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Effects of processed *Leucaena leucocephala* leaf meal on the reproductive and pre weaning performance of rabbits. (*Oryctolagus cunniculus*)

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Abstract

In an experiment designed to determine the effects of dietary inclusion of differently processed Leucaena leucocephala leaf meal on reproductive performance of rabbits does, 40 local breeds does of about 20 weeks old were fed five diets (T_1-T_5). Four different processing methods were used to reduce the mimosine content in Leucaena leucocephala leaf meal for inclusion in diets T_2, T_3, T_4 and T_5 at 40% fixed level. Diet T_1 which is the control contained no Leucaena leucocephala leaf meal and was designated NLLM, T_2 contained air dried Leucaena leucocephala leaf meal and was designated ADLLM, T_3 contained soaked Leucaena leucocephala leaf meal in fresh water for 36 hours and was designated FWLLM, T_4 contained Leucaena leucocephala leaf meal soaked in 60^0C hot water for 24 hours and was designated HWLLM while T_5 contained fermented Leucaena leucocephala leaf meal for five days and was designated FLLM. The result showed significant ($P<0.05$) differences in all the reproductive parameters measured. Pre weaning performance traits of rabbit kittens were significantly ($P<0.05$) lower in rabbits fed diets containing air dried Leucaena leucocephala leaf meal. It was concluded that air dry method of processing Leucaena leucocephala leaf meal was not effective enough to reduce the mimosine content to a tolerable level in rabbit diet.

Soaking Leucaena leucocephala leaf meal, in fresh water for 36 hours at room temperature, in 60^0C hot water for 24 hours and fermentation of Leucaena leucocephala leaf meal for five days were recommended for use at 40% level of inclusion in rabbit diet.

Key words: *Leucaena leucocephala*, mimosine, rabbit production, reproduction, pre weaning and performance.

Introduction

Rabbit (*Oryctolagus cunniculus*) is a docile animal and its production is encouraged as an untapped economical source of meat in developing countries (Food and Agricultural Organisation, 1986). Rabbits have a high fecundity and prolificacy rate, short generation interval, high feed conversion efficiency and large number of offsprings (Ologhobo *et al*., 2003). Compared to other animal species, rabbit meat is considered a lean one that is rich in protein, it is highly appreciated, fits any taste, tender and of high culinary yield and a source of healthful food as it is low in cholesterol which makes it a good source of protein for coronary heart patients (Nodu, Oguzor and Onwurah, 2003; Hernandez, 2004). The meat is one alternative protein source in family diets in the rural areas and the availability and development of a production system for small-scale farms should be of major interest. Rabbit production would not only be an alternative protein source for the family, but also a source of monetary profit by marketing the products such as meat and the skin (Roca, 2007)

In spite of the apparent advantages, rabbit production has not yet played the key role expected of it in addressing the problem of inadequate protein intake among Nigerians; this is largely due to nutrition which constitutes the greatest input in animal production. Nutrition has a tremendous effect on the growth and life span of all domestic animals as it is impossible to isolate its effect from physiological activities such as growth rate, reproductive performance and related production parameters. Various studies have shown the effect of nutrition on different aspect of growth and reproductive life of animals (Agunbiade, 1999; Adama and Ayanwale, 2000; Adama and Adekojo, 2002). Protein supplementation is important to improve livestock

production and this must be done with respect to the requirement of the animal in addition to the balance of other nutrients

Currently, research efforts in Nigerian livestock industry are geared towards identifying and exploiting novel feed ingredients which are not in strict competition with man's dietary need. These novel feed ingredients include: industrial by-products and leaf meals of tropical browse plants such as *Microdesmis spp* (Esonu, Iheukwumere, Emenalom, Uchegbu and Etuk, 2002), paw paw leaf meal (Bitto, Arubi and Gumel, 2006), *Mucuna pruriens* (Emenalom, Esonu, Etuk and Araba, 2009), *Leucaena leucocephala* (Herbert, Ozoje and Adejumo, 2005) and *Azadirachta indica*. (Esonu, Ogbonna, Anyanwu, Emenalom, Uchgbu, Etuk and Udedibe, 2006; Ogbuewu, Okoh and IIoeje, 2009).

