Effects of Breeding Intervals and Parity Order on Growth and Reproductive Indices of Hyla Rabbit in Southwestern Nigeria

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Abstract

A study was carried out in southwestern Nigeria to assess the impact of breeding intervals and parity order on the growth and reproductive capabilities of Hyla rabbits. Twenty-four 6-month-old rabbits, with an average weight of 2600 ± 100 g, consisting of eight bucks and sixteen does, were completely randomised into four rabbits per treatment and randomly assigned four experimental treatments: T_1 (two-week), T_2 (four-week), T_3 (six-week), and T_4 (eight-week) breeding intervals. A doe served as a replicate for each treatment, and each treatment had four parities (P_1-P_4). The experiment lasted over 15 months. The results showed that number of matings per conception (NMC) was decreasing ($p<0.05$) as breeding interval and parity were increasing. Pregnancy weight gain in week 1 (70.50), week 2 (66.67), and week 3 (93.50) was higher ($p<0.05$) in T_3. Average litter weight at birth (304.80 g), at weaning (2576.40 g) and at the 12th week (5494.55 g), average weight at weaning (546.75 g), and at the 12th week (1318.30 g) including average litter size at birth (5.60) and at the 12th week (4.10), were higher ($p<0.05$) in T_3. Average litter weight at birth (324.38), at weaning (2684.00), and at the 12th week (5668.00), average weight at weaning (537.00 g) and at the 12th week (1337.00 g), were higher ($p<0.05$) in P_3. In addition, average litter size at birth (6.10), at weaning (5.50), and at the 12th week (4.25) were higher ($p<0.05$) in P_3. However, average litter (%) at weaning (94.90) and at the 12th week (85.10) were higher ($p<0.05$) in P_4. While average mortality (%) in both weaning (20.42) and the 12th week (32.89) was higher in P_2. NMC, gestation length, and average weight at birth were not influenced by both breeding interval and parity order. Average litter size at weaning and stillbirth were not affected by breeding interval and parity, respectively. It was concluded that does in 6-week interval performed better in growth and reproductive parameters measured. Parity order increased from first to third before declining except in average litter (%) at weaning and at 12th week, where it increased up to fourth parity. Therefore, a six-week breeding interval up to the third parity was recommended to Hyla rabbit breeders or keepers for the most favourable production, especially on a commercial scale.

Key words: Hyla rabbit, breeding intervals, parity order, growth indices, reproductive indices.

Running title: Breeding intervals, parity order on growth, reproductive indices of Hyla rabbit

Effets des intervalles de reproduction et de l'ordre de parité sur les indices de croissance et de reproduction du lapin Hyla dans le sud-ouest du Nigéria

