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Effect of Dietary Protein Utilization on Reproductive Performance of West African Dwarf Goats

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Abstract: The effect of varying dietary crude protein levels on the reproductive performance of pregnant goats of West African dwarf, WAD, breed was investigated. Fifteen does with average weight of 22 kg were utilized for the 22 wk study in a completely randomized design. The diets were formulated to be isocaloric (2.60 Mcal ME) and contained 10, 13 and 16% CP representing diet A, B and C respectively with 5 replications having one doe per replicate, hence giving 5 does randomly allotted per treatment. The treatment effects were evaluated in terms of does bodyweight changes, blood parameters gestation length, litter size and weight. The results revealed that does fed 10%CP (A) had the smallest litter size, with no difference ($p>0.05$) in litter weight among the three dietary groups. Treatment affects on dry matter intake DMI and bodyweight BW changes were significant. ($p<0.05$). Animals on 10% CP diet had lowest values for DMI and BW changes than their counterparts on diets B and C respectively. Similarly, the haemoglobin Hb concentration, packed cell volume and plasma urea nitrogen PUN was lower ($p<0.05$) in does fed diet A (10% CP)than their counterparts on diet B(13% CP) and C(16%CP).The experiment therefore indicates that a 10% dietary protein level may not be sufficient to meet the protein need of pregnant WAD goats.

Key words: Dietary protein, reproductive, goats

INTRODUCTION

Much of the improvement in the conformation and type of livestock has come about through the use of carefully planned breeding program characterized by an improved management, efficient breeding strategies and good nutrition. The importance of nutrition in livestock production cannot be over emphasized. Apart from the fact that nutrition promotes the productivity of animals through the increased production of the animal primary products such as meat, egg and milk, it elongates the useful parts of the animals' lifespan for continual service to man. Egbunike and Ladokun[1] observed that nutrition plays a vital role in enhancing the reproductive capacity of an animal and the overall increase of animal products. The essence of nutrition, therefore, is to provide all essential nutrients in adequate amounts and proportions in the diet for improved animal performance. It is important however that diets containing sufficient digestible protein be fed so as to replace that which is lost during renewal and also ensure high reproductive and productive performance.

Information on the reproductive performance of West African dwarf goats at different levels of dietary protein intake is limited in literature. Besides its cost, high dietary protein is detrimental to reproductive performance of dairy cows, causing changes in the secretions of reproductive hormones, progesterone and luteinizing hormone[2]. According to the researchers the mechanism by which high dietary protein exerts a deleterious effect on reproduction was through a relative energy deficiency. High dietary protein intake results in increase in energy requirements by the liver for the clearance of excess ammonia to urea.

Nutrient requirements of pregnant animals vary with stages of pregnancy. Animals tend to require more dietary supply of protein and energy during the last trimester because of the growth of the foetus and supporting tissues as well as to be able to build enough vigour for the expulsion of the foetus during parturition. Adequate supply of nutrients during pregnancy, therefore, becomes imperative to a very resounding reproductive performance of livestock as severe undernourishment during late pregnancy was reported[3] to depress birth weight and vigour of offspring.

In view of this, however, the experiment was designed to study the implication of feeding different levels of protein on reproductive performance (such as gestation length, number of litter size, birth weight of kids and live weight changes of dams)of WAD goats.

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MATERIALS AND METHODS

Animals and management: Fifteen (15) West African dwarf, WAD, goats aged 3 years with an average weight of 22 kg were used for the present study. The animals were confined for one-month adaptation period prior to the breeding date and were placed on a 10% CP diet and 2.57 Mcal/kg DM (Table 1).They were treated against ecto and endoparasitic infections by bathing them in a solution of diasuntol and deworming using a thiabendazole® product, respectively. The heat of the animals was synchronized with intramuscular injection of 0.5 mL of prostaglandin F_2 and per doe. Doe were served on confirmation of heat by proven bucks.

Experimental design and diets: The animals were maintained on diet containing 10%CP and 2.57Mcal ME for 10 wks into the pregnancy. On wk 11 of the pregnancy, the animals were randomly allotted to one of the three isocaloric (2.61 Mcal ME) diets with varying crude protein, CP, levels of A(10%), B (13%) and C (16%) in a completely randomized design . Each diet was replicated 5 times with one pregnant doe per replicate.