One possible source of cheap protein is the leaf meals of some tropical legume browse plant, which do not only provide protein sources but also some essential vitamins and oxycarotenoids. The major limitations to the utilization of these leaf meals reside on the presence of anti-nutritional factors and deficiencies of certain amino acids (Anhwange, Ajibola and Oniye, 2004). *Leucaena leucocephala* is one the highest quality and most palatable fodder trees of the tropics, often being described as the 'alfalfa of the tropics'. The leaf quality compares favourably with alfalfa or lucerne in feed value except for its higher tannin content and mimosine toxicity to non-ruminants

Recently, there has been growing interest in the utilization of *Leucaena leucocephala* leaf meal as protein source for livestock (Oduguwa, Fanimo, Onyekwere, Oyenuga and Sobogun, 2000; Adama and Adekojo, 2002). In spite of being excellent sources of nutrients, the presence of anti-nutritional factors limits the efficiency of utilization of its foliage in livestock nutrition. At high concentration, there is reduction of animal performance.

Rabbits are highly prolific animals with a gestation period of 28-32 days (Adejinmi, Hamzat and Fapohunda, (2007), Omoikhoje, Bamgbose and Aruna, 2008). The reproductive behaviour of rabbits is extremely high. Rubio-Rubio, Torres-Hernandez, Martnez-Garcia, Mastache-Lagunas and Lagunas-Silva (2004) reported significant difference ($P<0.05$) in litter size at birth and weaning when they crossed New Zealand white and Chinchilla, California and New Zealand white and Chinchilla with California. Nutrition, age and weight at different reproductive phases of the females have been reported to play crucial and determinant roles. Adama and Ayanwale (2000) observed that reproductive performances in rabbits are primarily affected by the number of offspring born and reared.

Several tropical forages such as *Clitoria ternatea, Pennisetun purpureuin, Macroptilium atropurpureum, Ipomea batatas* and *Neonatonia whittii* have been evaluated for reproductive performance of 12 does by Muir and Massaete (1995) and compare with those on *Leucaena leucocephala*. The trial was undertaken to determine whether *Leucaena* fed at a fixed 24 % (dry matter basis) of the diet affected reproductive performance of does and weaning weights of the youngs. Their result showed that 75 % of the does fed *Leucaena leucocephala* either died or were eliminated due to pododematitis. They concluded that inclusion of *Leucaena leucocephala* at 24% of the diet is detrimental to does and negatively affect reproduction.

Some investigations have indicated that *Leucaena leucocephala* caused anoestrous, poor conception and a high percentage of resolved foetuses among rats (Nsahlai, Byebwa and Bonsi*,* 2005) and embryonic death and resorption among heifers grazed on *Leucaena* stand alone. Murrah male goats have also been reported to have poor semen quality when *Leucaena* comprised 50 % of their diet. The objective of this research is to evaluate the effects of dietary inclusion of differently processed *Leucaena leucocephala* leaf meal on reproductive and pre weaning performance of rabbits (*Oryctolagus cunniculus)*.

MATERIALS AND METHODS.

Experimental site

The experiment was conducted at the rabbitry section of the Teaching and Research farm of the Department of Animal Production, School of Agriculture and Agricultural Technology, Federal University of Technology, Minna, Niger state, Nigeria. Minna is situated in the southern guinea savanna zone located between latitudes 9º 37' and 9º 45' North and longitudes 6º 31' and 6º 45' East of the equator (Usman, 2011). The altitude is 260 m above sea level. The annual precipitation averages 1312 mm with a mean temperature of between 19 ºC and 37 ºC. Minna is characterized by two distinct seasons, the wet season from April - October and the dry season from November - March (Oguntoyinbo *et al.,* 1982).

Sources and chemical composition of *Leucaena leucocephala* leaves.

