/kg$W^{0.75}$ from 61 d post-mating to term. HL group was offered concentrate from 61-90 d post-mating and 121d post mating to term at the rate of 20 g/kg $W^{0.75}$ and from 91-120 d post-mating at the rate of 40 g/kg $W^{0.75}$. LH group was provided with concentrate from 61 to 120 d post-mating and 121 to term at the rate of 20 g and 40 g/kg$W^{0.75}$, respectively. Mean total dry matter and concentrate intake (g/kg$W^{0.75}$) was significantly higher on HH in comparison to comparable intake of HL and LH treatments, however, wheat straw followed the reverse trend. Haematological and biochemical parameters except serum glucose, total serum protein and A:G ratio did not differ significantly among dietary treatments. The gross gain in weight, products of pregnancy at 21 weeks of gestation, pregnant does average daily gain, birth weight of kids and survivability of kids were significantly lower in treatment HL in comparison to comparable values for HH and LH treatments. The net gain in gravid does was significantly higher in treatment HH than the comparable values obtained in HL and LH treatments. The last month of pregnancy was found to be nutritionally most sensitive period of gestation for native goats. ***(Asian-Aust. J. Anim. Sci. 2003. Vol 16, No. 12 : 1725-1731)***

Key Words : Does, Voluntary Intake, Blood-biochemical Profile, Reproductive Performance, Strategic Supplementation

INTRODUCTION

Majority of the world's goat population is found in the small holder farming system where nutritional conditions are often sub-optimal (Sibanda et al., 1999). With the development of goat rearing as an industry, upcoming trend is to keep goats under stall-fed conditions, which require more attention for supplying the nutrients. Under these intensive management conditions, reproduction is one important aspect, which is very crucial from point of view of nutrient requirements. Reproduction increases the animal's requirement for nutrients, but conversely, the nutrient supply to animals can influence their reproductive processes. The literature is scanty on the effects of supplementary feeding of goats during gestation based on their known intrauterine growth pattern. NRC (1981) recommends high plane of nutrition for pregnant goats from day 60 post-mating to term because the nutrient diversion to foetus and other associated tissues is extremely small before sixty days of gestation (Blanchart and Sauvant, 1974; Osuagwuh and Aire, 1990). Rapid rate of foetal growth during the final six weeks of pregnancy imposes a metabolic challenge to the doe, which is met by the mobilization of maternal body tissue (Osuagwuh and Aire, 1990) and this may result in weight loss of doe, if the dietary supply of nutrients is inadequate (Sibanda et al., 1997). West African Dwarf (WAD) goats were found to be very sensitive to nutritional stress during pregnancy, especially between 90 to 120 days of gestation (Osuagwuh and Akpokodje, 1986; Osuagwuh and Aire, 1990). An unscientific approach to animal feeding during pregnancy, may lead to reproductive wastage resulting from either abortion or neonatal death due to low birth weight resulting from malnutrition during pregnancy or dystocia due to absolute foetal oversize as a result of high level of feeding throughout gestation (Osuagwuh, 1992). Present investigation was undertaken to investigate the effect of strategically supplemented pregnancy allowance during different phases of gestation on the performance of goats from mating to parturition.

MATERIALS AND METHODS

Experimental animals

The experiment was conducted during July-February 2002 at Animal Nutrition Division of Indian Veterinary Research Institute, Izatnagar located at 170 m above sea level (28°22' latitude north and 79°22' longitude east) in the Northern upper Gangetic Plain of India. Twenty-one local non-descript adult does, about 3 years old with a mean live weight of 16.26±0.82 kg were taken as the experimental animals. Local goats of the area are unimproved indigenous medium sized goats with variable coat colours ranging from black, brown and white and combination of the three colours, and are kept primarily for meat. All the does were

* Corresponding Author: Narayan Dutta, Fax:+91-0581-447284, E-mail:pn@ivri.up.nic.in

Received March 14, 2003; Accepted June 20, 2003

Table 1. Ingredients and chemical composition of feeds (% DM)

Attributes	Concentrate mixture*	Wheat straw
Ingredients (%)		
Wheat bran	55	-
Maize	20	-
Soybean meal	22	-
Mineral mixture**	2	-
Common salt	1	-
Chemical composition (%)		
OM	92.28±0.54	93.42±0.17
CP	22.85±1.45	3.14±0.13
EE	2.30±0.05	1.40±0.33
Total ash	7.72±0.54	6.58±0.17
CF	9.14±0.32	39.71±0.42
NDF	32.12±0.28	83.76±1.14
ADF	10.99±0.38	57.53±0.36

* Each 100 kg batch of concentrate mixture was supplemented with 250 g Supplevite-M that contained: vitamin A-500,000 IU. vitamin D_3-100.000 IU, vitamin B_2-0.2 g, vitamin E-75 units. vitamin K-0.1 g, Cal. panthothenate-0.25 g, nicotinamide-1 g, vitamin B_{12}-15 g. Ca-75 mg. Mn-2.75 g, Iodine-0.1 g, Iron 0.75 g, Zn-1.5 g, Cu- 0.2 g, Co- 0.045 g.

