Ghanaian Journal of Animal Science
Journal of the Ghana Society of Animal Production
GJAS, Volume 17, Number 1, 2026

Prenatal and Postpartum Performance of Rabbit does and Kits Fed Levels of *Vernonia amygdalina* Leaf Meal

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https://dx.doi.org/10.4314/gjansci.v17i1.3

ABSTRACT

Inclusion of unconventional feed resources in rabbit diets presents a promising option for improving performance of breeding does. This study was carried out to assess the effect of dietary levels of Vernonia amygdalina leaf meal on the performance of breeding does and their kits. The experimental diets were formulated using 0, 5, 10 and 15% Vernonia amygdalina leaf meal (VLM)/ kg diet along with other feed ingredients. Twenty breeding does with their kits were allotted into four groups using a Completely Randomised Design and fed the diets for ten weeks. The feed intake, conception rate, gestation length, litter size and weight at birth; postpartum weight of the dams, weekly litter size and weight, milk yield and survival rate at 3 weeks were recorded and subjected to statistical analysis at p<0.05. Feed intake was similar among the rabbit groups during gestation and lactation; a 100% conception rate was recorded for all groups, with no adverse effect on body weights. The maternal weight change differs significantly (p<0.05) during lactation. Rabbit does fed diet with 15% VLM had the least average litter size. The average litter weight at birth was similar across the groups. Litter size decreased significantly (p<0.05) in the VLM5 and VLM15 groups postpartum. The highest milk yield (237.48ml) and survival rate (89.23%) was recorded in the 0% VLM group. VLM significantly depressed milk yield in VLM10 and VLM15 groups. Vernonia amygdalina leaf meal influenced the performance of breeding rabbit does and kits in a dose-dependent manner. Low VLM levels had minimal effects on indices assessed, however higher levels reduced milk yield and kit survival. Its use in breeding rabbit especially during lactation should be limited.

Keywords: *breeding rabbits, conception rate, prenatal performance, lactation performance, kits survival*

INTRODUCTION

The rising cost of major feed ingredients driven by competition between humans and animals for grains and protein-rich feedstuff has intensified the search for sustainable cost-effective feed resources for efficient animal production. Non-conventional feed resources of plant origin have offered promising opportunities for enhancing livestock productivity. However, performance of breeding rabbits along with their kits remains a major factor that determine the productivity and profitability of rabbit production systems (Mukaila, 2003). Poor nutrition in gestating rabbits can impair ovarian functions and fetal development (Arias-Alvarez *et al*., 2026). Reduced weight, depressed immunity, low milk yield, delayed rebreeding and high pre-weaning mortality of young animals are possible effects of

inadequate nutrition during lactation in farm animals (Chadio *et al*., 2014; Assan, 2018; Thornburg and Valent, 2024). Also, the highest mortality usually occurs within the first two weeks postpartum and continues at varying degrees in rabbit population (Belabbas *et al*., 2023). Therefore, providing diets that meet the elevated physiological requirements of breeding does and support kits performance without compromising performance is of utmost importance.

In livestock production, phytogenic and unconventional feedstuffs have been increasingly explored due to their growth promoting and therapeutic potentials (Adeyemi *et al.,* 2022: Okyere *et al*., 2024; Wang *et al*., 2024, Adeyemi et al., 2025). *Vernonia amygdalina* leaf (bitter leaf) one of such feedstuff is widely distributed across tropical Africa and used for its medicinal property in treating gastrointestinal disorders, microbial infections, among others (Oyeyemi *et al*., 2018, Degu *et al*., 2024). Its nutritional profile as a rich source of protein, some essential vitamins A, C, E and minerals such as phosphorus and calcium make it suitable to support kits development and milk synthesis in female animals. Also, *V. amygdalina* leaf has been extensively studied for its rich phytochemical profile, including sesquiterpene lactones, flavonoids, saponins, tannins, and alkaloids. These bioactive compounds have been associated with hypoglycemic, antimicrobial, antioxidant and anti-inflammatory properties (Edo *et al*., 2023). *Vernonia amygdalina* leaf can be processed and used in different forms (Degu *et al*., 2024). Aqueous extract of *Vernonia amygdalina* leaves had anti-helminthic property in goats (Adediran and Uwalaka 2015, Adebayo *et al*., 2022) and hepatoprotective effect in poultry thereby mitigating oxidative stress (Tokofai *et al*., 2021).

