

Research Paper

PHYSIOLOGICAL INFLUENCES OF *Aspilota africana* ON LITTER TRAITS OF BREEDING RABBIT DOES

ABSTRACT

The study examined the effect of feeding *A. africana* as forage on litter traits of breeding does. Thirty dutch breed rabbit does aged 5 to 6 months were used in a completely randomized design study. The treatments consisted of mixed forages without *A. africana* (T₁, control), fresh *A. africana* (T₂) and wilted *A. africana* (T₃). The rabbits were fed the same concentrate diet throughout the study and mixed forages from the commencement of the experiment till the does kindled. After parturition, fresh and wilted *A. africana* forages were introduced in T₂ and T₃ respectively while the control continued on mixed forage throughout the study. The result of the study revealed no significant differences (P>0.05) in the litter sizes among the various treatment groups though T₁ had highest numerical mean value. There were no significant differences (P>0.05) in litter sizes at weaning but conversely T₁ had the lowest value at weaning. Litter weight at birth revealed significant differences (P<0.05) between the various treatment groups. Weights at weaning were also significantly different (P<0.05) in which the treated groups had superior values. Significant differences (P<0.05) were also observed for the pre-weaning mortality. The body weights gain of litters from birth to weaning showed no significant differences (P<0.05) in week 1 but from weeks 2 to 4 there were significant differences (P>0.05) in which litters in T₂ and T₃ had higher values. This study revealed that *A. africana* has the potential for increasing body weights of litters during lactation.

Keywords: Physiological, litter traits, breeding, rabbit does, *Aspilota africana*

INTRODUCTION

One of the problems facing Nigeria and most developing countries is scarcity of food for the teeming population and feed for the dwindling livestock industry (Carlini and Udedibe, 1997). The level of nutrition greatly influences productivity in livestock, when adequate; it increases animal performance and makes animal products available for human use. Conversely inadequate quantity and quality of feed is known to be largely responsible for low livestock productivity in the tropics (Paterson, 1994).

40 Various plans and agricultural policies have been formulated at one time or the other
41 to combat the acute shortage of animal protein supply (Adedeji *et al.*, 2010). The
42 relevance of animal protein in human and animal nutrition in Nigeria cannot be
43 overemphasized. In recent times, there has been a significant short fall between the
44 production and supply of animal protein to feed the ever increasing population (Akpan
45 *et al.*, 2009). Animal protein content in the diets of low income earners that constitute
46 the majority of Nigerian populace is very low (Yusuf *et al.*, 2009). Average
47 consumption of animal protein in this country is estimated at 4.5g/head/day as against
48 a minimum requirement of 35g/head/day recommended by the Food and Agriculture
49 Organization of the United Nations (Atsu, 2002). The production of the conventional
50 protein and energy sources is still grossly inadequate in most developing countries of
51 the world and often times demand exceeds supply (Matthew *et al.*, 2010). This is
52 reflected in the competition between, man, livestock and industries for existing
53 conventional feedstuffs which has led to high costs of these ingredients which
54 consequently has contributed to the existing high prices of livestock feed and
55 products, taking them beyond the reach of the average Nigerian (Ukachukwu, 2000;
56 Akinmutimi, 2007). High cost of feed ingredients and other costs associated with
57 production had accounted for the failure of the plans and policies. These have resulted
58 to farmers looking for various alternatives to replace the expensive feeding which
59 accounts for over 70% of the total cost of producing livestock intensively
60 (Ogunfowora, 1984). Increasing demand and subsequent high cost of conventional
61 animal feed ingredients in the tropics have created the need for sustainable alternative
62 (Osagie, 1998). The research for alternative feed ingredients for livestock feeding has

continued to attract attention of researchers especially in the developing nations of the world (Lamidi *et al.*, 2008). This problem can be solved by directing efforts at the exploitation of hitherto neglected novel plants that are indigenous, readily available, of high quality, cheaper and capable of reducing production cost of feeds (Ahamefule *et al.*, 2000; Etuk *et al.*, 2002). According to Osagie (1998), sustainable alternative particularly natural feed resource indigenous in the region was suggested. A possible option of exploring into the utilization of ingredients or substitutes which do not form part of food for human and industry was suggested by Akpodiete and Okagbare (1999). As reported by Tewe (1986) in the face of diminishing and high costs of conventional sources, venturing into these alternative sources is most economical. One of such alternatives are forages.