** Mineral mixture contained (g/kg): Moisture 70 (maximum), calcium 280 (minimum), phosphorus 120 (minimum) and fluorine: 0.40 (maximum).

penned individually in well-ventilated cement floored shed under uniform managerial conditions and dewormed for endo and ecto-parasites before onset of experiment. The animals were teased twice daily for oestrus detection and were bred by a single buck during standing oestrus. The does were also weighed immediately at buck's introduction. Does returning to heat again in the subsequent cycle were re-bred. The confirmation of pregnancy was done by ultra-sound technique at 60 days post mating using Scanner 200 VET (Pie Medical Philipsweg 16227 AJ MASTRICHT. The Netherlands). Eighteen confirmed pregnant goats were randomly allotted to three dietary treatments with each treatment consisting of 6 does in a completely randomized block design.

Feeds and feeding

The components and chemical composition of the concentrate supplement and wheat straw are given in Table 1. Different quantities of concentrate were fed to the animals at different gestational periods, while wheat straw was offered *ad libitum* throughout the experiment. All the does were given concentrate mixture initially at the rate of 20 g/kg $W^{0.75}$ and during early gestation period (up to 60 days post-mating). However, gravid does were given 40 g concentrate mixture per kg $W^{0.75}$ from 60 days post mating to term, 90 to 120 days post-mating and 120 days post mating to term in treatment HH. HL and LH, respectively. 250 g Supplivite-M (Sarabhai) was added to each batch of 100 kg concentrate mixture to take care of daily vitamin A requirement of animals (900-1.800 IU). Weighed quantities of concentrate mixture were offered to does in the morning. wheat straw was then offered *ad libitum* when all the does consumed the concentrate mixture completely. Clean wholesome drinking water was made available *ad libitum* twice daily. Offered and refusals of wheat straw from all the goats were weighed daily and sampled at weekly intervals for subsequent analysis of DM to assess average DM intake during the experimental period. Samples of feed and refusals were analyzed for proximate principles (AOAC, 1995) and fibre fractions (Goering and Van Soest, 1970).

Blood collection and blood-biochemical profile

Blood samples from experimental animals were collected in the morning before feeding by juglar vein puncture at 0, 45. 90 and 135 days post mating. Serum was separated from about 8 ml of whole blood collected from each animal and stored at -20°C. Another 2 ml blood sample was collected in tubes containing ethylene diamine tetraacetate at 1 mg/ml blood. for haematological parameters. Haemoglobin and packed cell volume (PCV) were estimated in whole blood immediately after the collection of the blood by acid haematin method (Benjamin. 1985) and Wintrobe's tube (Hawk. 1965), respectively. Serum glucose concentration was determined by colorimetry (Hultmann. 1959). The serum protein and albumin (A) content of serum were measured as per Wotton (1964) and Doumas et al. (1971). Globulin (G) values were obtained by substracting the value of albumin from total protein and A:G ratio was calculated. The activity of serum alkaline phosphatase (King and Armstrong, 1934) and serum urea (Rahmatulla and Boyde. 1980) were estimated as per standard colorimetric methods using reagents kits supplied by M/S Qualigens Fine Chemicals (A division of Glaxo India Ltd.) with the help of spectrophotometer (Spectronic 20).

Table 2. Effect of strategic feed supplementation during gestation on the daily dry matter intake (g/d) of gravid does

Feeds	Gestation period (days)/treatments[†]											
	0-60			61-90			91-120			121-150		
	HH	HL	LH	HH	HL	LH	HH	HL	LH	HH	HL	LH
Conc.	166.9	162.1	170.9	358.4^b	170.6^a	180.8^a	379.2^b	359.2^b	189.3^a	407.1^b	187.0^a	402.7^b
WS	233.0	259.4	262.6	177.8^A	317.1^B	281.7^B	218.0^A	219.1^A	249.0^B	202.3^A	283.9^B	176.6^A
Total	399.9	421.5	433.5	536.2^2	487.7^{12}	462.4^1	597.1^3	578.3^2	438.4^1	609.4^3	470.9^1	579.2^2

$^{a,b,c/A,B,C/1,2,3}$ Values with different superscripts within the row in a period differ significantly ($p<0.05$). Conc: concentrate; WS: wheat straw.