Measurement of reproductive responses: The following responses were evaluated: gestation length, number of litter size birth weight of kids and live weight changes of dams. In addition, individual feed intake was monitored. Immediately after kidding, each kid was tagged, sexed and weighed before allowing suckling.

Blood parameters: Blood samples were collected from does via jugular venipuncture at the end of wks 14, 18 and 22 of pregnancy using evacuated blood tubes. Plasma was harvested and stored in a deep freezer at (-20°) until required for analysis. Blood samples for haematological Studies were collected into bottles containing anticoagulant EDTA. Plasma urea nitrogen PUN and plasma total nitrogen, PTP, were measured to show differences in nitrogen metabolism of does. Plasma glucose was measured to examine the extent of metabolism stress in the does fed the three diets. Haemoglobin Hb concentration and packed cell volume PCV were determined according to the standard methods[4].

Table 1: Ingredient and chemical composition (%) of the fed diets

Ingredients	A	B	C
Maize meal	30.37	26.08	23.41
Citrus pulp	45.39	39.12	35.11
Ground rumen scraping*	1.24	7.68	11.69
Groundnut cake	1.01	5.12	7.79
Grass hay	20.00	20.00	20.00
Mineral premix	1.00	1.00	1.00
Oyster shell	1.00	1.00	1.00
Total	100.00	100.00	100.00
Chemical analysis			
Dry matter	90.01	92.52	92.10
Crude protein	10.01	13.01	16.00
Acid detergent fibre	37.10	38.32	38.37
Energy (Mcal ME)	2.57	2.63	2.64

*Rumen scraping is an abattoir waste obtained from the rumen during evisceration. It is the tissue lining of the rumen and contains 65% crude protein

Statistical analysis: Data were collected using the general linear model procedure of SAS [5]. Means were separated where applicable using Duncan's method[6].

RESULTS AND DISCUSSIONS

Dry matter and performance characteristics: The quality of any feed is a function of sufficiency of its nutrients, particularly, the energy and protein in adequate amounts and proportions. The metabolisable energy contents (2.60 Mcal ME) of the three diets were within the recommended[7] values (2.1-2.7 Mcal ME) for pregnant does. The dietary crude protein levels of the offered diets (10, 13 and 16%) were more than what was fed elsewhere[3] for similar groups of Alpine goats in the temperate. There was no significant difference ($p>0.05$) between the dry matter intake DMI of goats on diets B and C indicating that diet B could still be fed to the pregnant does for sustainable optimal performance. The DMI of the does amounted to 3.2% of their body weight and still fell within the acceptable[7] range (3.0-3.5%) for goats. The decrease in the DMI with advancing gestation is expected with increase in fetal growth requiring more space in the abdominal cavity. Treatment effect on DMI was significant ($p>0.05$).Animals on diet A (10%) had the lowest DMI (g) of 801 than their counterparts on diets B and C which had 895 and 930, respectively (Table 2). Dietary protein has been known to influence DM intake which might explain the reason for the differences observed in DMI of the experimental does.

Changes in body weight were monitored as an indicator of nutritional stress. Mean body weight at the end of wk 10 was 26.31 kg, which was relatively lower than the corresponding reported value[3] of 56.04 kg for French Alpine dairy goats. Treatment effect on BW changes was significant ($p>0.05$). Changes in body weight during the study for does on diets B and C were similar but relatively larger than the observed value for does on diet A (Table 1). This could be due to the dietary protein intake. The effect of varying dietary protein concentration on reproductive characteristics are presented in Table 2. Diet C does had the highest number of kids than their

