FOLLICLE STIMULATING HORMONE LEVELS OF WEST AFRICAN DWARF BUCKS FED DIETS CONTAINING GRADED LEVELS OF *MORINGA OLEIFERA* LEAF MEAL

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ABSTRACT
A trial was carried out to determine the follicle stimulating hormone levels of West African Dwarf bucks fed diets containing graded levels of Moringa oleifera leaf meal (MOLM). Sixteen (16) bucks were designated into four treatment groups T_1, T_2, T_3 and T_4 respectively with four (4) bucks per treatment, and each buck serving as a replicate in a Completely Randomized Design (CRD). Bucks in the first treatment group (T_1) were fed the control diet (0% MOLM) while bucks in the second (T_2), third (T_3) and fourth (T_4) treatment groups were fed diets containing graded levels of Moringa oleifera leaf meal (10%, 20% and 30%) respectively. The trial lasted for 120 days. Inclusion of Moringa oleifera leaf meal in concentrate diets positively influenced follicle stimulating hormone levels of West African Dwarf bucks. This study has demonstrated that Moringa oleifera leaf meal possesses good dietary quality for optimal reproductive performance of West African Dwarf bucks, and should be incorporated into their concentrate diets.
Keywords: Follicle stimulating hormone, Bucks, *Moringa oleifera*

INTRODUCTION
Moringa oleifera Lam is a medicinally important plant, belonging to the family *Moringaceae*. Arabshahi-D *et al*. (2007) and Fahey (2005) reported that the leaves of *M. oleifera* can be eaten fresh, cooked, or stored as a dried powder for many months without any major loss of its nutritional value. Follicle Stimulating Hormone (FSH) is a 35.5KDa glycoprotein heterodimer, consisting of polypeptide units, alpha and beta. The factors which influence circulating levels of Follicle Stimulating Hormone in farm animals include stress, and nutrition. The effects of feed or nutrition occur not only in the ruminants but in monogastric species as well (Wood *et al*., 1991). Nutrition affects all aspects of the chain of reproductive events from gametogenesis to puberty in males and females. Follicle Stimulating hormone activates the transcription of genes involved in metabolic homeostasis and supports germ cell functions (Zimmermann *et al*., 2015). In males, follicle stimulating hormone (FSH) stimulates the maturation of primordial germ cells. FSH induces sertoli cells to secrete androgen binding proteins (ABP's) regulated by inhibin's negative feedback mechanism on the anterior pituitary. The activation of sertoli cells by FSH sustains spermatogenesis and stimulates inhibin B secretion (Zimmermann *et al*., 2015). In females, follicle stimulating hormone (FSH) initiates follicular growth, specifically affecting granulosa cells. FSH levels then decline in the late follicular phase due to concomitant rise in inhibin B. FSH helps to start the ovulatory cycle (Zimmermann *et al*., 2015).

MATERIALS AND METHODS
The trial was conducted at the Small Ruminant Section of the Livestock Investigation Division, National Veterinary Research Institute (NVRI), Vom. Vom is on latitude 8°45′ E and longitude 9°43′ North and on an altitude of 1280 metres (NRCRI, 2023). Sixteen (16) West African Dwarf bucks ranging between 9 and 12 months and with body weights ranging between 11.8 and 12.8kg were used for the trial. The experimental animals were treated against ecto-parasites and endo-parasites and also vaccinated against *Peste des petits ruminants* (PPR) prior to the trial. Fresh *Moringa oleifera* leaf plus their stalks/twigs were obtained from Vom environs, rinsed in clean water and drained properly. The leaves were carefully detached from the stalks/twigs and air dried at room temperature (27°C) until it became crispy to touch while retaining their greenish colouration and thereafter pounded in a mortar to smaller particles and stored in airtight containers until incorporation into the diets. Four concentrate rations were formulated to contain the *M. oleifera* leaf meal (MoLM) at 0, 10, 20, and 30% composition respectively (Table 1). The animals were first fed the concentrate ration containing graded levels of *M. oleifera* at the rate of 0.3kg per head per day in the morning before being released for grazing on controlled natural pasture. Kikuyu grass hay was provided as a supplement to cater for any shortfall during grazing. Fresh drinking water was provided *ad libitum* throughout the period of trial which lasted for 120 days. Mineral lick was also provided. Blood samples were collected from each of the four bucks in each treatment. Five (5) mls of blood was collected via the jugular vein of each animal using a syringe and needle at days 1, 60 and 120 respectively, of the trial. The blood collected was emptied into a labeled plain vial for serum biochemical analysis.Assays on

effect of diets containing graded levels of *M. oleifera* leaf meal on levels of follicle stimulating hormone (FSH) of the experimental animals were conducted using the method of (Dorfman, 1956) at the Molecular Biology Laboratory of NVRI, Vom with commercial Enzyme linked Immunosorbent Assay (ELISA) kit (CSB-E13630G, Cusabio Biotech Co. Ltd., Wuhan, China) in line with the manufacturer's instructions.