Leucaena leucocephala is available all over Niger state. The quantities (35kg) used for this study were sourced for within Minna metropolis to guard against the influence of environmental factors on the chemical composition of the leaves when harvested from different sites and locations (Shelton *et al.,* 1998). The chemical

composition was determined using the methods of the Association of Official Analytical Chemists, (2006).

Processing of *Leucaena leucocephala* leaf meal.

Four different methods of processing were selected to reduce/eliminate the level of mimosine in the *Leucaena leucocephala* leaf meal (LLLM). The first method was to air-dry the leaves at room temperature for a week and milled for inclusion in the experimental diets (Kumar, 1983), this is called air-dried *Leucaena leucocephala* leaf meal (ADLLM), the second method was soaking *Leucaena leucocephala* leaf in fresh water at room temperature for 36 hours (Wee and Wang, 1987), and this is referred to as fresh water processed *Leucaena leucocephala* leaf meal (FWLLM), the third method used was soaking *Leucaena leucocephala* leaf in 60ºC hot water for 24 hours (Akbar and Gupta, 1985) and is labeled hot water processed *Leucaena leucocephala* leaf meal (HWLLM). The fourth method was fermentation of *Leucaena leucocephala* leave in airtight container for 5 days (Tawata *et al.,* 1986: Fayemi *et al*., 2011) and was designated as fermented *Leucaena leucocephala* leaf meal (FLLM).

Determination of anti-nutritional factors.

Anti-nutritional factors were determined at the National Research Institute for Chemical Technology (NARICT) Zaria and the Biochemistry laboratory, University of Jos, Plateau state using AOAC (1980). Mimosine, tannin, cyanogenic glycoside, phytic acid and oxalate were analysed.

Reproductive performance

Fifty five rabbits comprising eight females and three males of about 20 weeks old were used for the reproductive study which lasted for a period of 180 days (6 months). This was to allow for three reproductive cycles. Each animal was identified and tagged for proper recording. The does in each treatment groups were mated to bucks of the same treatment groups. The does were weighed prior to mating, during pregnancy, a day post-partum and 3 weeks post-partum. Pregnancies were detected by palpation of the abdominal region between the thighs. Nesting boxes were provided for pregnant does a week before parturition in preparation for kindling. The following reproductive parameters were measured.

a. Birth traits

(i) Litter size at birth (LS): This was measured by counting the number of kittens at birth.

(ii) Litter weigh**t** at birth (LWB): Weight of all the kittens per litter (g).

(iii) Kindling Loss (KL): Difference between the weight of the does before kindling and their weight a day post-partum (g).

(iv) Neonatal mortality (%): $\frac{\text{Number of mortality in kittens}}{\text{Total number of kittens}} \text{X } 100$

(v) Coefficient of milking capacity (CMC) = $\frac{C2 - C1}{21 \times C1}$

C_1= Litter weight at birth (g)

C_2= Litter weight at 21 days post-partum (g)

b. Weaning traits (at 6 weeks i.e. 42 days post-partum)

(i) Litter size at weaning (LSW) – Total number weaned.

(ii) Litter weight at weaning (LWW) – weight of all weaners per litter (g).

(iii) Litter weight gain (LWG) – The difference between litter weight at birth and litter weight at weaning (g).

(iv) Weaning sex ratio – proportion of males to females at weaning.

(v) Survival rate to weaning – this was obtained using the formula:

$$\frac{\text{Litter size at weaning} \times 100}{\text{Litter size at birth}}$$

(vi) Total number of young **weaned** per doe during the trial period.

c. Growth traits

1. Individual body weight of kits at 7, 14, 21, 28, 35, 42 days

Data analysis

All the data collected on the parameters evaluated in this experiment at various stages of the studies were subjected to statistical analysis of variance (ANOVA) using (SAS, 1998) computer package. The variations in means were separated using the Duncan Multiple Range Test (Duncan, 1955).