[†] Treatments HH. HL and LH signify strategic feed supplementation (@ 40 g/kg $W^{0.75}$) during gestation from days 61 to term, 91 to 120 and 121 to term. respectively.

Table 3. Effect of strategic feed supplementation during gestation period on haemoglobin (g dl^{-1}), PCV%, serum glucose (mg dl^{-1}), serum urea (mg dl^{-1}) and alkaline phosphatase (IU L^{-1}) in gravid does

Attributes/treatments†	Periods (days post pregnancy)				Treatment mean±SEM
	0	45	90	135	
Haemoglobin					
HH	9.5	9.5	9.18	9.28	9.37±0.14
HL	9.52	9.5	9.22	8.98	9.3±0.12
LH	9.42	9.45	9.12	9.27	9.31±0.11
Period mean±SEM	9.48±0.14	9.48±0.15	9.17±0.14	9.18±0.14	9.33±0.07
PCV					
HH	26	29.83	27.17	28.17	27.79±1.21
HL	30	29.83	27.33	26.33	28.38±0.44
LH	30.17	30.33	27.83	28.83	29.29±0.35
Period mean±SEM	28.72±1.67	30±0.23	27.44±0.28	27.78±0.38	28.49±0.44
Glucose					
HH	42.01	40.72	39.16^{b}	41.04^{b}	40.73^{b}±0.59
HL	42.09^{B}	41.12^{B}	33.3^{aA}	34.57^{aA}	37.77^{a}±0.95
LH	41.85^{B}	40.77^{B}	31.6^{aA}	40.55^{bB}	38.69^{a}±1.02
Period mean±SEM	41.98^{C}±0.65	40.87^{C}±0.59	34.69^{A}±1.01	38.72^{B}±0.94	39.07±0.52
Urea (mg dl^{-1})					
HH	42.04^{a}	39.99	37.67^{b}	38.19^{b}	39.47±0.85
HL	47.81^{bC}	41.10^{B}	32.72^{aA}	31.64^{aA}	38.32±1.49
LH	44.92^{abB}	41.88^{B}	33.20^{aA}	40.55^{bB}	40.14±1.16
Period mean±SEM	44.92^{C}±0.84	40.99^{B}±0.22	34.53^{A}±0.68	36.79^{A}±0.22	39.31±0.69
ALP (IU L^{-1})					
HH	148.8^{A}	150.02^{A}	166.64^{B}	189.50^{abC}	163.74±3.54
HL	146.39^{A}	150.45^{A}	169.98^{B}	186.11^{aC}	163.23±3.42
LH	146.07^{A}	151.98^{A}	169.75^{B}	192.83^{bC}	165.16±3.85
Period mean±SEM	147.08^{A}±1.26	150.82^{B}±0.88	168.8^{C}±0.85	189.48^{D}±0.99	164.04±1.14

a,b,c Values with different superscripts in a column differ significantly ($p<0.05$). A,B,C,D Values with different superscripts in a row differ significantly ($p<0.05$). † Treatments HH, HL and LH signify strategic feed supplementation (@ 40 g/kg $W^{0.75}$) during gestation from days 61 to term, 91 to 120 and 121 to term, respectively.

Body weight changes

All the does were weighed before feeding and watering at fortnightly intervals to find out the live weight changes during the study from mating to 24 h post kidding. The live weight of both does and kids were recorded within 24 h of kidding. The does were weighed after expulsion of placenta.

The results obtained were subjected to analysis of variance in a completely randomized design and treatment means for three treatments were ranked using Duncan's multiple range test (Snedecor and Cochran, 1989). The live weight of pregnant does at mating and pregnancy variables were subjected to regression analysis on a personal computer.