Table 2: Performance characteristics of does fed graded levels of protein

		A	B	C	SEM
Mean body weight (kg)					
	Wk	121.50	22.03	22.82	1.03
	11	3.53^{a}	27.10^{ab}	28.30^{b}	1.52
	22	26.85^{a}	33.35^{b}	34.32^{b}	1.98
Body weight change (kg)					
	Wks 1-10	2.03	5.07	5.48	0.95
	11-22	3.32^{a}	6.25^{b}	6.02^{b}	0.85
	Total	5.35^{a}	11.32^{b}	11.50^{b}	1.01
Dry matter intake (g day^{-1})		800.08^{a}	895.10^{b}	930.20^{b}	10.07
Gestation length (days)		153	154	153	1.02
Litter size		1.00	1.20	1.61	0.95

a, b, c: Means along the same rows with similar superscripts are not significantly different (p>0.05) A,B,C: see text SEM: Standard error of the means

Table 3: Summary of blood biochemical parameters of pregnant WAD goats

Parameter		A	B	C	SEM
PUN (mg100ml-1)					
Wks	14	8.15	10.53	10.12	1.01
	18	8.20^{a}	11.43^{ab}	13.50^{b}	1.20
	22	7.50^{a}	10.80^{ab}	13.06^{b}	1.10
PTP	14	59.23	61.12	61.23	1.32
	18	58.30	59.30	60.45	1.56
	22	58.01	60.10	61.15	1.35
GLU	14	62.50	69.54	68.62	1.65
	18	58.10^{a}	65.21^{ab}	66.21^{b}	1.70
	22	57.20^{a}	63.26^{b}	62.20^{ab}	1.63
Hb (gm %)	14	6.51	8.03	7.90	1.05
	18	7.90^{a}	10.70^{b}	9.70^{ab}	1.20
	22	6.70^{a}	9.70^{b}	9.50^{b}	1.31
PCV (%)	14	26.50	29.20	27.10	1.50
	18	29.20^{a}	34.20^{b}	33.50^{b}	1.75
	22	28.50^{a}	33.80^{b}	32.90^{b}	1.80

a, b, c: Means along the same rows with similar superscripts are not significantly different (p>0.05) A,B,C: See text SEM: Standard Error of the means

counterparts on diets B and A. The percentage (%) of does that kidded were 60, 80, 80 for diets A, Band C, respectively.

Although, litter size and litter weight were not statistically different (p>0.05), does in group A had lower litter size and litter weight than those in group B and C. Mean litter weight (1.85 kg) recorded during the present study was lower than 7.83 reported for dairy goats[3]. The improvement in litter birth weight observed in goats B and C does could be attributed to increased dietary protein levels as reported elsewhere[8,9]. Mean gestation length was 153.33 days and not affected by (p>0.05) by dietary protein levels. Twining was observed across the three groups with the does on diet B highest number of two. Mean birth weight for singles and twins observed during the study were 2.05 and 1.79 kg, respectively. Afolabi[10] and Babayemi[11] also reported higher birth weights for kids born singles than twins in their various studies on goat's mineral utilization by pregnant does. Therefore, the major cause of differences in reproductive responses generally, could be attributed to differences in genotypes, body fat reserves and probably environments within which the animals were raised.

Haematological and blood biochemical studies: The result of dietary protein concentration on blood biochemical properties of pregnant does are presented in Table 3. Dietary protein levels influenced (p<0.05) plasma urea nitrogen PUN concentration throughout the period of pregnancy. Does on diet C had highest concentration of PUN with the least value obtained for does on diet A. This indicates that the PUN status of goats as in other animals is a function of its dietary protein levels.

The plasma protein concentrations tended to be higher (p<0.05) in diets fed B and C groups compared to A dietary group with highest mean values observed in wk 14. The glucose GLU concentration declined with advancing pregnancy as fetal requirement progressively increased. Twining had no effect on GLU concentration of the animals as does on diet B with highest number of twins had greater mean GLU values than others in groups A and C. Since fetal requirement for energy is met primarily by maternal glucose[3,12] does on diet B with multiple twins were expected to show lower plasma glucose during pregnancy, High plasma glucose levels observed in does fed B and C diets might be due to gluconeogenesis from dietary amino acid.

The result of plasma total protein, PTP, is also presented in Table 3. The PTP were also measured since they are of significant importance in determining the nutritional and health status of animals. Except on wk 22, effect of varying dietary protein levels was not significant (p>0.05) on PTP concentration of the experimental does. The lower value recorded for does on diet A could also be due to lower dietary protein level.