RESULTS

The proximate composition of processed *Lecaena leucocephala* leaf meal is presented in Table 1 The dry matter percentage of the fermented *Leucaena leucocephala* leaf meal (89.82%) was significantly ($P<0.05$) lower than the air-

dried (91.32%), fresh water (91.07%) and 60ºC hot water (91.29%) processed *Leucaena leucocephala* leaf meal. The crude protein was significantly lower (P<0.05) in 60ºC hot water processed *Leucaena leucocephala* leaf with the air dried having the highest value of 29.17%. The crude fibre values ranged from 5.35% in fermented to 13.77% in air-dried *Leucaena leucocephala* leaf meal. Ash content was higher (P<0.05) in hot water treated sample (10.78%) followed by the air-dried sample (9.14%), fresh water treated sample (8.13%) and fermented *Leucaena leucocephala* leaf (3.22%). Ether extract is significantly (P<0.05) higher in fresh water treated sample (6.13%) followed by 5.83%, 5.66% and 5.59% for hot water treated, air-dried and fermented samples respectively. Nitrogen free extract values showed significant (P<0.05) difference with air-dried sample having the lowest value of 42.27%, followed by fresh water treated sample (50.21%), hot water (50.93%) with the highest value of 61.05% in fermented sample. Gross energy content of processed *Leucaena leucocephala* leaf ranged from 3366.55Kcal/kg in air-dried sample to 3927.55Kcal/kg in fermented sample. Fresh water and hot water treated samples have values of 3568.65Kcal/kg and 3468.30Kcal/kg respectively.

Table 1 Proximate composition and energy content of processed *Leucaena leucocephala* leaf meal

Parameters	ADLL	FWLL	HWLL	FLL	SEM	LS
Crude Protein	29.17^{a}	25.23^{b}	22.67^{c}	24.69^{b}	0.44	*
Crude Fibre	13.77^{a}	10.32^{b}	9.80^{b}	5.35^{c}	0.24	*
Ash	9.14^{b}	8.13^{c}	10.78^{a}	3.22^{d}	0.15	*
Ether Extract	5.66^{b}	6.13^{a}	5.83^{ab}	5.59^{b}	0.09	*
Nitrogen Free Extract	42.27^{c}	50.21^{b}	50.93^{b}	61.05^{a}	0.55	*
ME (Kcal/kg)	3366.55d	3568.65^{b}	3468.30^{c}	3927.55^{a}	127.58	*

Means with the same letter(s) within rows are not significantly different (P>0.05)
ADLL = Air-Dried *Leucaena leucocephala* Leaf
FWLL = Fresh Water *Leucaena leucocephala* Leaf
HWLL = Hot water *Leucaena leucocephala* Leaf
FLL = Fermented *Leucaena leucocephala* Leaf
SEM = Standard Error of the Mean
LS = Level of Significance

- = Significant

ME = Metabolisable energy

The effects of processing on anti-nutritional factors of *Leucaena leucocephala* leaf are presented in Table 2. The result showed that there were significant (P<0.05) difference on the effect of processing methods in reduction or eliminating of mimosine content. The values were significantly (P<0.05) higher in air-dried (0.26 mg/100g) and lowest in 60oC hot water treated *Leucaena* (0.00 mg/100g). Fresh water treated and fermented samples have (0.09 mg/100g) and (0.14 mg/100g) respectively. The effects of the processing methods in tannin, cyanogenic glycoside, phytic acid and oxalate were not significantly (P>0.05) different but with lower values in hot water treated sample. The percentage reduction was lower in all anti-nutrients for hot water sample except in cyanogenic glycoside

Table 2 Effect of different processing methods of processing on anti-nutritional factors in *leucaena leucocephala* leaf

Parameters (mg/100g)	RLL	ADLL	FWLL	HWLL	FLL	LS	SEM
Mimosine	0.42^{a}	0.26^{ab}	0.09^{ab}	0.00^{b}	0.14^{ab}	0.11	*
Tannin	322	311.4	248	120.5	163.1	110.29	NS
Cyanogenic glycoside	3.97	3.89	1.39	1.5	1.12	0.31	NS
Phytic acid	10.02	9.22	6.81	4.98	5.57	1.69	NS
Oxalate	1961.4	1909.7	904.5	763.8	730.5	656.81	NS