Résumé

Une étude a été menée dans le sud-ouest du Nigeria pour évaluer l'impact des intervalles de reproduction et de l'ordre de parité sur la croissance et les performances reproductives des lapins Hyla. Vingt-quatre lapins âgés de 6 mois, avec un poids moyen de 2600 ± 100 g, comprenant huit mâles et seize femelles, ont été répartis de manière aléatoire en quatre traitements expérimentaux : T_1 (intervalle de 2 semaines), T_2 (4 semaines), T_3 (6 semaines) et T_4 (8 semaines). Chaque traitement comprenait quatre parités (P_1-P_4), et l'expérience a duré plus de 15 mois. Les résultats ont montré que le nombre de saillies par conception (NMC) diminuait ($p < 0,05$) avec l'augmentation de l'intervalle de reproduction et de la parité. Le gain de poids gestationnel en semaine 1 (70,50 g), semaine 2 (66,67 g) et semaine 3 (93,50 g) était plus élevé ($p < 0,05$) dans T_3. Le poids moyen des portées à la naissance (304,80 g), au sevrage (2576,40 g) et à la 12ème semaine (5494,55 g), ainsi que le poids moyen individuel au sevrage (546,75 g) et à la 12ème semaine (1318,30 g), étaient supérieurs ($p < 0,05$) dans T3. De même, la taille moyenne des portées à la naissance (5,60) et à la 12ème semaine (4,10) était plus élevée ($p < 0,05$) dans T_3. Concernant l'ordre de parité, le poids moyen des portées à la naissance (324,38 g), au sevrage (2684,00 g) et à la 12ème semaine (5668,00 g), ainsi que le poids moyen individuel au sevrage (537,00 g) et à la 12? semaine (1337,00 g), étaient plus élevés ($p < 0,05$) en P_3. La taille moyenne des portées à la naissance (6,10), au sevrage (5,50) et à la 12ème semaine (4,25) était également supérieure ($p < 0,05$) en P3. En revanche, le taux moyen de survie au sevrage (94,90 %) et à la 12ème semaine (85,10 %) était plus élevé ($p < 0,05$) en P_4, tandis que la mortalité moyenne au sevrage (20,42 %) et à la 12ème semaine (32,89 %) était plus élevée en P_2. Le NMC, la durée de gestation et le poids moyen à la naissance n'ont pas été influencés par l'intervalle de reproduction ni par l'ordre de parité. La taille moyenne des portées au sevrage et le taux de mortinatalité n'ont pas été affectés respectivement par l'intervalle de reproduction et l'ordre de parité. Il a été conclu que les lapines soumises à un intervalle de reproduction de six semaines (T_3) présentaient de meilleures performances en termes de croissance et de reproduction. Les performances augmentaient de la première à la troisième parité avant de décliner, sauf pour le taux de survie au sevrage et à la 12ème semaine, qui augmentait jusqu'à la quatrième parité. Ainsi, un intervalle de reproduction de six semaines jusqu'à la troisième parité est recommandé pour les éleveurs de lapins Hyla afin d'optimiser la production, notamment à l'échelle commerciale.

Mots-clés : Lapin Hyla, intervalles de reproduction, ordre de parité, indices de croissance, indices de reproduction.

Introduction

Domestic rabbits are jumping mammals of medium size with long legs, big ears, and short tails (Mullan and Saunders, 2018; McBride and Magnus, 2022). As non-ruminants, they belong to the phylum Vertebrata, class Mammalia, family Leporidae, genus Oryctolagus, and species Cuniculus of the Kingdom Animalia (Petrescu-Mag *et al*., 2019). Due to their small size, short gestation period, high reproductive potential, rapid growth rate, genetic diversity, and ability to use forage and by-products as major diet components, rabbits (*Oryctolagus cuniculus*) are preferred for their functional role of providing people with high-protein, low-cholesterol meat at a lower cost and risk than other types of livestock (Hanan *et al*., 2014). Additionally, rabbit dung may be useful for producing biogas and as ruminant feed (Pier *et al*., 2014), and rabbit skin may be utilized for cottage industries and for the production of toys, crafts, and clothes (Akinsola *et al*., 2013). As minilivestock that can produce meat, Hyla rabbits are a good way to assist fill the protein gap in many developing countries (Khalil *et al*., 2016; Sikiru *et al*., 2020; Goswani *et al*., 2025).

Breeding regimens for rabbits are frequently based on 7-day intervals for record-keeping convenience. Cutting the breeding interval short is a workable strategy to boost the quantity of weaned kits produced (Khan *et al*., 2014). It is possible for rabbits to mate 24 hours after kindling since they are induced ovulators (Oseni, 2012). Because of intensive breeding methods, however, more does may be removed annually due to "burn out." Even if early re-mating is a substantial possibility, neonatal death remains one of the main problems limiting rabbit productivity (Khan *et al*., 2014; Awojobi and Adejumo, 2014).

Short re-breeding intervals after kindling, however, may not allow the does' body reserves to fully recuperate. This could lead to a decrease in fertility, milk production, and litter weight during weaning, as well as an increase in kit mortality (Oseni, 2012). Some of the most important indicators of rabbit growth and reproductive performance that determine the productive capacity are litter size, birth weight, growth, and mortality rate; these variables are connected to parity order (Malta Pollesel *et al*., 2020).