Leaf meals can be utilized by rabbits because they have well-developed caecum that enhance digestion of fibrous diets through microbial fermentation. Most existing studies on the use of leaf meals report more on growth performance, general health indices and carcass characteristics, in some livestock species (Daramola *et al*., 2024, Olosunde and Odeyinka, 2024), with limited emphasis on reproductive physiology. Nutritional adequacy directly influences reproductive performance of livestock especially during the breeding phase (Byrne and Kenny, 2025). Inclusion of VLM at 10kg/100kg diet of male rabbits improved weight gain with no adverse effect on reproductive parameters (Adeyemi *et al*., 2022). Young rabbits are born hairless with total dependence on maternal milk during the early stage of life which is influenced by maternal nutrition (Assan 2018). The nutritional, antioxidant and anti-inflammatory properties of *Vernonia amygdalina* leaf may be beneficial to reproduction in female rabbits when oxidative stress and inflammatory processes can impair ovulation, recovery and lactation; this has not been extensively explored or reported. Hence, the need to assess its influence on performance indices in female breeding rabbits. This study therefore evaluates the effect of VLM on gestational indices, growth performance, milk yield, and survival of rabbit offspring postpartum. The findings will provide information on maternal performance and viability of offspring using VLM as an unconventional feedstuff such as *Vernonia amygdalina* leaf meal.

MATERIALS AND METHODS

Study Location

The study was carried out at the Teaching and Research Farm, Obafemi Awolowo University, Ile-Ife located at approximately latitude 07°26'-07°33'N and longitude 004°30'-004°35'E within the agroecological zone in Southwest Nigeria. The experimental site had a daily temperature that ranged from 24.4 to 34.7°C during the raining season when this study was carried out.

Preparation of Test Ingredient and Management of Experimental Animals

Fresh *Vernonia amygdalina* leaves were harvested from research plots within study location, air dried under shade for 5-7 days and then milled to obtain the leaf meal. Samples of the leaf meal were subjected to proximate analysis using the method of AOAC (2010). The leaf meal was added to other feedstuff at 0, 5, 10 and 15 % levels to compound the experimental diets used for this study (Table 1). Twenty (20) breeding does of heterogeneous stock with an average weight of 2.2kg were procured from reputable sources within Ile-Ife Nigeria, housed individually in wire mesh cages; acclimatized for 2 weeks to adapt to the experimental feed. The

does were supplied the experimental diets at 120g/rabbit/day and mated to viable males. After parturition, 150g of feed was provide to each doe daily and clean water was provided *ad-libitum* for 10weeks of the study. The rabbits were carefully handled throughout the experiment by adhering strictly to the guidelines of the Animal Ethics Committee, Department of Animal Sciences, Faculty of Agriculture, Obafemi Awolowo University, Ile-Ife, Nigeria.

Data Collection

The daily feed intake of the dams was estimated as amount of feed consumed after weighing the leftover every morning. Conception rate (number of does that conceived / number of does mated multiplied by 100), gestation length (number of days from mating till parturition), litter size (number of kits born) and litter weight at birth were recorded. The does were weighed before mating, after parturition and at 3 weeks postpartum. The litter size was monitored weekly from birth till 3 weeks old. The kits were weighed at birth and weekly for 3 weeks. Weekly body weights were measured using digital weighing scale. Apparent milk yield at 21days post-partum was estimated as 1.18 multiplied by the difference between live weight of kits at 21days and live weight of kits at day old (Lebas et al 1986). Survival rate was measured in percentage to estimate the number of kits alive from birth till 3 weeks post-partum using the formula below:

$$\text{Survival rate (\%)} = 100 - \left\{ \frac{\text{No. of kits at birth - No. of kits at 3 wks old}}{\text{Number of kits at birth}} \times 100 \right\}$$

Statistical Analysis

Data obtained on feed intake, gestation length, litter size and litter weight at birth, weights before mating, after parturition and at 3 weeks postpartum; and milk yield were analysed using one-way Analysis of Variance (ANOVA). The general linear model (GLM) procedure of SAS (2009) software was used for this statistical analysis. Means were separated using Duncan Multiple Range Test at a probability level (p) of $p<0.05$. Conception rate and survival rate were analysed using descriptive statistics at values were expressed in percentage.