Means with the same letter(s) within rows are not significantly different (p>0.05)

RLL = Raw *Leucaena leucocephala* leaf

ADLL = Air dried *Leucaena leucocephala* leaf

FWLL = Fresh water processed *Leucaena leucocephala* leaf

HWLL = Hot water processed *Leucaena leucocephala* leaf

FLL = Fermented *Leucaena leucocephala* leaf

SEM = Standard Error of Mean

LS = Level of Significance

- = Significance

NS = Not Significant

Table 3. Composition of the experimental diets

Items	T_1	T_2	T_3	T_4	T_5
Maize	71.55	46.55	46.55	46.55	46.55
Soybean	25.70	10.70	10.70	10.70	10.70
Leucaena	0.00	40.00	40.00	40.00	40.00
Bone meal	2.00	2.00	2.00	2.00	2.00
Vit Premix	0.25	0.25	0.25	0.25	0.25
Salt	0.50	0.50	0.50	0.50	0.50
Total	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**

T_1= 0 % *Leucaena leucocephala* leaf meal
T_2= 40 % *Leucaena leucocephala* leaf air dried
T_3= 40 % *Leucaena leucocephala* leaf soaked in fresh water for 36 hours at room temperature.
T_4= 40 % *Leucaena leucocephala* leaf soaked in 60^0C hot water for 24 hours
T_5= 40 % *Leucaena leucocephala* leaf fermented for 5 days.

Table 4 Proximate composition of the experimental diets

Parameters	T_1	T_2	T_3	T_4	T_5	SEM	LS
Crude Protein	20.97^{a}	17.49^{c}	21.45^{a}	19.08^{b}	19.77b	0.26	*
Crude Fibre	4.16^{d}	13.05^{a}	10.96^{b}	9.77^{c}	9.72c	0.17	*
Ash	5.55^{d}	8.72^{ab}	6.90^{c}	9.07^{a}	7.99^{b}	0.22	*
Ether Extract	5.37^{a}	4.20^{d}	4.79^{bc}	4.69^{c}	5.04^{b}	0.08	*
NFE	63.95^{a}	56.55^{bc}	55.91^{c}	57.38^{b}	57.49^{b}	0.34	*
ME (kcal/kg)	3844.40^{a}	33.19.50b	3524.85^{b}	3480.05b	3543.35b	1.87	*

Mean with the same letter(s) within rows are not significantly different (P>0.05)
SEM = Standard Error of the Mean
LS = Level of Significance
* = Significant

The results of the reproductive performance of rabbits fed differently processed *Leucaena leucocephala* are presented in Table 5. There were significant (P<0.05) differences in the parameters determined except the average number of conception

and the average number of mortality per doe. All other parameters measured were significantly ($P<0.05$) different. The average weight of doe at mating was significantly ($P<0.05$) higher in rabbits fed fermented *Leucaena leucocephala* leaf meal (1775.40g), followed by 1666.70g, 1605.60g, 1531.50g and 1402.80g for T_4, T_3, T_1 and T_2 respectively. This trend was also observed in the average weight of does before, after and 3 weeks after kindling. The values obtained for the average weight of does at weaning was significantly ($P<0.05$) lower in rabbits fed diets with no *Leucaena leucocephala* leaf meal inclusion (1412.96g). The highest value was obtained in T_5 (1704.17g), followed by 1598.61g, 1552.78g and 1477.78g for T_4, T_3 and T_1 respectively. The average number of conception per doe was not significantly ($P<0.05$) different among the treatment means. It ranged from 2.00 in T_4 to 2.78 in T_5.

The average number of kindling per doe was highest in treatments 3 and 5 and lowest in treatment 2. There were significant ($P<0.05$) differences among the treatment groups. Average number of pregnancy absorbed was highest in rabbits fed air dried *Leucaena leucocephala* leaf meal (T_2) and lowest in rabbits fed hot water treated *Leucaena leucocephala* leaf meal (T_4). The values were significantly ($P<0.05$) different among the treatment groups.