Table 1 Composition of Experimental Diets

	Experimental	Diets		
Ingredient (%)	**1**	**2**	**3**	**4**
Maize	10	5	5	5
Wheat offal	15	25	12	5
Maize offal	24.5	16	20.5	17.5
Rice bran	35.0	35.5	35	37
Groundnut cake	13	6.0	5	3
MoLM	0	10	20	30
Limestone	1	1	1	1
Bone meal	1	1	1	1
Common salt	0.5	0.5	0.5	0.5
Total	100	100	100	100
Calculated analysis				
ME (Kcal/kg)	2483	2312	2477	2501
Crude Protein (%)	16.0	15.9	16.5	16.9
Ether Extract (%)	6.92	6.75	6.91	6.10
Crude Fibre (%)	9.60	10.44	10.46	10.42
Calcium (%)	0.78	1.47	2.15	2.83
Available Phosphorus	0.44	0.48	0.46	0.44

MoLM = *Moringa oleifera* Leaf Meal
ME = Metabolizable energy

RESULTS AND DISCUSSION

Table 2: Follicle Stimulating Hormone levels of West African Dwarf bucks fed diets containing graded levels of *Moringa oleifera* leaf meal

Duration	Treatment					
	T_1(0%)	T_2(10%)	T_3(20%)	T_4(30%)	SEM	LoS
Day 1	2.67	3.00	2.70	2.90	1.26	NS
Day 60	6.00^a	4.50^{ab}	1.50^c	4.50^{ab}	0.76	*
Day 120	5.67^b	5.00^b	6.00^{ab}	7.00^a	0.26	*

^{a,b,c} Means on the same row with different superscript are significantly different (P<0.05)
SEM: Standard Error of Mean
LoS = Level of significance
*Significant (P<0.05)
NS = Not significant (P>0.05)

Values for follicle stimulating hormone levels in the bucks at Day 1 of the experiment were 2.67, 3.00, 2.70 and 2.90 for T_1, T_2 , T_3 and T_4, respectively. The values across the treatment means were not significantly different. At day 60 of the trial, values for follicle stimulating hormone levels of the bucks were 6.00, 4.50, 1.50, and 4.50 for T_1, T_2 , T_3 andT_4 respectively. The highest value observed in T_1 was statistically similar to the values in T_2 and T_4, but significantly different from the value in T_3. At day 120 of the experiment, values for follicle stimulating hormone levels of the bucks were 5.67, 5.00, 6.00 and 7.00 for T_1, T_2, T_3 andT_4 respectively. The highest value of 7.00 observed in T_4 was similar to T_3, but significantly higher (p<0.05) than values obtained for T_1 and T_2, in that order. Follicle stimulating hormone levels were positively affected in a dose dependent manner. Sanford *et al*. (1977) and Kishk(2008) observed increased volume of ejaculates in rams with maximal levels of serum testosterone, and that application of exogenous testosterone elicited sexual arousal in sexually inactive mixed-breed bucks (Luna-Orozco et al., 2012). However, De Oliveira-Souza (2011) observed no correlation between seminal testosterone levels and sperm characteristics in bulls. Armansyah *et al*. (2018) reported that increases in LH is linked to higher testosterone levels in bucks, while Ghorbani *et al*. (2018) observed differences in testosterone levels between goat breeds in response to supplementation with Selenium. Selenium acts by indirectly stimulating the anterior pituitary to release the follicle-stimulation hormone (FSH) and luteinizing hormone (LH) (Lukusa *et al*., 2017). Not much work has however been done on follicle stimulating hormones in male breeders in the tropics.

CONCLUSION

From the results obtained in this trial, it is recommended that up to 30% MoLM can be incorporated into concentrate diets for breeding bucks. Research on the quality and quantity of semen obtained will give further insight into the efficacy of the MoLM on reproductive performance of West African Dwarf bucks. Other leaf meals should be identified and utilized to enhance nutrition and reproductive performance of small ruminants, especially during the dry season when forage is scarce.

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