RESULTS AND DISCUSSION

Proximate Composition of *Vernonia amygdalina* leaf meal and Experimental Diets

The proximate composition of *Vernonia amygdalina* leaf meal and the experimental diets used in this study is presented in Table 2. Increase in VLM levels resulted in higher crude protein and crude fiber in the diets. Although *Vernonia*

Table 1: Gross Composition of Experiment diets (%)

Ingredients	VLM0	VLM5	VLM10	VLM 15
Maize	20	20	20	20
Soya bean meal	6	6	6	6
Wheat bran	30	25	20	15
Groundnut cake	8	8	8	8
Palm kernel cake	12	12	12	12
Corn bran	8	8	8	8
Rice bran	12	12	12	12
VLM	0	5	10	15
Others	4	4	4	4
Total	**100**	**100**	**100**	**100**

VLM – Vernonia amygdalina leaf meal; Others: bone meal 2.5, Lysine 0.25, Methionine 0.25, Premix 0.5, Salt 0.5

Table 2: Proximate composition of *Vernonia amygdalina* leaf meal and the Experimental Diets

Parameters (%)	VLM	VLM0	VLM5	VLM10	VLM15
Ash	12.34	10.49	10.44	10.51	10.81
Moisture	16.56	8.85	9.16	10.83	10.18
Crude fibre	6.65	9.32	10.72	10.86	11.39
Crude protein	30.32	16.78	17.72	18.38	18.64
Ether extract	1.61	2.04	0.74	1.87	1.53

VLM – Vernonia amygdalina leaf meal, VLM0 – diet with no VLM, VLM5– diet with 5%VLM, VLM10 – diet with 10%VLM, VLM15 – diet with 15%VLM

amygdalina leaf meal contained relatively high crude protein (30.32%), the crude protein of the experimental diets increased only slightly with increasing inclusion levels due to dilution effects from other dietary ingredients and the relatively low inclusion rates (5–15%). However, the crude protein content of the experimental diets ranged within 17 - 18 % recommended for lactating rabbits (de Blas and Wiseman, 2003; Halls, 2010). Dietary protein plays a central role in follicular activities, foetal development, milk synthesis in lactating does, supports growth and survival of suckling kits, as milk production is closely linked to the availability of metabolizable protein and essential amino acids (Byrne and Kenny 2025). However, its effectiveness depends on overall dietary balance, nutrient utilization, and protein–energy interactions. The slightly higher crude fibre in the VLM diets may be attributed to the fibre level in the leaf meal. The ash contents of all the diets were similar while there were variations in the ether extract content of the diets. However, all the diets met the nutrient requirement for lactating and gestating does (Halls, 2010).

Feed Intake in breeding does fed levels of *Vernonia amygdalina* leaf meal

It is essential that female rabbits eat sufficiently to meet the nutrient required for body weight maintenance, efficient reproduction and development of their offspring. Dietary levels of VLM had a non-significant ($p>0.05$) effect on feed intake across the groups during gestation and lactation (Figure 1). The average daily feed intake ranged from 117.30 to 119.58 g/rabbit during gestation with the highest intake in the rabbits fed 15% VLM while a range of 141.06 to 147.22 g/rabbit was recorded postpartum. The non-significant effect of VLM on feed intake across the groups suggest that increasing levels had no adverse effect on acceptability and consumption of the diets. This relates well with the improved intake of VLM diet reported by Adugna *et al*. (2023) The finding of this study is at variance with the report of Vidjannagni *et al.* (2018), who recorded reduced feed intake in breeding rabbits fed diets containing neem leaf meal. This difference may be attributed to variations in phytochemical composition, as neem leaves contain higher levels of bitter limonoids and stronger anti-feedant compounds compared to *Vernonia amygdalina*, which is generally more acceptable to rabbits at moderate inclusion levels. The feed intake recorded in this study falls slightly above the minimum recommendation of 5% of body weight for rabbit production which could efficiently support low-cost maintenance under tropical conditions.