Choosing and adopting a good time to mate following parturition and identifying suitable parity are therefore challenges in the management of domestic rabbits, particularly in an intensive production system. There may be a chance to boost rabbit farming productivity with the right re-mating interval and rabbit parity. This study is intended to assess the effects of various breeding intervals and parity order on the growth and reproductive performance of Hyla rabbit does and kits in southwestern Nigeria in order to determine the optimal time to mate a rabbit after parturition and the most suitable parity order.

Materials and methods

Experimental site

The experiment was carried out at Rabbitry Unit of the Teaching and Research Farm of Osun State University, Ejigbo Campus, Ejigbo. The area is located within the Forest Zone of Nigeria on latitude 7^0 54'0^0 N and longitude $4^0$18'54^{0}E. The average elevation is 426 metres (Monga Bay, 2011). It has average annual rainfall of 1,330 mm. The rainy season usually lasts from April to October. Ejigbo is about 40 kilometres to Osogbo the capital of Osun. It is a known town in Yoruba land strategically situated in the core of Ejigbo local government area 30 kilometres from Ogbomosho, 35 kilometres north east of Iwo, and 24 kilometres from Ede. Their population is about 132,641 as at 2006 population census. Majority of the populace are engaged in farming as a source of livelihood; producing potatoes, cassava, yam, cowpea, corn, guinea corn, cocoa, coconut, kolanut, and so on. They also engage in clothing and imported good trading. The laboratory bench work was carried out at a reputable laboratory in Ibadan, Oyo State, Nigeria.

Composition of Experimental Rabbits and their Management

Weaners were fed the prepared formulated pelleted feed on a regular basis after weaning at 35 days of age; the contents and chemical makeup of this feed are listed in Tables 1 and 2, respectively.

Table 1: Composition of formulated diet

Ingredients	**Kg**
Groundnut cake	17.00
Soya bean cake	2.00
Toxin binder	0.20
Corn bran	15.00
Limestone	2.00
Maize	3.00
Wheat offal	45.40
Palm Kernel cake	15.00
Enzyme (multi-enzyme blends)	0.20
*Premix	0.20
TOTAL	**100**

*Premix composition (per kg diet):vitamin A(12,000 I.U), vitamin D3(2500 I.U), vitamin K(2mg), vitamin B1(2.20mg), vitamin B2(6mg), vitamin B12(0.015 meg), Niacin (40.00mg), Panthothenic (15.00mg), Folic acid (1.50mg), Biotin (0.050meg), Choline chloride (300.00mg), Manganese (80.00mg), Zinc (50.00mg), Iron (20.00mg), Copper (5.00mg), Iodine (1.00mg), Selenium (1.00mg), Cobalt (0.50mg), Antioxidant(125.00mg).

Table 2: Analysed proximate composition of formulated diet

Parameters	**(%)**
Dry matter	97.99
Crude protein	15.23
Ash	12.53
Crude fat	10.00
Crude fibre	13.42
Soluble Carbohydrate	52.87

Twenty-four healthy 6-month old, rabbits weighing an average of 2,600 g ± 100 g were selected at random for this investigation. There were eight bucks and sixteen does. In a completely randomized design (CRD), does were randomly assigned to four experimental treatments: T_1 (two-week), T_2 (four-week), T_3 (six-week), and T_4 (eight-week) breeding intervals. Each treatment included four rabbits. The bucks were employed in a 1:1 ratio to service does, with the remaining bucks set aside for replacement in the event that any of the active bucks died. Does were bred four (4) times to have four (4) parities (P_1-P_4).

The rabbit pen and hutches were cleaned and sanitized a week before stocking. Before the rabbits were put into the experimental treatments, each one was weighed and documented upon arrival. In order to treat them against a variety of bacterial, protozoal, and specific rickettsial pathogens, they were placed in quarantine for two weeks and given the antibiotic Sulfanor, which contains sulfadimidine sodium 333 mg/mL, at a rate of 0.3 mL per 2.5 kg live body weight for three days. For the treatment and control of both endo and ecto parasites, Ivanor containing ivermectin (1%) injection was also given once subcutaneously. Using a sensitive weighing scale, the body weight of each replicate was recorded at the start of the experiment and then every week after that. Feed was given twice daily at 7:30 am and 4:00 pm. Throughout over fifteen months of the experiment, all rabbits were fed the same concentrate feed and were kept in the same environment.