Moreover, to meet the increasing demand for animal protein, emphasis needs to be given to non-conventional sources as against the conventional sources such as cattle, sheep, goat, pig and poultry that would require more capital, space and time (Yusuf *et al.*, 2009). Efforts have to be directed towards boosting the micro-livestock sector (Akpan *et al.*, 2009). There is need to focus attention on the production of livestock whose nutritional requirement does not put much strains on the limited sources of feed ingredients to which men also subscribe. An example of such livestock is rabbit. Rabbit (*Oryctolagus cuniculus*) is a non-ruminant herbivore which utilizes much undigested and unabsorbed feed material as sources of nutrient for maintenance and production. Rabbits are known to supply animal protein and provide a cheap source of meat to the Nigerian populace (Hassan and Owolabi, 1996; Amaefule *et al.*, 2005; Henry *et al.*, 2009). This is evident in the widespread of small scale rabbitary in

backyards in Nigerian cities (Henry *et al.*, 2009). Rabbit provides inexpensive source of meat that is low in cholesterol and fat, high in protein compared with beef, mutton and pork (Ensminger, 1991; Oguike and Ohaja, 2009). Rabbit has been described as a pseudo-ruminant scavenger capable of coprophagy with high feed conversion efficiency (Dada-Joel, 2010). The act of coprophagy in rabbit aids in the absorption of some of the essential amino acids and vitamins especially K and B complex vitamins (Ensminger, 1991). In spite of the numerous advantages of rabbit over other classes of livestock and recent advances for alternative sources for this micro-livestock in Nigeria, feed cost and scarcity still limit profitable rabbit production in the country (Ozuo and Arigbogu, 2009). The keen interest of farmers and consumers in rabbit production in Nigeria has provoked research into ways of increasing production and exploiting ways to meet the needs of Nigeria's teeming population (Adedeji *et al.*, 2010). According to Iyeghe-Erakpotobor *et al.* (2009) competition between humans and rabbits for grain is low because rabbits can be raised on roughages. Rabbits can convert roughages with high fibre content to meat efficiently and without the deterioration of the quality of meat. About 12 – 15% dietary fibre in rabbit rations can minimize enteritis (Aduku and Olukosi, 1990). One method used to alleviate the use of grains and cakes in rabbit diets is the replacement of a percentage of grains and cakes in rabbit diets with agro-industrial by-products and forages. Replacement or supplementation of diets with non-conventional feed sources is very promising as it reduces competition between rabbits and humans for grains and also reduces cost of production (Iyeghe-Erakpotobor *et al.*, 2009). According to Oguike and Ohaja (2009), varieties of feedstuffs have been used successfully in feeding rabbits. Traditionally,

109 rabbits are managed with forage based diets as the principal feed sources. Rabbits
110 have the ability to thrive on forages which cannot be consumed directly by man. To
111 ensure better performance, rabbits are fed with both concentrate and forages
112 (Onyimonyi and Ene, 2003). Studies have shown that rabbits can thrive on a number
113 of tropical forages supplemented with concentrates (Odeyinka and Ijiyemi, 1997;
114 Shiawoya and Musa, 2003). Such forages are cheap, abundant and available in many
115 parts of Nigeria (Yusuf *et al.*, 2009). One of such forages is *Aspilia africana*.

116 Adisa and Oladoja (2008) stated that if efforts are intensified in encouraging
117 and motivating rabbit keepers to increase their stock and adapt more rabbit
118 innovations, this will undoubtably increase rabbit production and ensure adequate
119 nutrition for every household through animal protein consumption. This will enable
120 developing countries like Nigeria attain household food and nutritional sufficiency.
121 The means through which the aforementioned can be achieved lies with an
122 improvement on litter traits of breeding does. Rabbits nutrition is the single most
123 limiting aspect of production and their nutritional needs vary according to age and
124 stage of production. Lukefahr (1992) stated that it is not always practical to attempt to
125 provide a nutritionally balanced diet for rabbits. Nutritional status, parity, and
126 environment among other factor were identified by Cheeke *et al.* (1982) as
127 influencing litter traits of breeding does. The litter traits of rabbits are very important
128 features that determine the efficiency of rabbit production (Hammond *et al.*, 1983;
129 Cheeke, 1986; Odubote and Akinokun, 1991; Henry *et al.*, 2009). According to Lebas
130 *et al.* (1986), prolificacy is measured by the number of live births or total birth per

131 litter per year. It varies significantly according to several factors which may be
132 inherent in the animal.