Prenatal Performance of breeding does

As shown in Figure 2, 100% conception rate was recorded in all groups. This suggests that levels of *Vernonia amygdalina* leaf meal had no detrimental effects on ovulation, fertilization, or embryonic development. Levels of VLM had a non-significant effect on the prenatal parameters assessed (Table 3). The weight of the rabbits was similar across the groups. Diets with VLM had no deleterious effect on gestation length (GL), litter size and litter weight at birth. This implies that the level of *Vernonia amygdalina*

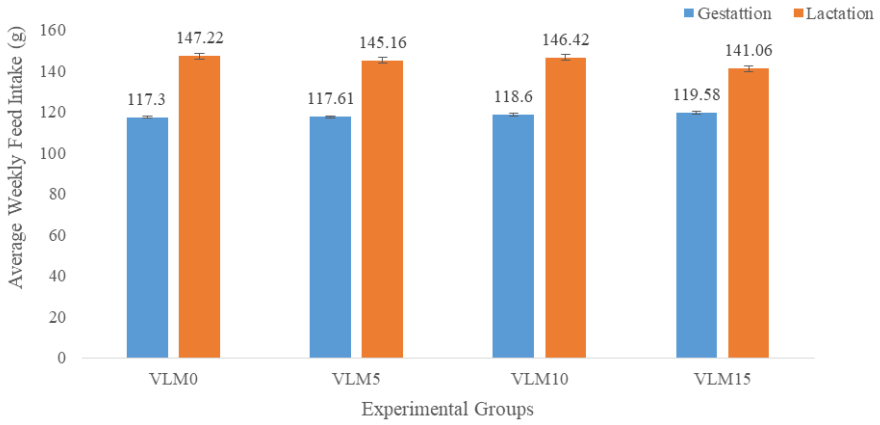


Fig. 1: Feed intake of breeding rabbits fed *Vernonia amygdalima* leaf meal during gestation and lactation

leaf meal used in this study had no adverse effect on survival of fetus till parturition and neither did it have abortifacient effect in the female rabbits as no abortion was recorded. This is at variance with the findings of Gesto *et al*., 2022 who reported varying conception rates and longer gestation length in breeding rabbits fed diet with inclusion levels of *Ipomea asarifola* leaf meal.

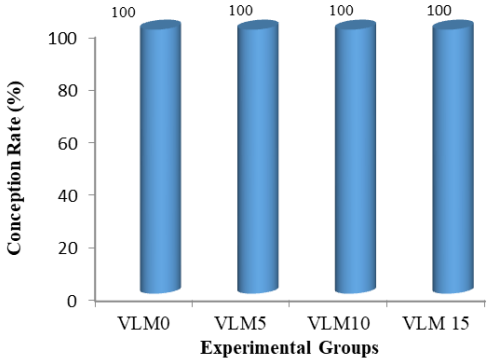


Figure 2: Conception rate of female rabbits fed *Vernonia amygdalina* leaf meal

Postpartum Performance of breeding does fed VLM diets

Table 3 further shows performance of rabbit does and kits fed levels of *Vernonia amygdalina* leaf meal postpartum. The performance of the rabbits does and kits fed *Vernonia amygdalina* leaf meal presented showed body weight changes in the does, litter size progression, growth performance of kits from birth to three weeks of age. Rabbit does have elevated nutritional demands postpartum, thus insufficient nutrient intake during this phase can depress milk production and kit survival (Castellini *et al*., 2010; Assan, 2018). In the current study, levels of VLM had no adverse impact on the average weekly weights of does after parturition and within the first three weeks postpartum. However, a 60g weight change was recorded in the VLM5 group within the 1st 3 weeks postpartum which was significantly ($p<0.05$) lower than 330 – 440 g recorded in VLM0, VLM10 and VLM15 groups. This suggests that dietary levels of VLM up to 5% had no negative impact on feed utilization and body weight maintenance in the lactating rabbits. This corroborates the reports on the nutritive potential of *V. amygdalina* leaves when properly processed and incorporated into diets of livestock (Adebayo *et al.,* 2022; Wang *et al*., 2024; Ehielu *et al*., 2024). Dietary levels of VLM significantly ($p<0.05$) reduced litter size at