Housing

The animals were kept in a closed-door house without environmental control in galvanized battery cages that were 55 x 65 x 35 cm in size and raised 80 cm above the ground. They always had access to water through a 0.5-inch water pipe with nipples that passed through the cage. Each cell has an L-shaped feeder attached to it. The rabbit pen and hutches were cleaned and disinfected a week before stocking. Daily routine management procedures include providing clean water, cleaning the hutches and their surroundings, removing leftover feed, and serving fresh feed every day.

Data collection

Weight of the doe during gestation, weekly weight gain of does during prenatal and postnatal periods, weight of kits (litter) and individual at birth and on a weekly basis until the 12th week, weight of the kit at weaning (5th week), 12th week, and mortality rate before and after weaning were the parameters that were measured in order to determine growth and reproductive indices in the gestating rabbits and kits. Other factors included the number of kits at kindling, weaning,

stillbirth, gestation duration (GP), and number of matings per conception rate (NMC).

Statistical analysis

Statistical Package for Social Sciences (SPSS) version 25 was used to do a one-way analysis of variance (ANOVA) on the obtained data. The Duncan's Multiple Range Test of the same statistical program was used to distinguish means differences at a 95% confidence level.

Results

Table 3 expressed the impacts of breeding intervals on growth parameters of does and kits of Hyla rabbit in southwestern Nigeria. All parameters except bred doe weight and average birth weight were significantly different ($p<0.05$) across the breeding intervals. Hyla doe in T_3 was significantly higher ($p<0.05$) in weeks 1–3 of pregnancy weight gain (70.50, 66.67, and 93.50, respectively). However, does in T_2 had a substantially larger ($p<0.05$) pregnancy weight gain in week 4 (144.75). Does in T_3 had higher ($p<0.05$) average litter birth weight (304.80), average litter weaning weight (546.75), average litter weight at 12th week (1318.30), average litter weaning weight (2576.40), and average litter weight at 12th week (5949.55).

Table 3: Effects of breeding intervals on growth indices of does and kits of Hyla rabbit in southwestern Nigeria

Parameters (g)	T_1	T_2	T_3	T_4	SEM
Bred Doe weight	2621.00	2628.00	2613.00	2647.00	66.23
Pregnancy weight gain (week 1)	61.67^{b}	13.71^{c}	70.50^{a}	65.63^{a}	2.97
Pregnancy weight gain (week 2)	62.17^{a}	55.42^{b}	66.67^{a}	48.69^{c}	3.02
Pregnancy weight gain (week 3)	71.83^{b}	69.17^{b}	93.50^{a}	88.75^{a}	3.65
Pregnancy weight gain (week 4)	108.07^{c}	144.75^{a}	124.00^{b}	121.88^{b}	10.21
Average litter birth weight	241.13^{b}	245.79^{b}	304.80^{a}	271.69^{ab}	13.35
Average birth weight	51.03	50.69	53.19	50.55	0.87
Average weaning weight (5th week)	421.07^{bc}	405.58^{c}	546.75^{a}	465.88^{b}	16.23
Average weight at 12th week	1043.60^{c}	1160.87^{b}	1318.30^{a}	1202.94^{b}	28.41
Average litter weaning weight	1837.80^{b}	1815.29^{b}	2576.40^{a}	2175.81^{b}	130.45
Average litter weight at 12th week	3883.97^{c}	4704.58^{b}	5494.55^{a}	4923.50^{a}	228.35

^{abc} means in the same row with different superscripts are significantly different ($p<0.05$). S.E.M. = Standard Error of Mean.

