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Effects of mixed Gmelina arborea and Moringa oleifera leaf meal in Digitaria smutsii Hay based diets on the performance of pregnant Red Sokoto Does and their Kids

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***Target Audience:** livestock farmers, nutritionists, extension officers and feed producers.*

Abstract

Gmelina arborea and Moringa oleifera leaf meals combined in ratio 75:25 and included at 0, 10, 20 and 30% in Digitaria smutsii hay based complete diets were fed to pregnant Red Sokoto does to investigate effect of the graded levels of the mixed forage on the dry matter intake, live weight, pregnancy of the does and birth weight of their kids. Twenty-four pregnant Red Sokoto does aged between 13 and 14 months with an average weight of 22.50 ±0.12 kg were randomly assigned to four treatments with six does (in their last trimester of pregnancy) per treatment in a completely randomized design. The diets were offered at 4% of body weight. Results indicated that mixed Gmelina arborea and Moringa oleifera leaf meal (GMMO) increased dry matter intake of the does and birth weight of their kids. Dry matter intake was significantly (P<0.05) higher in does fed 20% leaf meal. Birth weight was significantly higher (P<0.05) in does fed 20% and 30% GMMO leaf meal (1.58 kg and 1.68 kg) respectively. GMMO leaf meal did not affect the dams' weight after kidding. It can be concluded that mixed Gmelina and Moringa leaf meal can be included in the diets of pregnant Red Sokoto does for improved dry matter intake and birth weight of their kids. GMMO leaf meal inclusion did not have adverse effect on the haematological and serum biochemical parameters of pregnant does.

***Key Words:** Gmelina arborea, Moringa oleifera, leaf meal, pregnant, birth weight, Red Sokoto doe.*

Description of Problem

Small ruminants are kept for meat, milk, wool and skin but, in Nigeria, they are primarily produced for meat. There is demand for chevon (goat meat), and goats have characteristics as the species of animals that can meet this demand because they are highly prolific (1). The meat from goat is preferable to those from other livestock species because of its flavour, tenderness and palatability (2). They are able to utilize degraded land and thrive under conditions that other species cannot cope with (3). There is need, therefore, to provide adequate nutrition to goats to allow them produce optimally and address the problem of weight loss and reduction in birth weight and milk production during the dry season. Inadequate supply of all year round quality forage is a major constraint to livestock production in the tropics (4). Most available ruminant feeds/feedstuffs during the dry season are poor in nutrients which deteriorate rapidly with increasing fibre and decreasing protein (5). Sources of cheaper alternative forages of high quality for ruminants have been a subject of research in recent years (6), especially for farmers in the tropics. Browse plants have great potential as source of high quality nutrient for ruminants, being high in protein, minerals and vitamins (7). They are

available all year round because of their drought resistance, persistence, vigorous growth, re-growth and palatability (8). The use of browse plants as supplement has been shown to enhance intake, improve growth rate and increase reproduction in ruminants (9, 10). However, most of these forage trees have not been widely used because they often contain anti-nutritional compounds that have deleterious effects on animal performance (9). The objective of this study was to investigate the effect of mixed *Gmelina arborea* and *Moringa oleifera* leaf meal on intake, pregnancy and weight changes of Red Sokoto does and their kids.

Materials and Methods

The experiment was conducted in the Experimental Unit of the Small Ruminant Research Programme of the National Animal Production Research Institute (NAPRI), Shika, Zaria, Kaduna State, Nigeria.

Fresh *Gmelina arborea* (GM) leaves were harvested within Ahmadu Bello University Main Campus. Leaves were allowed to air-dry for three days and then removed by carefully beating the branches with sticks. Dried *Moringa oleifera* leaves were sourced from Sabon-Gari market, Zaria. *Digitaria smutsii* (Wooly finger grass) hay was sourced from the Feeds and Nutrition Research Programme of NAPRI. The dried leaves of the two browses and *D. smutsii* hay were ground with a hammer mill fitted with 2 cm screen for easy mixing with other feed ingredients. The ground ingredients were packed in sacks and stored in a well-ventilated storeroom. Twenty-four pregnant Red Sokoto does aged between 13 and 14 months with an average weight of 22.50 ±0.12 kg were randomly assigned to four treatments with six animals (in their last trimester of pregnancy) per treatment in a completely randomized design. They were individually penned and given prophylactic treatment, consisting of Ivermectin® at 200 µg/kg body weight (BWT) against endo- and ectoparasites and Terramycin long acting (LA)® at 20 mg/kg BWT against bacterial diseases 7 days before the commencement of the experiment.