133 According to Lebas *et al.*, (1986), prolificacy is measured by number of
134 livebirths or total birth per litter per year. It varies significantly according to several
135 factors which may be inherent in the animal. Herbert (1998) reported that litter size is
136 a function of ovulation rate. Litter size at birth increases with successive kindling
137 (Brambella, 1972; Lebas *et al.*, 1986). Litter size increases by 10-20 percent from the
138 first to the second parity, increases again but less from the second to the third, with no
139 change from the third to the fourth. After the fourth parity, the size may decrease.
140 Inbreeding may reduce prolificacy (Lebas *et al.*, 1986). Studies by Gregory (1932)
141 showed that litter size depended on the number of eggs produced after mating and this
142 number depends on the body size of the breed. He also reported a litter size of 7 to 8
143 kits. Odubote and Akinokun (1991) observed litter size at birth varying from 2 to 9
144 kits. Also, according to Lebas *et al.* (1986) breeder could influence the litter size and
145 litter weight at weaning by the food provided for the nursing doe. Szendro and
146 Maeterns (2001) reported that litter size at birth exerts a positive effect on litter
147 weight. Litter weight at birth depends on the breed and a mean birth weight per
148 individual. Increased feed utilization will result in a higher litter birth weight. Odubote
149 and Akinokun (1991) reported a litter birth weight of 223.3g and Asuquo (1996)
150 reported a litter birth weight of 246.77g. Etim (unpublished) reported that does fed
151 *Aspilia africana* had higher milk production. Burkil (1985) reported that *Aspilia*
152 *africana* is used as lactation stimulant. Lebas *et al.* (1986) observed rapid growth of
153 kits during the peak of lactation coincides with three weeks of lactation. Peace Corps

(1982) reported that after the third week, milk production gradually declines. Ugwuene and Ojewola (2009) reported that the mean daily weight gain of rabbits fed *A. africana* at four weeks of age was significantly greater than others. Ugwuene and Ojewola (2009) further observed that feeding *A. africana* or *Centrosema pubescens* to rabbits at four weeks will enhance their performance. Most pre-weaning mortality occurred in the first week of life (Partridge *et al.*, 1984; Fayeye *et al.*, 2000). Mendez and Fraga (1986) reported a pre-weaning mortality of 5 – 54%. Pre-weaning mortality of 17 – 6% was also reported by Somade (1982) and Abdulmalik (1994).

There is a paucity of information on the effects of *Aspilia africana* on litter traits of breeding does. Therefore, this study was carried out to evaluate the feeding potentials of *Aspilia africana* on performance and growth of rabbit litters.

MATERIALS AND METHODS

Experimental Location

The study was conducted in the Rabbitry Unit of the Teaching and Research Farm of the College of Animal Science and Animal Production, Michael Okpara University of Agriculture, Umudike, Abia State, Nigeria.

Umudike bears the co-ordinate of 5°28¹ North and 7°31¹ East and lies at an altitude of 122m above sea level. It is located within the tropical rainforest zone and the environment is characterized by an annual rainfall of 2177mm.

Experimental Animals and Management

Thirty sexually mature nulliparus dutch breed rabbit does and four bucks aged 5 to 6 months were used for the study. The rabbits were certified healthy and were identified with tags for ease of identification. Both sexes were separated. They were

177 housed singly in rabbit hutches made of wooden frame and wire mesh. The animals
178 were fed concentrate diet (Table 1) and mixed forages until after kindling. The does
179 were mated two weeks after commencement of the experiment. The mating ratio was
180 1 buck : 10 does. The does were taken to the bucks' pen for mating and were all mated
181 within an interval of 3 days. The does were palpated after 14 days of mating to
182 confirm pregnancy. Following kindling, *Aspilia africana* forage was introduced as the
183 experimental diet at the rate of 500g per day per doe.

184 **Experimental Design and Data Collection**

185 The experiment was a completely randomized design with three treatments.
186 The treatments consisted of mixed forages (*Centrosena pubescens*, *Ipomea batatas*
187 leaves and *Panicum maximum*) without *A. africana* (control; T₁), fresh *Aspilia*
188 *africana* (T₂), wilted *Aspilia africana* (T₃). Ten does were randomly assigned to each
189 treatment. Each treatment was replicated five times with two does per replicate.