The effects of breeding intervals on reproductive parameters in Hyla rabbit is reflected in Table 4. Number of matings per conception, gestation length and litter size at weaning were not significantly different ($p<0.05$) across breeding intervals. Litter size at birth (5.60), litter size at 12th week (4.10), litter (%) at weaning (93.75) and at 12th week (85.63), mortality (%) at weaning (14.97) and at 12th week (25.37) were significantly higher ($p<0.05$) in Hyla does under T_3. However, stillbirth was higher significantly ($p<0.05$) in the Hyla doe in T_1.

Table 4: Effects of breeding interval on reproductive indices of does and kits of Hyla rabbit in southwestern Nigeria

Parameters	T_1	T_2	T_3	T_4	SEM
NMC	3.00	2.88	2.75	2.38	0.16
Gestation length (days)	32.17	32.04	31.90	31.81	0.20
Average litter size at birth	4.77^{b}	4.67^{b}	5.60^{a}	5.44^{a}	0.24
Stillbirth	0.17^{a}	0.00^{b}	0.00^{b}	0.00^{b}	0.05
Average litter size at weaning	4.23	4.38	4.70	4.69	0.18
Average litter size at 12th week	3.67^{b}	3.92^{ab}	4.10^{a}	4.13^{a}	0.14
Average litter at weaning (%)	90.98^{ab}	85.04^{b}	93.75^{a}	86.66^{b}	2.18
Average litter at 12th week (%)	80.58^{ab}	74.64^{b}	85.63^{a}	75.82^{b}	2.94
Average mortality at weaning (%)	7.16^{b}	5.49^{b}	14.97^{a}	13.35^{a}	2.40
Average mortality at 12th week (%)	16.37^{bc}	14.38^{c}	25.37^{a}	23.29^{ab}	2.93

^{abc} means in the same row with different superscripts are significantly different ($p<0.05$).S.E.M. = Standard error of mean. NMC: Number of mating per conception

Table 5 presented the effects of parity order on growth indices of Hyla rabbit in southwestern Nigeria. All parameters except average birth weight were significantly different ($p<0.05$) across the parity order. From the first to the fourth week, pregnancy weight varies ($p<0.05$) in all parity orders. The weights of the average litters at birth, at weaning, and at the 12th week including average weight at weaning and at the 12th week were all significantly higher ($p<0.05$) in P_3 (324.38, 2684.00, 5668.00, 537.00, 1337.00, respectively).

Table 5: Effects of parities order on growth indices of does and kits of Hyla rabbit in southwestern Nigeria

Parameters (g)	P_1	P_2	P_3	P_4	SEM
Bred doe weight	2627.00^{b}	2659.00^{b}	2686.00^{c}	2724.00^{a}	0.12
Pregnancy weight increase (week 1)	51.00^{c}	73.00^{b}	101.00^{a}	43.00^{d}	0.51
Pregnancy weight increase (week 2)	56.00^{a}	44.00^{b}	44.00^{b}	43.00^{c}	0.13
Pregnancy weight increase (week 3)	98.00^{a}	91.00^{b}	87.00^{c}	97.00^{a}	0.13
Pregnancy weight increase (week 4)	120.00^{b}	136.00^{a}	124.00^{b}	122.00^{b}	0.13
Average litter birth weight	282.25^{c}	308.06^{b}	324.38^{a}	236.06^{d}	15.0
Average birth weight	50.89	51.01	53.57	50.49	0.91
Average weaning weight	459.00^{c}	489.00^{b}	537.00^{a}	443.00^{d}	26.9
Average weight at 12th week	1139.00^{d}	1237.00^{b}	1337.00^{a}	1179.00^{c}	43.4
Average litter weaning weight	2295.00^{c}	2366.00^{b}	2684.00^{a}	1950.00^{d}	69.5
Average litter weight at 12th week	4759.00^{c}	5340.00^{b}	5668.00^{a}	4549.00^{d}	132

^{abc} means in the same row with different superscripts are significantly different ($p<0.05$). S.E.M. = Standard Error of Mean.