Litter size per doe at birth and at weaning among the treatment means differ significantly ($P<0.05$) with T_3 having the highest value of 7.72 at birth, followed by 7.61, 7.50, 6.17 and 1.67 for T_4, T_5, T_1 and T_2 respectively. At weaning T_4 has the highest litter size of 7.44 followed by 7.28 for T_5, 6.94 for T_3, 5.83 for T_1 and 1.67 for T_2. The average litter weight at birth were also significantly ($P<0.05$) lower in T_2 and highest in T_3 while T_1 was highest in the average litter weight pre doe at weaning. There was no significant ($P>0.05$) difference in the average mortality per doe among the treatment groups, however T_3 has the highest value of mortality per doe.

The co-efficient of milking capacity was significantly ($P<0.05$) higher in T_1 and lowest in T_2. The values ranged from 0.04 for T_2 and 0.14 for T_1. The average litter weight at weaning was significantly ($P<0.05$) higher in T_1 (457.13g) and lowest in T_2 (101.33g). The differences were not significant ($P>0.05$) among other treatment groups.

Table 5 Effects of dietary inclusion of differently processed *Leucaena leucocephala* leaf meal on reproductive performance of rabbits (*Oryctolagus cunniculus*)

TREATMENTS PARAMETERS	T_1	T_2	T_3	T_4	T_5	SEM	LS
Average wt of Does at mating (g)	1531.5^{ab}	1402.8^{b}	1605.6^{ab}	1666.7^{a}	1776.4^{a}	73.24	*
Av wt of Does after kindling (g)	1592.6^{ab}	1472.2^{b}	1716.7a	1775.5^{a}	1812.0^{a}	70.87	*
Av wt of Does 3 weeks after kindling	1507.41^{bc}	1436.11^{c}	1550.0^{bc}	1655.56^{b}	1783.33^{a}	57.64	*
Av wt of Does at weaning (g)	1412.96^{b}	1477.78^{b}	1552.78^{ab}	1598.61^{ab}	1704.17^{a}	64	*
Av no of conception per Doe	2.17	2.22	2.56	2	2.78	0.43	NS
Av no of kindling per Doe	1.61^{ab}	0.33^{b}	1.89^{a}	1.67^{ab}	1.89	0.42	*
Av no of pregnancy absorbed per Doe	0.44b	1.89^{a}	0.56b	0.33^{b}	0.89^{b}	0.25	*
Av litter size per Doe at birth	6.17^{a}	1.67^{b}	7.72^{a}	7.61^{a}	7.50^{a}	1.43	*
Av litter wt per Doe at birth (g)	57.25^{a}	15.00^{b}	68.58^{a}	58.56^{a}	51.93^{a}	11.26	*
Average Mortality per Doe	0.33	0	0.78	0.17	0.22	0.26	NS
Av litter size per Doe at weaning	5.83^{ab}	1.67^{b}	6.94^{a}	7.44^{a}	7.28^{a}	1.35	*
Av litter wt per Doe at weaning (g)	457.13^{a}	101.33^{b}	410.69^{a}	385.13^{a}	337.71^{a}	55.65	*
Co-efficient of milking capacity	0.14^{a}	0.04^{b}	0.11^{ab}	0.11^{ab}	0.09^{a}	0.02	*

Mean with the same letter(s) within rows are not significantly different (P>0.05)

The results of the pre weaning performance traits of kittens from rabbits fed diets containing differently processed *Leucaena leucocephala* leaf meal are presented in Table 6. The mean birth weight of kittens ranged from 15.00g in T_2 to 68.58g for T_4. There were significant (P<0.05) differences among the treatment groups. Average weight of kittens at 7days post-partum was significantly (P<0.05) higher in T_3 (115.28g) followed by 107.55g, 88.70g,78.88g and 20.00g for T_1, T_4, T_5 and T_2 respectively. Average of kittens at weaning (42 days) ranged from 101.33g in T_2 to 457.13g for T_1. The difference was significant (P<0.05).