weeks 2 and 3 postpartum with higher litter size in VLM0 and VLM10 group. The fairly consistent litter size observed in the VLM10 group compared to those fed other VLM implies that the rabbits fed 10% VLM harnessed the nutritional benefits of the leaves with minimal adverse impact of the phytochemicals. Dietary VLM had no significant effect on average birth weight and kits body weight at three weeks of age.

Milk Yield of does and Postpartum Response of kits to Dietary VLM Level

Figure 3 presents an inverse relationship between VLM levels and milk yield. Levels of *Vernonia amygdalina* leaf meal had significant $p<0.05$ influence on milk yield in the does. Rabbits fed VLM0 had a significantly ($p<0.05$) higher milk output (237.48 ml) with a similar value (235.17 ml) in the VLM5 group. Does fed higher VLM levels (10 and 15 %) had significantly lower milk yield (192.35 - 193.35 ml). This suggests that incorporation VLM at 5% of the total

Table 3: Prenatal Performance of rabbit does fed *Vernonia amygdalin*a leaf meal

Parameters	VLM0	VLM5	VLM15	VLM15	SEM	p value
Initial weight of does (kg)	2.27	2.22	2.19	2.13	0.31	0.61
Weight of doe after parturition (kg)	2.53	2.48	2.49	2.40	0.07	0.60
Gestation length (days)	29.50	30.00	30.00	29.50	0.49	0.57
Average litter size at birth	6.25	4.33	5.75	4.20	0.40	0.14
Average litter weight at birth (g)	42.58	42.20	43.15	42.56	1.09	1.00

VLM – Vernonia amygdalina leaf meal, VLM0 – diet with no VLM, VLM5 – diet with 5%VLM, VLM10 – diet with 10% VLM, VLM15 – diet with 15%VLM

Table 4: Postpartum performance of rabbit does and kits fed levels of *Vernonia amygdalina* leaf meal

Parameters	VLM0	VLM5	VLM10	VLM15	SEM	p value
Average weight of doe at parturition (kg)	2.53	2.48	2.49	2.40	0.07	0.60
Average weight of doe at 3weeks postpartum (kg)	2.20	2.42	2.05	2.06	0.10	0.66
Weight change in does (kg)	0.33^{b}	0.06^{a}	0.44^{b}	0.34^{b}	0.13	0.03
Litter size at day old	6.25	4.33	5.75	4.20	0.40	0.14
Litter size at 1week	5.75	3.67	5.50	4.25	0.35	0.11
Litter size at 2weeks	5.75^{a}	3.33^{b}	4.75^{a}	3.25^{b}	0.36	0.02
Litter size at 3weeks	5.50^{a}	2.67^{b}	4.75^{a}	3.25^{b}	0.36	0.01
Average birth weight (g)	42.58	42.20	43.15	42.56	1.09	1.00
Average weight at 3weeks (g)	242.75	241.33	209.50	206.00	7.33	0.13

VLM – Vernonia amygdalina leaf meal, VLM0 – diet with no VLM, VLM5 – diet with 5%VLM, VLM10 – diet with 10%VLM, VLM15 – diet with 15%VLM
[a,b,c] Means in the same row with different letters are significantly different at $p<0.05$