The effects of parity order on reproductive parameters of does and kits of Hyla rabbit is shown in Table 6. Both gestation period and stillbirth were not significantly different ($p>0.05$) across the parity order. Average litter size at birth and weaning were significantly higher ($p<0.05$)

in P_1 (5.38 and 4.81, respectively), P_2 (6.06 and 5.00, respectively), and P_3 (6.10 and 5.50, respectively). Average litter at weaning (%) and at the 12th week were higher ($p<0.05$) in P_4 (94.90 and 85.10, respectively). Average mortality at weaning (%) and at the 12th week was significantly higher ($p<0.05$) in P_1 (17.14 and 28.73, respectively) and P_2 (20.42 and 32.89, respectively). NMC was decreasing as parity was increasing across the parity order, with the highest value (4.00) in P_1 and the least (3.33) in P_4.

Table 6: Effects of parity order on reproductive indices of does and kits of Hyla rabbit in southwestern Nigeria

Parameters	P_1	P_2	P_3	P_4	SEM
NMC	2.00	1.90	1.44	1.33	0.16
Average gestation length (days)	31.63	32.31	31.88	31.41	0.33
Average litter size at birth	5.38[a]	6.06[a]	6.10[a]	4.63[b]	0.15
Average stillbirth	0.00	0.06	0.00	0.06	0.08
Average litter size at weaning	4.81[a]	5.00[a]	5.50[a]	4.38[b]	0.22
Average litter size at 12th week	4.06[a]	4.19[a]	4.25[a]	3.88[b]	0.21
Average litter (%) at weaning	80.52[b]	82.90[b]	92.08[a]	94.90[a]	3.15
Average litter (%) at 12th week	67.11[c]	70.39[c]	78.23[b]	85.10[a]	3.78
Average mortality (%) at weaning	17.14[a]	20.42[a]	6.67[b]	5.10[b]	2.85
Average mortality (%) at 12th week	28.73[a]	32.89[a]	19.89[b]	13.85[c]	3.58

[abc] means in the same row with different superscripts are significantly different ($p<0.05$). S.E.M. = Standard Error of Mean. NMC: Number of matings per conception

Discussion

Does in the six-week interval had higher pregnancy weight gain from weeks one through three, most likely as a result of resting after weaning to recover from lactating stress and having the capacity to store more body reserves and nutrients with higher levels of leptin, which may have aided fertility (Arias-Álvarez *et al*., 2010; Bandara *et al*., 2022). They found that the superiority in the does with some days rest over others due to their ability to store more body reserve before pregnancy. Doe in two-week interval equally had high weight gain like a doe in six-week interval in second week of pregnancy. This is in contrary to the report of Iyeghe-Erakpotober *et al*. (2005) that doe mated 14 days postpartum lost more weight in the second week of pregnancy than other groups. The disparity might be as a result of difference in breeds of rabbit used for the study.

Average litter weight at birth, weaning, and 12th week including average weight at weaning and 12th week were very high in does in six-week interval. This could be as a result of the concurrent of lactation-gestation period that was no more and gonadotropin depression that was minor, which allowed improving receptivity, ovulation and implantation rate (Hadid, 2015; Lamothe *et al*., 2015). In contrast, Awojobi *et al*. (2011) found no significant relationship between breeding interval and litter weight at birth in their study of New Zealand White, Chinchilla, and Dutch Belted. Iyeghe-Erakpotober *et al*. (2005) also noted that cutting the re-mating interval after parturition seemed to have no effect on the litter weights of the kit. Saha *et al*. (2011), however, concurred with this study's findings. In comparison to 24-hour and 28-day postpartum intervals, they found that litter weight was higher at 10 days postpartum. Additionally, this study