The average weight gain of the kittens was significantly (P<0.05) different among the treatment groups. The values was highest in T_1 (397.50g) followed by T_3, T_4, T_5 and T_2 having values of 336.67g, 325.28g, 285.16g and 86.33g respectively.

The survival rate (%) at weaning was highest in T_4 (98.33%) and lowest in T_2 (33.33%). Average number of males at weaning was higher T_1 and T_4 while T_2, T_3

and T_5 recorded higher number of females than males. There were significant ($P<0.05$) differences among the treatment means. Average litter size at weaning was significantly ($P<0.05$) higher ranging from 7.44 in T_4 to 1.67 in T_2.

Table 6 Effects of dietary inclusion of differently processed *Leucaena leucocephala* leaf meal on pre weaning performance traits of kittens of rabbits does.

TREATMENTS PARAMETERS	T_1	T_2	T_3	T_4	T5	SEM	LS
Av wt of kittens at birth (g)	57.25[a]	15.00[b]	68.58 a	58.56[a]	51.93[a]	11.26	*
Av wt of kittens at 7 days	107.55[a]	20.00[b]	115.28[a]	88.70[a]	78.88[a]	14.66	*
Av wt of kittens at 14 days	150.09[a]	30.00[b]	170.28[a]	137.20[a]	115.92[a]	20.6	*
Av wt of kittens at 21 days	225.28[a]	53.33[b]	228.89[a]	189.05[as]	165.02[a]	29.61	*
Av wt of kittens at 28 days	281.48[a]	68.33[b]	273.06[a]	243.34[a]	218.57[a]	39.12	*
Av wt of kittens at 35 days	365.83[a]	78.33[b]	337.36[a]	308.78[a]	260.05[a]	43.33	*
Av wt of kittens at 42 days	457.13[a]	101.33[b]	410.69[a]	385.13[a]	337.71[a]	55.65	*
Av wt gain of kit (1-42) days	397.50[a]	86.33[b]	336.67[a]	325.28[a]	285.16[a]	46.84	*
Survival rate at weaning (%)	95.24[a]	100.00[a]	91.53[a]	98.33[a]	82.16[b]	16.82	*
Neo-Natal Mortality (%)	4.76	0	8.47	1.67	1.17	3.02	NS
Av no of males at weaning	3.28[a]	0.67[b]	3.39[a]	4.22[a]	3.44[a]	0.65	*
Av no of females at weaning	2.56 [ab]	1.00[b]	3.56[a]	3.22[a]	3.83[a]	0.78	*
Av litter size at weaning	5.83 [ab]	1.67[b]	6.94[a]	7.44[a]	7.28[a]	1.35	*

Mean with the same letter(s) within rows are not significantly different ($P>0.05$)
NLLM = No *Leucaena leucocephala* leaf Meal
ADLLM = Air dried *Leucaena leucocephala* leaf meal
FWLLM = Fresh water processed *Leucaena leucocephala* leaf meal
HWLLM = Hot water processed *Leucaena leucocephala* leaf meal
FLLM = Fermented *Leucaena leucocephala* leaf meal
SEM = Standard Error of the Mean
LS = Level of Significance

