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Reproductive Performance of Rabbit Feed With Graded of Balsam Apple (*Momordica balsamina*)

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Abstract: *This research was carried out at the Demonstration farm, College of Agriculture, Umaru Ali Shinkafi Polytechnic Sokoto. Sixty (60) rabbits were purchased, constituting 45 does and 15 bucks. The animals were housed in 15 pens containing 3 Does (female rabbit) and 1 buck each. Body weight of the animal was taken at the beginning of the research, subsequently, the animal was weighed for body weight changes. The Does were also weighed during gestation, also the kid were weighed pre and post weaning. Research ingredient such as maize, soya beans, wheat offal's and salt were being purchased from the Sokoto central market. Fresh M. balsamina was sourced from villages close to the Polytechnic. Bone meal and blood meal were sourced from the abattoir, milled and separately bagged for diet formulation. M. balsamina was dried under shade in an open air and fed coarsely along with concentrate. Five experimental diet was fed along with cowpea hay as balsal diet. M. balsamina was included 5,10,15 and 20% inclusion levels and designed as diet l,2,3,4 and 5 respectively. All the experimental animals were tagged, allowed two weeks pre-conditioning period and medicated against common disease like coccidiosis. They are also given prophylactic coccidiostat (Ample-vitracycline) via drinking water at the rate of one teaspoon into 4liters of water.The data was generated and subjected to analysis of variance (ANOVA) using general linear model in SAS (2002). Duncan multiple range test was used in separating the means where significant difference was recorded.*

Key words: *Reproductive, Performance, Rabbit, Balsam-apple, ANOVA*

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INTRODUCTION

The animal protein content of a typical Nigerian diet is about 17% of the total protein requirement, which is lower than 60% in the United Kingdom and 71% in New Zealand (World Bank, 2001). Pagot (1992) predicted a decline in protein intake to 5.3g per head per day by the year 2010 which would be the lowest in the world. The myriad attempt aimed at solving low protein intake and poverty alleviation by Nigerian government still remains a mirage (Nworgu and Hammed, 2009).

The reasons behind this inadequate intake of animal proteins includes short supply of animal products (such as, meat milk and egg) due to poverty, general economic recession and low level of production of the indigenous breeds of animals (Ogunbosoye and Babayemi, 2010).

In order to maximize food production and meet protein requirements in Nigeria, viable options need to be explored and evaluated (Owen *et al*., 2008). Amongsuch alternatives is the use of livestock species such as rabbit that have great potential for improved production.

Improved rabbit production can help in boosting the protein supply in Nigeria. Animal protein production from cattle, sheep and goat require much capital as compared to rabbit which has small body size and short gestation interval. Fast-growing animals such as rabbits possess a number of features that might be of advantage to the small holder subsistence – type integrated farming especially in developing countries. The potentials and attributes of rabbit which makes it unique among farm animals include, high growth rate, high efficiency of conversion, short gestation period, high prolificacy, low cost of production, high quality (meat which includes low fat, sodium, and cholesterol levels). Rabbit meat has a high protein level (about 20.8%) and its consumption is bereft of cultural and religious biases. (Jibir *et al.,* 2014). Rabbit meat is of high quality, it is high in protein and low in fat content (Mailafia *et al*., 2010).

Increasing demand and subsequent high cost of conventional animal feed ingredients coupled with increase in human population has created the need for sustainable alternatives, particularly natural feed resources. The use of forages and other agricultural by-products such as *Tridax precumbens*, Moringa (*Moringa oleifera*) (Odeyinka *et al*., 2008), Acacia (*Acasia nilotica*) (Abdu *et al*., 2011), composite cassava meal (Ukachukwu *et al*., 2011), and*Commelina benghalensis*, *Leucerna leucocephala, Boerhavia diffusa,* Impomia triloba (Yakubu *et al*., 2012) have been documented.