190 Following kindling, data were collected on the litter size, litter birth weight and
191 weekly weight gain of the litters were measured using kitten scale. Then at weaning;
192 litter size at weaning, litter weight at weaning were measured. Mortality was also
193 recorded for the kits.

194 **Data Analysis**

195 The data generated were analyzed using ANOVA. Significant means were
196 separated using LSD according to the methods of Steel and Torrie (1980).

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RESULTS AND DISCUSSION

The results of effects of *Aspilia africana* on litter traits are presented in Table 2. Litter size for T₁ was higher, followed by T₂ while T₃ had the lowest litter size. The litter sizes were not significantly different ($P>0.05$) but numerically different between the three treatment groups. The low litter sizes at birth for T₂ and T₃ could be associated with the number of ova discharged after mating since litter size is dependent on the ovulation rate (number of ova discharged). This is in agreement with the report by Herbert (1998) that litter size is a function of ovulation rate. The study recorded no still birth.

The litter sizes recorded in this study were higher than the litter size of 3.97 for polish does reported by Gregory (1932), but lower than the litter size of 2 to 8 kits reported by Lukefahr and Cheeke (1990) and within the range of 2 to 9 kits observed by Odubote and Akinokun (1991). The low litter size of the study could be as a result of the does being in their first parity, since it has been shown that litter size at birth increase with successive kindling (Brambella, 1972; Lebas *et al.*, 1986).

The mean litter size at weaning was highest for T₂, followed by T₃ while T₁ had the lowest litter size. Though not significantly different ($P>0.05$) varied numerically. The mortality rate in T₁ (control) was higher than in T₂ while T₃ (treated with *Aspilia africana*) recorded no mortality. Thus, there was a relatively high decrease in litter size at weaning of the control compared with the treated groups. This could be attributed to high milk production from does in T₂ and T₃ which were fed fresh and wilted *Aspilia africana* respectively. This is in line with the report by Etim (Unpublished) that does fed *Aspilia africana* had higher milk production. The test

222 plant (*A. africana*) helped stimulate milk let down and increase milk yield which
223 thereby increased the survival of the litter and reduced preweaning mortality. This in
224 turn resulted in higher litter size at weaning for T₂ while T₁ had the least although at
225 birth T₁ had the highest litter size.

226 Litter weight at birth as shown in Table 2 was significantly different ($P<0.05$)
227 among the various treatment groups, which T₂ had the lowest mean body weight at
228 birth and T₁ had the highest. This could be due to litter size at birth since T₁ had the
229 highest litter size at birth. This agrees with the findings of Szendro and Maeterns
230 (2001) who reported that litter size exerts a positive effect on litter weight. The result
231 of this study is also in line with the findings of Odubote and Akinokun (1991) who
232 stated that litter weight at birth depends on the breed and a mean birth weight per
233 individual. However, the litter birth weight for T₁ may also be due to the ability of the
234 rabbits in that group to effectively utilize the feed which enhanced better embryonic
235 development as observed by Asuquo (1996) that increased feed utilization will result
236 in higher litter birth weight. The overall litter birth weight obtained in this study is
237 lower than 223.3g obtained by Odubote and Akinokun (1990) and also lower than
238 246.77g obtained by Asuquo (1996). The differences could be attributed to higher
239 litter sizes the authors obtained at birth.

240 The mean litter weaning weight was highest in T₂ followed by T₃ while T₁ had
241 the lowest. The mean weaning weights were significantly different ($P<0.05$). Higher
242 weaning weights in treatments 2 and 3 may be due to the role of the experimental
243 plant as lactation stimulant as reported by Burkil (1985) and the ability of the does in
244 these treatment groups to effectively utilize minerals and other nutrients in the feed to

increase the quantity/quality of milk for proper nursing of the kittens which thereby resulted in the higher litter weaning weight. While on the other hand, low litter weaning weights observed for the control group (T_1) could be as a result of low milk let-down from the does. This agrees with the findings of Lebas *et al.* (1980) that the breeder could influence the litter size and litter weight at weaning by the feed provided for the nursing doe.