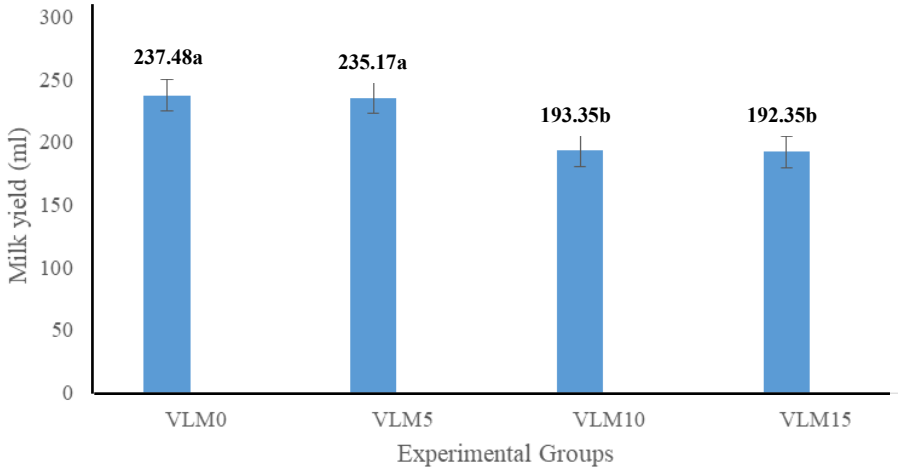


Fig. 3: Milk yield of rabbit does fed *Vernonia amygdalima leaf meal postpartum*

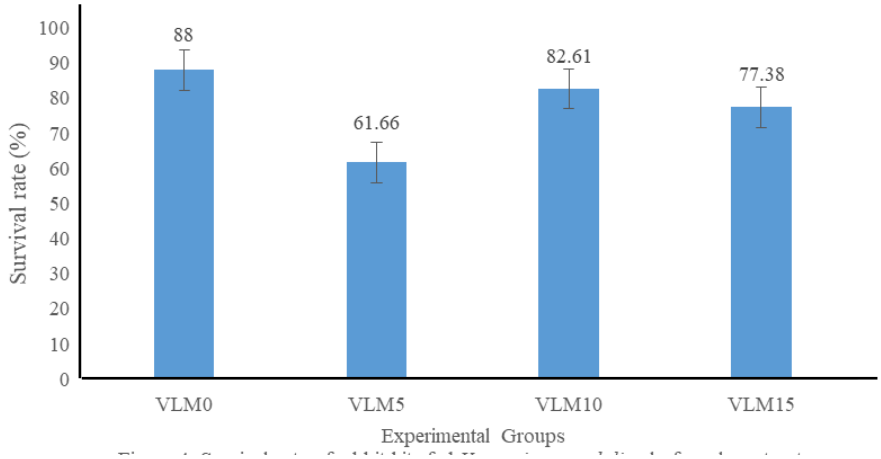


Fig. 4: Kits survival of rabbit does fed *Vernonia amygdalina* leaf meal postpartum

diet did not significantly alter lactation performance in the rabbits, indicating the ability of the does to tolerated VLM at this level without deleterious effects on milk production. The doe milk yield in this study (192.35 – 237.48 ml) was higher than 116.61 - 136.73g reported by Akinmuyisitan *et al*. (2015) and lower than 580.02 - 720.1 g reported by Gesto *et al* 2023. This implies that dietary components may influence lactation in rabbits by altering some hormones such as prolactin that enhances milk secretion and oxytocin stimulates milk letdown. Despite higher milk yield in does fed VLM5%, this did not reduce mortality of the kits (Figure 4). The lower survival rate of kits from does fed VLM diets may be associated with factors beyond milk availability which are not assessed in this study. Overall, rabbit kits from VLM0 had the highest body weight at 3 weeks post-partum (242.75g), milk yield (237.48ml), with the highest survival rate (89.23%). As much as unconventional feedstuff may offer economic benefits by reducing feed costs and demand for conventional feed ingredients for livestock production,

its inclusion in the diet of breeding does must be carefully considered to prevent negating its potential. Reduction in milk yield at higher inclusion levels may be associated with dietary effects of VLM, although the exact mechanism was not evaluated in this study.

CONCLUSION

The study showed that VLM could be fed to gestating rabbits up to 15% with no deleterious effect on feed intake, body weight and gestation indices. Levels of VLM may depressed postpartum performance in breeding rabbit, as higher inclusion levels depressed milk yield and kit survival rate; and lower survival rate despite higher milk yield in the VLM5 group *Vernonia amygdalina* could serve as a sustainable cost-effective feed resources for efficient breeding in rabbit production, however its use during lactation should be minimal or avoided.

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