The concentrations of haemoglobin Hb (gm %) and packed cell volume PCV (%) were also affected by dietary protein levels. Treatment effect was significant (p<0.05) on Hb and PCV values of the experimental does. Does on diet A (10% CP) consistently having lower mean values of (6.90) and (28.07), respectively compared to their counterparts on diets B and C (Table 3).This may probably due to low protein intake and utilization.The general trend of concentration of Hb and PCV of the experimental does was that they increased at wk 18 of pregnancy but slightly declined towards the end (wk 22)of pregnancy. The Hb values recorded for groups B and C, however, were within the normal range (8-14 gm %) reported for goats[13] and relatively stable throughout the period of pregnancy. Generally, mean PCV values (Table 3) of does obtained in this study (p>0.05) were comparable to a mean value of 26±4.50 reported for adult WAD goats[14] and the normal range(15-30%) for goats[15]. This also indicates adequacy of nutrition of the test animals.

CONCLUSION

All the three diets were acceptable to WAD goats, but diets B and C supported reasonable body weight changes. The obtained data suggest that does fed diet containing 10% CP may have experienced metabolic stress during pregnancy on account of low GLU, PUN, Hb and PCV values. Their reproductive performance was also relatively lower than those on diets B and C. In addition, since there was no marked differences between the performances of does on diets B and C, therefore, diets containing 13-16% CP may be nutritionally adequate for feeding pregnant does especially in the tropics.

REFERENCES

1. Egbunike, G.N. and A.O. Ladokun, 1998. Testis function in pubertal rabbits as affected by three dietary proteins. Proc. of the 3rd ASAN Conf. Ikeja, Nigeria, pp: 210-212.
2. Ojewola, G.S., S.F. Abasiekong, M.U.U Ko and M. Oguike, 2006. Influence of lysine supplementation on the reproductive performance of rabbits in a tropical environment. J. Anim. Vet. Adv., 5: 114.
3. Sahlu, T., J.M. Fernandez, C.D. Lu and M. Potchoiba, 1988. Influence of dietary protein on reproductive performance of dairy goats. In; Report of the American Institute of goats Research. Langston Univ. Oklahoma.
4. Coles, E.N., 1974. Veterinary Clinical Pathology, 2nd Edn. W.B. Saunders, Philadelphia, London Toronto, pp: 615.
5. Statiscal Analysis System Institute, 1995. SAS User's Guide. SAS Institute Cary. N.C.
6. Duncan, D.B., 1955. Multiple range and multiple f. Test. Biometrics, 11: 1-42.
7. NRC, National Research Council, 1985. Nutrient Requirement of Sheep. 6th Edn. Nation. Acad. Sci. Washington D.C.
8. Steele, M., 1996. Goats. A CTA publication series, Macmillan (Rene costa, Series) Ed. A.J. Smith, pp: 132-136.
9. Singh, H. and E.N. Moore, 1982. Livestock and Poultry production.2nd ed.(Revised).Prentice Hall of India Private Ltd, pp: 550.
10. Afolabi, G.O., 1995. Calcium and phosphorus utilization for pregnancy and lactation by West African dwarf (Fouta djallon) goats Ph.D., thesis. U.I. Nigeria.
11. Babayemi, O.J., 1997. Magnesium and Copper requirements of West African dwarf goats for pregnancy and lactation. Ph.D., thesis, U.I. Nigeria.
12. Frandison, R.D. and F.H. Whitten, 1981. Anatomy and Physiology of Farm Animals. 3rd Edn. Balliere Tindall, London Printed, USA., pp: 318-319.
13. Puls, R., 1994. Minerals levels in animal health diagnostic data. In: Canadian Cataloguing in Publication Data 2nd Edn., pp: 305-306.
14. Schalm, O.W., I971. Veterinary Haematology. 2nd Ed. Lea and Febiger, Philadelphia, USA, pp: 247.
15. Oduye, O.O., 1976. In: Diurnal variation in the haematology values of West African dwarf goats. (Oyewale,J.O. and Olowookorun, M.O. Ed). Bull. Anim. Health Prod. Afric., 34: 161-164.