Experimental treatments, design and feeding of animals

Four isonitrogenous complete diets were formulated, with 40% *D. smutsii* hay. The complete diets were compounded to contain 15% CP. *Gmelina arborea and Moringa oleifera* leaf meals were combined at 75 and 25% respectively. The mixture of Gmelina and Moringa leaf meal was included at 0, 10, 20 and 30%. Each inclusion level served as a treatment. Other ingredients in the complete diet included maize offal, cotton seed cake, common salt and bone meal (Table 1). The diets were mixed fortnightly to maintain freshness and samples were taken to determine the chemical composition. Six animals were randomly allocated to four treatments with each animal serving as a replicate in a completely randomized design. At 08:00 hours, the animals were fed daily at 4% of their body weight. The does were weighed weekly. Weight changes were recorded as the difference between weight of the previous week and the current. Weekly weights of the does were used to adjust the quantities of feeds offered in order to maintain the pre-determined level. Water was provided *ad libitum* to the animals. The does were adjusted to the experimental diets for 14 days before data collection. The does and kids were weighed at kidding. The birth weight (kg) of kids was measured using digital weighing balance.

Blood sampling and analysis

Blood samples (5ml) were collected from three randomly selected does per treatment before kidding through the jugular vein using a 5 ml syringe. Two ml of the blood sample collected was transferred into a sampling bottle

containing ethylene diamine tetra acetic acid (EDTA) as anti-coagulant and was shaken gently to ensure easy mixing of blood with the anti-coagulant. The blood samples collected were taken to the Veterinary Teaching Hospital, Ahmadu Bello University, Zaria for determination of haematological parameters.

The remaining blood sample (3ml) was poured into plain bottle and allowed to clot at room temperature within 3 hours of collection. Plasma was separated by centrifugation at 3500 revolutions per minute (r.p.m) for 15 min and serum was thereafter frozen at -20ºC for the determination of total protein, albumin, total cholesterol, glucose, creatinine and urea nitrogen with the use of Elisa Multiplex Commercial Kits (Pfizer Animal Health, New York, NY).

Statistical Analysis

All data were analyzed statistically using the General Linear Model (GLM) procedure of (11). Significant differences between treatment means were determined according to Duncan's Multiple Range Test of same package. Significance was declared at $P<0.05$.

Results and Discussion

Results of the effect of levels of Gmelina and Moringa leaf meal on feed intake, weight changes and birth weight of kids of Red Sokoto Does fed *D. smutsii* hay based diets are presented on Table 2. Dry matter intake (DMI) was similar ($P>0.05$) all for 10%, 20% and 30% treatments. Animals fed 20% GMMO leaf meal had a higher ($P<0.05$) DMI than those on control diet. Dam's weight at kidding was not significant ($P>0.05$) across the treatments. Birth weight was similar ($P>0.05$) in does fed 20% (1.58 kg) and 30% (1.68 kg) GMMO leaf meal. However, birth weight of 30% GMMO treatment was higher ($P<0.05$) higher than those control and 10% GMMO.

Results of the effects of GMMO leaf meal inclusion on haematological parameters of pregnant Red Sokoto does fed *D. smutsii* hay based diets are shown on Table 3. The PCV was significantly ($P<0.05$) higher (36.33%) in treatment group fed 30% GMMO compared to other treatments. Haemoglobin was significantly ($P<0.05$) higher in treatments with GMMO inclusion compared to the control group.

Results of effect of GMMO leaf meal inclusion on serum biochemical parameters of pregnant Red Sokoto does fed *D. smutsii* hay based diets are presented in Table 4. There were significant ($P<0.05$) differences in urea nitrogen and cholesterol concentrations. Blood urea nitrogen (BUN) was significantly ($P<0.05$) higher in control than other dietary treatment. Cholesterol concentration was higher ($P<0.05$) statistically in does fed 0% and 10% GMMO leaf meal than those on 20% (85.62mg/dL) and 30% (92.13mg/dL) leaf meal respectively.

Improved feed intake in animals fed GMMO leaf meal may be as a result of acceptability and digestibility of the feeds. The improved feed utilization was likely to have resulted in higher birth weight of kids. The higher birth weight (1.58 kg and 1.68 kg) was observed in does fed 20% and 30% GMMO leaf meal, respectively. This was similar to 1.73 kg and 1.76 kg reported by (12) and (13), respectively for Red Sokoto kids. However, (14) reported lower birth weight of 1.07-1.40 kg for Red Sokoto kids. Birth weight of animals is one of the most important factors influencing the pre-weaning growth of the young and subsequent live body weight (15). The birth weight in this work may be a result of adequate nutrition of the does, the acceptability and palatability of the browse leaf meals. This was in agreement with the report of (16) who stated that birth weight is highly dependent on the dam's nutrition and in particular energy intake during the last month of the pregnancy.