The physiology of farm animals is affected by several factors, one of which is nutrition (Ajao *et al.,* 2013). Nutritional status of an individual is dependent on dietary intake and effectiveness of metabolic processes. These can be determined by combinations of chemical, anthropometric, biochemical or dietary methods (Bamishaiye *et al.,* 2009). Feed is an important aspect of livestock production. The importance of feed supplementation in animal production has increased in the last few years (Sharifi *et al.,* 2011). Increase in meat production can be achieved through proper nutrition and inclusion of feed ingredients at normal or required levels (Etim and Oguike, 2010). Addass *et al.* (2012) posited that nutrition affects blood values of animals. Processing of feed could have effect on haematological parameters of farm animals (Aya *et al.,* 2013). Dietary content affects the blood profile of healthy animals as reported by (Herbert, 2002 Kortuglu *et al.,* 2005).

Isaac *et al.* (2013) stated that haematological components which consists of red blood cells, white blood cells or leucocytes, Mean Corpuscular Haemoglobin and Mean Corpuscular Haemoglobin Concentration are valuable in monitoring feed toxicity, especially, with feed constituents that affect the blood as well as the health status of farm animals. Aro and Akinmoegun (2012) and Aro *et al.* (2013) reported that haematological parameters like haematocrit value, haemoglobin concentration, white blood cell count and red blood cell count are used in routine screening for the health and physiological status of livestock and even humans. Aderemi (2004) reported that haematological traits especially Packed Cell Volume (PCV) and Haemoglobin (Hb) are correlated with the nutritional status of the animal. Isaac *et al.* (2013) stated that RBC is involved intransport of oxygen and absorbed nutrient. Blood viscosities are however, also affected by nutrition, especially, when processed agro-

industrial wastes are taken into consideration. Livestock blood, for instance, may be subjected to hyperviscosity syndrome consequent on the feed they consume which may ultimately affect other blood values including haematocrit and erythrocyte sedimentation rate (Rosencranz and Bogen, 2006; Aro *et al.,* 2013).

M. balsamina L is commonly known as African pumpkin (or African cucumber), Balsam apple (or balsam pear) and locally called "Garahuni" (Hausa language), (Roger, 2007). It is a very good source of seventeen essential amino acids (Hassan and Umar, 2006). The plant is a perennial herb with soft stems and tendrils that climbs up shrubs, boundary fields and fences. The green leaves are deeply palmately 5-7 lobes about 12cm long with toothed and stalked margine. *M. balsamina* produces spindle shaped fruits (dark green when unripe and bright to deep orange when ripe). The seeds are embedded into a sweet edible red fleshy pulp testing like watermelon (Welman, 2004).

MATERIALS AND METHODS

The experiment was conducted at the College of Agriculture Demonstration farm, Umaru Ali Shinkafi Polytechnic Sokoto, Nigeria which is located at the main campus of the Polytechnic.

Experimental feed Sources

Experimental ingredients that were used in this experiment includes: maize, soya bean, wheat offal and salt which are all purchased from the Sokoto central market. Bone and Blood meal are sourced from the Sokoto metropolitan abattoir, milled and separately bagged for diet formulation. Fresh *M. balsamina* will be sourced from villages around Sokoto metropolis. The plant is dried under the shade in an open air.

Formulation of Experimental Diets

Four experimental diets were formulated and fed along with cowpea hay as basal diet. *M. balsamina* was included at 0, 2.5, 5 and 7.5%, inclusion levels. The diets were designated as diet 1, 2, 3, and 4 respectively in the experiment.

Table 1: Gross composition of the experimental diets (%)

		Treatment		
Ingresients%	1	2	3	4
M.balsamina	0	2.5	5.0	7.5
Maize	37.6	37.45	36.2	36.1
Cowpea hay	25.0	24.5	27.5	25.5
Soy bean	1.3	1.3	1.3	1.3
Meal				
Blood meal	10.0	9.5	9.5	9.5
Rice offal	12.4	11.2	6.7	6.8
Wheat offal	10.1	10.1	10.4	10.4
Bone meal	2.5	2.5	2.5	2.5
Premix	0.5	0.5	0.5	0.5
Salt	0.5	0.5	0.5	0.5
Total	**100**	**100**	**100**	**100**
Calculated Chemical Composition				
Energy (ME/Kg)	2500.09	2500.40	2500.99	2500.30

Experimental Animals and Their Management

All the experimental rabbits were tagged. They were dipped with cinatic powder base on the instruction given by the manufacturer. Daily washing of feeders and drinkers, and disinfecting of the pens were also carried out.