The result of the pre-weaning mortality analysis revealed that there were significant differences ($P>0.05$) among the various treatment groups. Most of the pre-weaning mortality occurred in the first week of life which agrees with the report by Partridge *et al.* (1984) and Fayeye *et al.* (2000). The pre-weaning mortality observed in the study was low. Overall mean litter loss of 0.21% reported for this study fall below the range of 5 – 54% reported by Mendez (1986) and also lower than the average value of 17.6% reported by Somade (1982) and Abdulmalik (1994).

The results of the effect of *Aspilia africana* on weekly body weight gain on litters from birth to weaning are presented in Table 3. The body weights of the kits in week 1 showed no significant differences ($P>0.05$) between the different treatments. Kits in T_2 had the highest mean value, followed by T_3 while T_1 had the lowest mean value. By the second week, the weight gain of litters in T_3 was significantly lower than those of T_2 but not significantly different from T_1 . However, the rate of gain in all the treatment groups in weeks 3 and 4 were higher than those in weeks 1 and 2 and T_2 had the highest mean value. The sharp increase in weights of kits at three weeks postpartum agrees with the findings of Lebas *et al.* (1986) who observed that rapid growth rate of kits during the peak of lactation coincides with three weeks of age from

birth. Furthermore, it could be observed that T₂ and T₃ showed superior increase compared to T₁ (control) in week 3 which may be as a result of high milk yield/let-down from the mammary gland of does which was stimulated by the test plant (*Aspilia africana*) as reported by Burkil (1985). The mean weekly body weight gain for week four also showed significant difference (P<0.05) between the different treatments in which T₂ had the highest mean value, followed by T₃ and T₁ (control) still had the lowest value. The slight difference in the weights of kits in T₃ whose dam were fed wilted *A. africana* compared with T₂ which received fresh *A. africana* could be as a result of differences in palatability. The results of this study agrees with the findings of Ugwene and Ojewola (2009) who reported that the mean daily weight gain of rabbits fed *A. africana* at four weeks of age was significantly greater (P<0.05) than others. Ugwene and Ojewola (2009) further stated that feeding *A. africana* or *centrosema pubescens* to rabbit at four weeks will enhance their performance.

Table 1: Percent composition of concentrate ration

Ingredients	T ₁	T ₂	T ₃
Maize offal	45.5	45.5	45.5
Palm kernel cake	30	30	30
Soybean meal	20	20	20
Blood meal	2.0	2.0	2.0
Bone meal	2.0	2.0	2.0
Vitamin-mineral Remix	0.25	0.25	0.25
Salt	0.25	0.25	0.25
	100	100	100

285 **Table 2:** Effects of *Aspilia africana* on litter traits

Parameters	T ₁	T ₂	T ₃	SEM
Litter size at birth (g)	5.60	5.20	4.00	0.40
Litter size at weaning (g)	3.70	4.60	4.00	0.45
Litter weight at birth (g)	261.50 ^a	116.50 ^b	175.00 ^{ab}	23.70
Litter weight at weaning (g)	410.00 ^b	736.30 ^a	621.25 ^a	47.17
Pre-weaning mortality (%)	0.42 ^a	0.20 ^b	0.00 ^c	0.06

286 a,b,c, means in same row with different superscripts are significantly different (P<0.05).

287

288 **Table 3:** Effect of *Aspilia africana* on weekly body weight gain of litters from birth
289 to weaning (g)

Weeks	T ₁	T ₂	T ₃	SEM
Week 1	290.00	380.63	316.25	30.94
Week 2	297.50 ^b	534.38 ^a	445.00 ^a	41.25
Week 3	405.00 ^b	690.60 ^a	584.40 ^a	43.43
Week 4	410.00 ^b	736.30 ^a	621.30 ^a	47.15

290 a,b,c, means in same row with different superscripts are significantly different (P<0.05).

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295 CONCLUSION

296 *Aspilia africana* are abundant and available in this country. Reducing the cost
297 of feed production by utilizing *A. africana* forage will increase rabbit production in
298 Nigeria. The various parameters (litter size and weight at birth, litter at size and
299 weight at weaning, pre-weaning mortality and litter weight gain from birth to
300 weaning) studied to observe the effect of *A. africana* on litter traits showed that litters
301 from does fed *A. africana* showed superiority in values for all the parameters
302 investigated except litter size and weights at birth. The higher milk let-down/yield

from does fed the experimental plant (*A. africana*) accounted for the rapid growth and performance of litters as well as low mortality of litters in the treated groups.

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