The importance of examining blood for

their constituents and the use in monitoring and evaluation of health, reproduction and nutritional wellbeing of animals has been well documented (17; 18; 19). Dietary treatments had effect on hematological parameters. However, the values obtained were within the range for healthy goats (20). This result can be attributed to the fact that the pregnant does were well adapted to the diets. This agreed with the observation of (21) who reported that nutritional status and management practices can influence the physiological attributes and ability of animals to cope with stress.

Reduced urea nitrogen observed may be as a result of the type and quality of protein. The lower cholesterol level obtained in animals fed 20% and 30% GMMO leaf meal agreed with the reports of (22). This could be as a result of the hypocholesterolemic properties of Moringa leaf meal included in the diets (23). The beta-sitosterol in *Moringa oleifera* leaf was reported to be responsible for its hypolipidaemic and antioxidant properties (24).

Table 1: Ingredient composition of experimental diets (%) fed to pregnant Red Sokoto does

Ingredients	Levels of GMMO leaf meal inclusion (%)			
75GM:25MO	0	10	20	30
Cottonseed cake	34.40	30.50	26.70	23.00
Maize offal	23.60	28.00	11.30	5.00
Bone meal	1.50	1.50	1.50	1.50
Common salt	0.50	0.50	0.50	0.50
D. smutsii hay	40	40	40	40
Total	100	100	100	100
Calculated analysis				
% Crude Protein	15.10	15.05	15.02	15.02
Cost/kg feed (₦)	45.79	42.21	38.64	35.08

75 GM: 25 MO= 3:1 mixture of Gmelina and Moringa leaf meal.

Table 2: Effect of GMMO leaf meal inclusion level on feed intake, weight changes and birth weight kids of Red Sokoto Does fed *D. smutsii* hay base diets

	Levels of GMMO leaf meal inclusion (%)				
Parameters (kg)	0	10	20	30	SEM
DMI (g/d)	576.85^{b}	632.40^{ab}	666.89^{a}	627.49^{ab}	40.12
Initial weight	21.60	22.50	22.55	22.62	1.55
Dam weight (at kidding)	22.35	23.25	23.37	23.40	1.53
Birth weight	1.50^{b}	1.41^{b}	1.58^{ab}	1.68^{a}	0.05

a,b, Mean values with different superscripts within a row differed significantly (P<0.05), SEM = standard error of mean, DMI=dry matter intake.

Table 3: Effects of GMMO leaf meal inclusion on hematological parameters of pregnant Red Sokoto does fed *D. smutsii* hay-based diets

Parameters	Levels of GMMO leaf meal inclusion (%)				SEM
	0	10	20	30	
PCV (HCT) (%)	26.37^{b}	23.33^{b}	26.73^{b}	36.33^{a}	2.36
Hgb (×10g/L)	9.97^{b}	10.80^{a}	10.87^{a}	11.37^{a}	0.38
RBC (×10^{12}/L)	9.53^{ab}	8.87^{b}	9.57^{ab}	11.47^{a}	0.55
WBC (×10^{12}/L)	10.63^{ab}	9.50^{b}	12.87^{a}	12.97^{a}	1.61

a,b, Mean values with different superscripts within a row differed significantly (P<0.05), SEM= Standard Error of Means .WBC = White blood cells; RBC = Red blood cells; Hgb = Haemoglobin; PCV (HCT) = Packed cell volume (Haematocrit).

Table 4: Effect of feeding of GMMO leaf meal inclusion on serum biochemical parameters of pregnant Red Sokoto does fed *D. smutsii* hay based diets

	Levels of GMMO leaf meal inclusion (%)				
Parameters	0	10	20	30	SEM
Total protein (g/L)	66.05	67.43	66.24	67.60	1.35
Albumin (g/L)	26.80^{b}	30.70^{b}	33.90^{ab}	38.83^{a}	3.57
Globulin (g/L)	39.25^{a}	36.73^{ab}	32.34^{b}	28.77^{c}	3.26
Glucose (mg/dL)	65.30^{ab}	70.17^{a}	59.43^{b}	56.77^{b}	4.64
Creatinine (µmol/L)	101.00	102.67	94.33	102.00	5.36
BUN (mmol/L)	5.00^{a}	4.26^{b}	3.76^{c}	3.71^{c}	0.13
Cholesterol (mg/dL)	114.87^{a}	114.40^{a}	85.62^{b}	92.13^{b}	6.05

a,b, c, Mean values with different superscripts within a row differed significantly (P<0.05), BUN= Blood Urea Nitrogen; SEM= standard error of mean.

Conclusion and Applications

1. Mixed *Gmelina arborea* and *Moringa oleifera* (GMMO) leaf meal can be included in diet of does up to 30% for enhanced birth weight of kids without affecting the weight of their dams.
2. GMMO leaf meal inclusion did not have adverse effect on the haematological and serum biochemical parameters of pregnant Red Sokoto does.
3. The diet combinations may help to alleviate the problem of feed scarcity for ruminants during the dry season.

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