Thirty adult mixed breed rabbits comprising of Chinchilla, New Zealand white and Dutch with an average weight of 2kg were purchased, constituting of 40 does and 20 bucks. The animals were housed in 20 pens containing 2 does and 1 buck each. The pens were made of concrete floor and zinc roofing and was partitioned into 12 pens. The rabbits were fed twice a day (morning and evening). Clean water and experimental diet were provided *ad-libitum*, plastic bowls were used as feeders and drinkers.

Experimental layout

Randomized Complete Block Design (RCBD) was used with four treatments replicated three times with 3 animals per replicate making a total of 60 rabbits.

Data collection

The data collected was in three phases, as follows:

Phase I

Reproductive performance of rabbits was taken at the end of the experiment. Subsequently the number of gestations does and total number of kittens produced per pen was counted and recorded. each rabbit will be weighed weekly. Feed intake will be recorded daily by subtracting the left over from the quantity of feed offered to the animals the previous day. Feed conversion ratio will be determined using feed intake and body weight gain.

Feed intake (g/rabbit) = Feed offered (g) – Leftover (g)

Feed conversion ratio (FCR) FCR = DM intake (g)/ live weight gain (g)

Average daily gain (ADG) = (final body weight-initial body weight)/total days of the experiment.

Phase II

Haematological assay

At the end of the experiment, all the males (4 males/ treatment) were humanely slaughtered for collection of 10 ml whole blood for haematology. Each 10ml blood sample was collected in a labelled ethylene-diamine tetra acetic acid (EDTA) bottle which serve as anti-coagulant Labeled samples (5ml each) and taken to the haematology laboratory, Usmanu Danfodiyo University Teaching Hospital Sokoto, for analysis.

Analytical technique

Analytical techniques are methods used in determining the following set parameters:

Haematological indices

Packed cell volume (PCV) and haemaglobin (Hb) concentration was determined by the microhematocrit and cyanmethaemaglobin methods respectively as described by Ewuola and Egbunike(2008). Erythrocyte was determined by the haematocytometry method as described by Ewuola and Egbunike (2008). Total white blood cells (WBC) and differential count was determined as described by Coles (1989). Erythrocyte indices including mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCH) and mean corpuscular haemoglobin concentration (MCHC) was derived from the values obtained from red blood cells (RBC) count, haemaglobin concentration and PVC values (Mitruka and Rawnsley, 1977; Lamb, 1981; Jain 1986; Duncan *et al*., 1994). Derived as follows:

$$\text{MCV (fl)} = \frac{\text{PCV}}{\text{RBC Count in } 10^6/\text{mm}^3} \times 10$$

$$\text{MCH (pg)} = \frac{\text{Hb (g/dl)}}{\text{RBC (in } 10^6/\text{mm}^3\text{)}} \times 10$$

$$\text{MCHC (g/dl)} = \frac{\text{Hb (g/dl)}}{\text{PCV (\%)}} \times 10$$

Data Analysis

The data generated was subjected to analysis of variance (ANOVA) using general linear model in SAS, (2000). Least significant difference (LSD) was used in separating the means where significant differences existed among treatments at 5% probability level.

RESULTS AND DISCUSSION

Table 2: Gross composition of the experimental diets (%)

	Treatment			
Ingredients %	**1**	**2**	**3**	**4**
M. balsamina	0	2.5	5.0	7.5
Maize	37.6	37.4	36.2	36.1
Cow pea hay	25.0	24.5	27.5	25.0
Soy bean meal	1.3	1.3	1.3	1.3
Blood meal	10.0	9.5	9.5	9.5
Rice offal	12.4	11.2	6.7	6.8
Wheat offal	10.1	10.1	10.4	10.4
Bone meal	2.5	2.5	2.5	2.5
Premix	0.5	0.5	0.5	0.5
Salt	0.5	0.5	0.5	0.5
Total	**100**	**100**	**100**	**100**
Energy (ME/Kg)	2500.09	2500.40	2500.99	2500.30
CP (%)	17.40	17.12	17.40	17.40
CF (%)	11.90	12.14	13.50	13.07

Chemical Analysis of Experimental Diet

Formulated experimental diets were analyzed for proximate components (crude protein, nitrogen free extract, crude fiber, ether extract, ash, energy and dry matter), as outlined by the Association of Official Analytical Chemists AOAC (2005).