RESULTS AND DISCUSSION

Voluntary intake

The daily dry matter intake (g/d) of gravid does during different phases of gestation is presented in Table 2. The mean dry matter intake (DMI) of does increased linearly with the advancement of gestation period. This increase in DMI is in agreement to the findings of Shalu et al. (1995), who attributed it to the changes in the fractional passage rate of digesta from the rumen by a decline in mean retention time of particulate matter as gestation progressed (Graham and Williams, 1962). However the findings are contrary to the reported decrease in DMI due to increase in foetal growth with the advancement of gestation (Forbes, 1970; Sauvant, 1981; Shalu et al., 1995). The effect of supplementation of pregnancy allowance was evident on the total DMI and wheat straw intake. Irrespective of the stage of pregnancy or treatment, total DMI increased and straw intake of gravid does decreased with the increased dietary level of concentrate. This is in accordance to the earlier reports stating that decrease in roughage to concentrate ratio increases the DMI due to a faster rate of passage of digesta (Kawas, 1984; Aregheore et al., 1992), reduction in cell wall contents and related bulk density of concentrate mixture (Waldo and Jorgason, 1981; Kawas et al., 1991). The mean total DMI (g/d) of does was significantly ($p<0.05$) higher on treatment HH in comparison to comparable intake on HL and LH treatments. This was obvious as does on treatment HH were kept on high plane of nutrition for three months of gestation in comparison to one month period in HL (90-120 d) and LH (120-term) groups. Mean wheat straw intake of does on treatment HL

Table 4. Effect of strategic feed supplementation during gestation on total serum protein (g dl^{-1}), albumin (g dl^{-1}), globulin (g dl^{-1}) and A:G ratio of gravid does

Attributes/treatments†	Periods (days post pregnancy)				Treatment mean± SEM
	0	45	90	135	
Total protein (g dl^{-1})					
HH	7.10^{B}	6.85^{B}	6.83^{bB}	5.94^{A}	6.68^{b}±0.14
HL	6.79^{B}	6.49^{B}	5.80^{aA}	5.51^{A}	6.15^{a}±0.14
LH	6.81^{B}	6.48^{B}	6.02^{aA}	5.87^{A}	6.30^{a}±0.1
Period mean±SEM	6.9^{C}±0.08	6.6^{C}±0.11	6.22^{B}±0.14	5.77^{A}±0.14	6.37±0.08
Albumin (g dl^{-1})					
HH	4.44^{bC}	4.21^{C}	2.21^{A}	3.59^{bB}	3.61^{c}±0.2
HL	3.68^{aB}	2.60^{aA}	2.84^{A}	2.97^{aA}	3.02^{a}±0.13
LH	4.11^{abC}	3.41^{bB}	2.74^{A}	2.95^{aA}	3.30^{b}±0.13
Period mean±SEM	4.08^{C}±0.12	3.41^{B}±0.19	2.6^{A}±0.14	3.17^{B}±0.11	3.31±0.09
Globulin (g dl^{-1})					
HH	2.65^{A}	2.64^{aA}	4.62^{B}	2.36^{A}	3.13±0.23
HL	3.11^{A}	3.89^{bB}	2.95^{aA}	2.54^{A}	3.12±0.18
LH	2.7^{A}	3.08^{abAB}	3.29^{aB}	2.92^{A}	2.99±0.11
Period mean±SEM	2.82^{AB}±0.13	3.2^{BC}±0.2	3.62^{C}±0.25	2.6^{A}±0.18	3.06±0.11
A:G Ratio					
HH	1.72^{bB}	1.69^{bB}	0.51^{aA}	1.82^{B}	1.44^{b}±0.16
HL	1.24^{aB}	0.71^{aA}	1.11^{bB}	1.27^{B}	1.08^{a}±0.09
LH	1.58^{abC}	1.17^{aAB}	0.84^{abA}	1.07^{A}	1.17^{a}±0.08
Period mean±SEM	1.51^{C}±0.09	1.19^{B}±0.13	0.82^{A}±0.09	1.39^{BC}±0.16	1.23±0.07

a,b,c Values with different superscripts in a column differ significantly ($p<0.05$). A,B,C,D Values with different superscripts in a row differ significantly ($p<0.05$). † Treatments HH, HL and LH signify strategic feed supplementation (@ 40 g/kg $W^{0.75}$) during gestation from days 61 to term, 91 to 120 and 121 to term, respectively.

and LH was significantly ($p<0.05$) higher than their counterparts on HH treatment. This indicates that does on treatment HL and LH tried to compensate for the lower concentrate intake by increasing wheat straw intake but it was not sufficient to achieve the DMI comparable to does on treatment HH due to limited physical capacity of rumen during late gestation.