demonstrated that average newborn weight was unaffected by breeding interval, which is consistent with findings from Awojobi *et al*. (2011) and Iyeghe-Erakpotober *et al*. (2005). The breeding interval had no effect on the size of the litter at weaning or the gestation time in the present research. In a study by Iyeghe-Erakpotobor *et al*. (2005) who used a crossbreed of California does and New Zealand Whites, litter size was also unaffected by the breeding interval. Contrary to the findings of this study, Awojobi *et al*. (2011) found that the gestation length was considerably lower in the 10–20 day group (30.7 days) than in the 1–9 day group (31.6 days) and the 21–28 day group (31.7 days). As the breeding interval increased, the NMC decreased statistically. This finding is consistent with that of Tessier *et al*. (2018), who found that stress-induced lactation decreased gonadotropin secretion, impacted sexual behavior and reproductive efficiency during short breeding intervals, and increased the NMC as breeding intervals decreased. Additionally, according to Awojobi *et al*. (2011), the conception rate was lowest in the 10–20 day group (68.40%) and greatest in the 21–28 day group (98.80%). But according to Oguike and Okocha (2008), responsiveness was higher during a 3-week breeding interval than at a 5-week one. Breeding interval had an impact on litter size at birth and stillbirth, which is contrary to the findings of Iyeghe-Erakpotobor *et al*. (2005). In this study, the litter size at birth for does that rebred two weeks apart (4.77) and four weeks apart (4.67) postpartum was smaller than the 6.67 and 5.80 that they reported. This discrepancy could result from different rabbit strains employed in the study. According to Fayeye and Ayorinde (2016), the higher pre-weaning mortality shown in large litters may be caused by increased competition for teat position, which is consistent with the higher pre-weaning mortality seen in does under T_3 in this study. Due to the concurrent lactation-gestation period and high levels of gonadotropin depression, which could not improve receptivity, ovulation, or implantation rate and could therefore result in stillbirth, the number of stillbirths was higher among does in T_1 (Hadid, 2015). All growth indices considered in this study except average birth weight were influenced by parity order in table 5. P_3 had the highest litter weight at birth (324.38), weaning (2684) and 12th week (5668), average weaning weight (537.00), and average weight at 12th week (1337.00). P_2 and P_1 were not far behind. This observation was consistent with previous reports by Kabir *et al*. (2011) and Ayo-Ajasa *et al*. (2015). They asserted that the doe's maturity caused more eggs to be released from the ovary in the parity after the first, increasing the likelihood of the litter being larger and heavier at birth. This outcome is also consistent with Marta Pollesel *et al*. (2020), who found that the lowest and greatest litter weight values (456.40 and 719.80) were found in the first and sixth parity orders, respectively.

The current study's findings about the relationship between parity order and reproduction are consistent with previous research showing a positive correlation between an increase in parity order and litter weight (Minuti *et al*., 2020). It is well known that when rabbits do start breeding, they typically haven't reached full body development yet (Castellini *et al*. 2010). As a result, litter parameters such litter weight are lower than in succeeding parturitions. This was supported by the current study, which showed that because does had already reached adult body size, litter weight was considerably larger in the third parity. These findings concur with those of Amao (2020), who found that third-kindling litters had the largest weights and sizes. According to Apori *et al*. (2014) and Sivakumar *et al*. (2013), the effect of parity order lasted longer and increased steadily until the fourth or sixth parturition.

According to Malta Pollesel *et al*. (2020), these variations are most likely caused by the genetic type utilized for meat production. Due to a

positive correlation between parity order increase and litter size and birth weight, parity has no effect on average birth weight (Minuti *et al*., 2020). This has a very slight impact on an individual's weight. P_3 continued to get the greatest score in this study (53.57), followed by first (50.89) and second (51.01).

Parity order had no effect on gestation length, which is consistent with research by Amao *et al*. (2020) and Lawal *et al*. (2024). In this study, the gestation length ranged from 31.41 to 32.31, whereas Amao *et al*. (2020) reported a ranged from 30.02 to 31.00, and Lawal *et al*. (2024) reported values from 30.87 to 31.08. The findings of this work contradict the results of their study regarding the effects of parity order on litter size at birth and weaning. However, these traits are influenced by parity in the study of Marta Pollesel *et al*., (2020). The discrepancy may be due to the number of parities in the study; Marta Pollesel *et al*. (2020) had more than nine parity orders of litter size at birth (8.96-12.39), which confirmed that parity could influence both litter size at birth and weaning when parity order goes beyond three.