Also, in the course of the experiment the test ingredient, *M. balsamina* was evaluated for toxins such as alkaloids, saponins and tannins content as outlined by AOAC (2005).

Experimental Animals and their Management

All the experimental rabbits were identified, allowed two weeks pre-conditioning period to acclimatize them, and medicated against coccidiosis and mange. They were given prophylactic coccidiostat (Ampro-vitracycline), via drinking water based on manufacture's recommended dose. They were dipped with cinatic powder base on the instruction given by the manufacturer. Daily washing of feeders and drinkers, and disinfecting of the pens were also carried out.

Thirty-six adult mixed breed rabbits comprising of Chinchilla, New Zealand white and Dutch with an average weight of 2kg were purchased, constituting 24 does and 12 bucks. The animals were housed in 12 pens containing 2 does and 1 buck each. The pens were made of concrete floor and zinc roofing and were partitioned into 12 pens. One m^2 per rabbit was used, based on Wayne (2009).

The rabbits were fed twice a day (morning and evening). Clean water and experimental diet were provided *ad-libitum*, plastic bowls were used as feeders and drinkers.

Chemical Composition of Experimental Diet

Proximate composition of the experimental diet showed that crude fibre is higher for treatment 4 and 3. The dry matter and nitrogen free extract composition of the diet decreased with increasing level of *M. balsamina.* The value for energy and crude protein were not comparable between the treatments (Table 3). Also, the phyto-chemical analysis of the test ingredient (*M. balsamina*) showed that there were some anti-nutritional factors present (Table 4).

The initial diet formulation was 0, 5, 10 1nd 15% inclusion levels of *M. balsamina*. In the course of the experiment, problem of abortion was encountered in treatment 3 and 4 at the second week of the experiment, which was attributed to the high level of the test ingredient. The diet was then amended by reducing the levels of the test ingredient to 0, 2.5, 5, and 7.5% inclusion levels.

Table 3: Proximate Composition of the Experimental Diets

Parameter	Treatment			
	1	2	3	4
Crude protein	17.34	18.06	15.36	16.08
Ether extract	2.86	2.78	4.75	3.39
Moisture	5.00	4.08	5.06	5.50
Fibre	8.03	9.10	10.82	12.88
Ash	9.85	9.95	10.95	8.35
Dry matter	95.00	95.92	94.94	94.50
Nitrogen free extract	56.92	56.03	53.06	53.80
Energy kcal/kg	2867.73	2856.67	2813.97	2755.26

Table 4: Phyto-chemical Components of *M. balsamina*

Parameter	Results
Flavonoids	-
Tannins	+
Saponin	+
Glycoside	+
Cardiac Glycoside	-
Steroid	+
Alkaloids	+
Saponin glycoside	+
Anthraquines	-
Phytate	4.65mg%
Oxalate	5.4mg%
Cyanide	0.06mg%
Tannins	1.89mg/ml
Nitrite	1.3ug/ml

Reproductive Performance of Rabbit Fed Graded with *M. balsamina*

Results indicate there is significant difference in reproductive performance between Rabbits fed with *M. balsam* and control group. The results shows that the higher the content of *M.balsam* in the feed the higher the number of kittens in a pen.

Table 5: Reproductive Performance of Rabbits Fed Graded Levels of *M. balsamina*

	Treatments			
Parameter	1	2	3	4
Feed intake (g/day)	228.56[a]	215.70[ab]	193.35[b]	186.14[b]
Number of gestation does	6	7	9	2
Number of kittens	10	14	17	3

CONCLUSION

The findings in this research concluded that *M.balsmina* is a herb that is rich in amino acids minerals. Hence, inclusion of it in the diet of rabbits indicates the increase in the reproductive performance of rabbits.

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