Blood-biochemical profile

The levels of Haemoglobin (Hb) and Packed cell volume (PCV) in gravid does were within normal range (8-12 g dl^{-1} Hb and 27-48% PCV) throughout gestation period (Benjamin, 1985; Kaneko et al., 1997). Roy et al. (1965) also observed that Hb did not differ from the normal value up to 120 days of gestation period in goats. It has been reported that Hb and PCV levels gradually fall as the animal approaches parturition due to developing foetus and mobilization of maternal Hb into the foetal circulation by the breakdown of maternal red cells and subsequent transfer of pigment (Prakash and Tandon, 1978; Purohit et al., 2000). The result of the present study also indicate a slight decrease in the Hb and PCV level from 90 days of pregnancy, however, the difference was non-significant. Mean serum glucose level was significantly higher in treatment HH than the comparable levels between HL and LH treatments. It is understandable because does under treatment HH remained on high plane of nutrition from 60 days post-mating to term contrary to goats under treatment HL and LH which were given pregnancy allowance at different stages of gestation. However, the serum glucose level of does in this study remained lower to the reported normal values (45-60 mg dl^{-1}) irrespective of dietary treatment (Swenson, 1977; Vihan and Rai, 1983). The decreased glucose level during late gestation in HL group may be attributed to possible stress on input-output balance of glucose in the face of high demand during the end term of pregnancy (Davis and Johnston, 1971; Jana et al., 1991; Purohit et al., 2000). The supplementation of higher amount of concentrate from 120 days onwards to goats under LH group probably contributed to higher blood glucose during the last phase of gestation.

The serum urea concentration of gravid does was close to the normal range (20-40 mg dl^{-1}) reported for goats (Kaneko et al., 1997; Rajendran, 1999) irrespective of dietary supplement or physiological stage (Table 3). However, comparatively lower serum urea level during late gestation on treatment HL can be explained on the basis of the fact that goats in this group had low crude protein intake at the time of blood sampling both at 90 and 135 days post-mating. Similarly, a significant increase in serum urea level was observed in does under treatment LH following higher level of strategic supplementation after 120 days post mating. The comparable alkaline phosphatase activity irrespective of dietary treatments indicated no adverse

Table 5. Effect of strategic feed supplementation during gestation on live weight changes and reproductive performance of does

Attributes	Treatments†			SEM
	HH	HL	LH	
Body weight of does (kg)				
At mating	16.1	15.9	16.8	0.82
21 weeks of gestation	23.3	19.9	22.98	1.02
24 h post kidding	19.0	17.2	18.3	0.89
Gross gain at 21 weeks gestation	7.2[b]	4.02[a]	6.14[b]	0.46
Reproductive performance of does				
Net gain	2.9[b]	1.3[a]	1.5[a]	0.31
No. of live kids at birth	6	5*	6	-
No. of still birth	0	4**	0	-
Does mortality (%)	0	33.3	0	-
Gestation length (days)	149.2	149.0	152.0	0.36
Survivability of kids (%) after one week	100	40	100	-
Kids birth weight (kg)	2.1[b]	1.73[a]	2.27[b]	0.08

[a,b,c] Values with different superscripts in a row differ significantly ($p<0.05$). * One goat was carrying twins. ** Two goats, carrying twins, died during parturition. † Treatments HH, HL and LH signify strategic feed supplementation (@ 40 g/kg $W^{0.75}$) during gestation from days 61 to term, 91 to 120 and 121 to term, respectively.

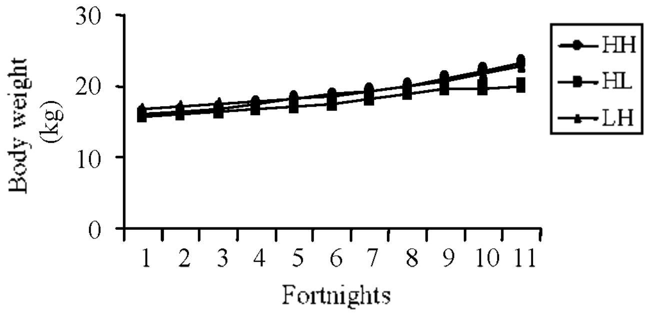

Figure 1. Effect of strategic supplementation on body weight changes of gravid does HH (61 d to term), HL (91 to 120 d) and LH (121 d to term).

effect on bone and liver in gravid does. The increased alkaline phosphatase activity observed during late gestation may be associated with its release from the placenta during pregnancy or uterine development, implantation and chorion development (Kitchener et al., 1965; Dutta and Baruah, 1996). This consequently also increases nutrient requirement and metabolic rate in the dam (Pathak et al., 1984). However, estimation of ALP level during pregnancy appears to have no clinical significance related to possible changes in foetal growth pattern.