This study's highest litter size at birth (6.10) was higher than the 5.00 reported by Oseni and Ajayi (2010) and the 5.70 reported by Oseni *et al*. (2016) for New Zealand rabbits, but they was lower than the 6.74 kits reported by Iraqi (2008). These results are consistent with Szendro (2000), who had the largest litter size in third parturition. The third parity's greatest litter size at birth value was consistent with Das and Yadav (2007) reported findings, which showed that the later parity order had significantly larger litter sizes at birth than the earlier ones. This suggested that as doe age and parity order increased, so did prolificacy and litter characteristics.

According to this finding, parity in P_2 had a significant impact on mortality (%) at weaning and the 12-week mark (20.42 and 32.89, respectively). The highest weaning mortality was 6.81 percent at eighth parity, 16.21 percent at third parity, and 20.30 percent at first parity, according to Marta Pollesel *et al*. (2020), Lawal *et al*. (2024), and Amao *et al*. (2020). The study's highest weaning mortality rate (20.42) is extremely near to the one Amao *et al*. (2020) reported (20.30). This may suggest that mortality in suckling rabbits is not influenced by a specific trend but rather by a number of variables, such as litter size and birth weight (Poigner *et al*., 2000a, b).

According to Marta Pollesel *et al*. (2020), primiparous animals do have litters with the highest percentage of kits weighing less than 45 g, which raises the risk of kit mortality. Given that kits with lower birth weights have a lesser chance of surviving, the likelihood of individual survival is correlated with birth weight (Agea *et al*., 2019). Comparing kits with low birth weight to those with medium or large birth weight at delivery, the current study also found that the former had many drawbacks. First of all, its sustainability was poor; kits with lower birth weights often drank less milk and suckled less than their heavier littermates (Ludwiczak *et al*., 2020).

All kits weighing less than 35 g died in the first week of life, as reported by Szendro and Barna (1984). The death rate was over 50% for kits weighing between 35 and 50 g and approximately 10% or less for kits weighing more than 50 g. In addition, neonates need specific maternal care, a safe environment, and enough food to survive (Hamilton *et al*. 1997). Perinatal mortality rises and energy reserves and thermoregulatory capacity are diminished if the birth weight is below the ideal weight (Vicente *et al*., 1995).

In this study, parity did not affect stillbirth. This outcome was consistent with the findings of Marta Pollesel *et al*. (2020), who looked at how litter homogeneity metrics were affected by parity order. While stillbirth (%) documented by Marta Pollesel *et al*. (2020) ranged from 0.15 to 0.62 in more than nine parities, stillbirth (%) in the current study was between 0.00 and 0.06 in four parity orders. When comparing the

reproductive performance of imported Hyla rabbits and Benin-born Hyla rabbits in a parity, Chrysostome *et al*. (2011) found that 17.70% of Hyla rabbits born in Nigeria and 29.60% of imported Hyla rabbits were stillborn at birth. This study's greatest stillbirth rate (0.06) was lower than Marta Pollesel *et al*. (2020) reported highest stillbirth rate (0.62). This was likely due to the study's higher number of parity involved in this study.

Having the highest NMC (2.00) in the first parity and the lowest NMC (1.33) in the fourth parity order, the number of mating per conception in parity does not follow the trend of breeding interval. This contradicts the findings of Oseni *et al*. (2021), who found that second parity produced higher NMC. Disparity could not be determined, most likely due to environmental effects and strains.

Conclusion

It was concluded that does in 6-week interval performed better in growth and reproductive parameters measured. Parity order increased from first to third before declining except in average litter (%) at weaning and at 12th week, where it increased up to fourth parity. Therefore, a six-week breeding interval up to the third parity was recommended to Hyla rabbit breeders or keepers for the most favourable production, especially on a commercial scale in southwestern Nigeria.

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