The plasma proteins are sensitive to nutritional influences but the changes are often subtle and difficult to detect and interpret. The level of serum proteins depends upon several factors including extent, duration and nature of the hepatic disorder, the inflammatory or metabolic hepatic processes and the presence of other organ disorders (Kaneko et al., 1997). The level of total serum protein was within the normal range of 6.0 to 8.5 g dl^{-1} (Vihan and Rai, 1983; Kaneko et al., 1997; Anbarasu et al., 2002). The mean serum protein level was significantly ($p<0.05$) higher in treatment HH in comparison to comparable values for treatment HL and LH (Table 4). It is obvious because the does on treatment HH remained at high plane of nutrition from 60 days post-mating to term while animals in treatment HL and LH were strategically supplemented at different stages of gestation. As observed in this study, a decrease in the serum protein level during late pregnancy may be due to higher rate of protein synthesis by the foetus from the amino-acids derived from the mother (Jainudeen and Hafez, 1994; Kaushik and Bugalia, 1999). The serum albumin and globulin level of gravid does during the experiment though differed significantly ($p<0.05$) during various phases of gestation, remained within the normal range (Kaneko et al., 1997). It has been reported that level of albumin decreases to a minimum at mid gestation and returns to near normal at term (Dunlap and Dickson, 1955) as observed in this trial. The higher Albumin: Globulin ratio (A:G ratio) on treatment HH could be due to higher albumin level of this treatment. However, A:G ratio remained within normal range irrespective of supplementation strategy (Kaneko et al., 1997).

Body weight changes and reproductive performance of does

All the experimental does had comparable body weight at mating, 21 weeks of gestation and 24 h post-kidding (Table 5). The usual changes in the live weight of dam during gestation are often assumed to be indicative of pre-natal development of foetus(es) (Amoah et al., 1996). Likewise, it has been also suggested that the live weight of pregnant does during gestation affect the amount of available energy for foetal growth (Issac et al., 1991). Therefore, changes in the weight of gravid does can be used to monitor foetal development (Akingbade et al., 2001). The gross gain in weight at 21 weeks of gestation was significantly ($p<0.01$) lower in treatment HL in comparison to comparable gross gain between treatment HH and LH. However, net gain (kg) of gravid does was significantly higher in treatment HH than the comparable values obtained for HL and LH treatments. It has been reported that during late pregnancy there is preferential nutrient utilization for foetal growth at the cost of mobilisation of maternal body tissues (Osuagwuh and Aire, 1990) and results in weight loss of doe if the dietary supply of nutrients is inadequate (Dayeh et al., 1996; Sibanda et al., 1997; Al-Totanji and Lubbadeh, 2000). The pattern of body weight changes of gravid does (Figure 1) corroborate these observations and also indicate that last month of gestation is the period of most rapid foetal growth. Mellor and Matheson (1979) also reported that abruptly imposed severe under-nutrition, around 120 days of gestation could slow down, or in some cases halve foetal growth within 3 days. Therefore, nutritional stress imposed during this period on the gravid does of treatment HL resulted in poor foetal growth and also loss of body condition of the pregnant animals, especially those bearing the twins. It may precisely be the reason of mortality of two parturating does, carrying twins, in treatment HL. They showed low glucose level (34.57 mg dl^{-1}) at 135 days post mating and were in the state of posterior paresis resulting in prostration during last week of gestation, with gradually reduced straw intake. The does appeared to be in distress at the time of labour with poor uterine motility.

A significantly ($p<0.01$) lower birth weight of kids in treatment HL was observed as compared to similar birth weight of kids in HH and LH treatments contrary to the earlier observation in WAD goats (Osuagwuh, 1992) but agree with the findings of Dayeh et al. (1996) in Damascus goats. It is also interesting to note that the high level of concentrate fed to gravid does in treatment HH did not have any appreciable benefit over treatment LH particularly in terms of birth weights of kids and their subsequent survivability.

Overall, it is concluded that supplementation of pregnancy allowance may depend on intrauterine growth pattern of goat breed. The last month of pregnancy (120 days post-mating to term) appears to be most nutritionally sensitive period of gestation for non-descriptive goats found in northern plains of India.

ACKNOWLEDGEMENT

This study was financially supported by Junior Research Fellowship provided by Indian Council of Agricultural Research, NewDelhi, India to the first author.

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