NS = Not significant

* = Significant

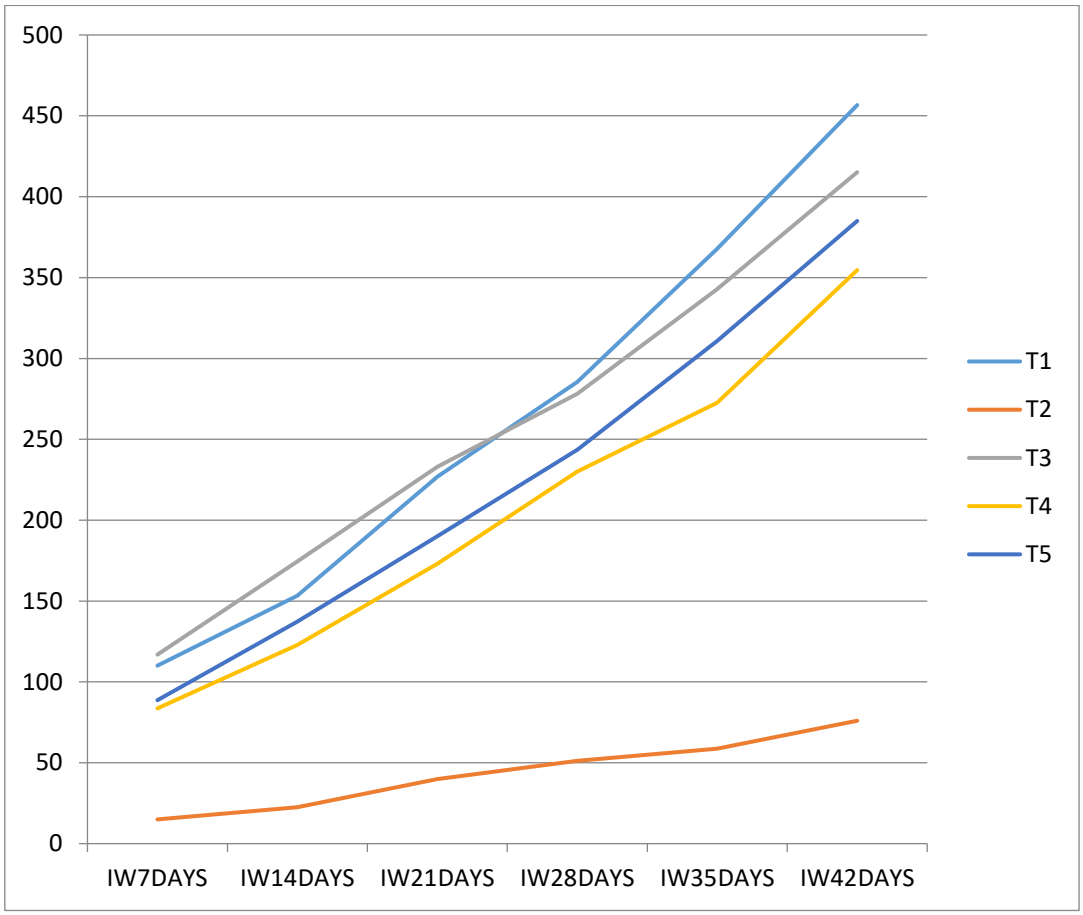

Figure 1.Average weights of kittens from 7 days to weaning (42 days).

T_1= 0 % *Leucaena leucocephala* leaf meal

T_2= 40 % *Leucaena leucocephala* leaf air dried

T_3= 40 % *Leucaena leucocephala* leaf soaked in fresh water for 36 hours at room temperature.

T_4= 40 % *Leucaena leucocephala* leaf soaked in 60^0C hot water for 24 hours

T_5= 40 % *Leucaena leucocephala* leaf fermented for 5 days.

IW7DAYS = Individual weight of kitten at 7 days

IW14DAYS = Individual weight of kitten at 14 days

IW21DAYS = Individual weight of kitten at 21 days

IW28DAYS = Individual weight of kitten at 28 days

IW35DAYS = Individual weight of kitten at 35 days

IW42DAYS = Individual weight of kitten at 42 days

DISCUSSION

The chemical composition of the diets shows that they were adequate to meet the nutrients requirement of the growing rabbits and also confirms with the recommended values (Aduku, 2005). The crude protein ranges of 17.49% to 21.45% (of processed *Leucaena* obtained) were within the range of 12 to 30% reported by Agbede and Aletor (2003); Ajit *et a.l,* (2010) and Fayemi *et al*, (2011). The crude fibre of 4.16% was however lower in diet T_1 (Control diet with no *Leucaena leucocephala* leaf meal inclusion) than the reported crude fibre by Fayemi *et al*., (2011) and Ruiz-Feria *et al*., (1998). Lukefahr and Cheecke, (1991) observed that feeding rabbits with a diet low in fibre and high in energy or a finely ground concentrate diet can result in high mortality due to intestinal disorders such as enterotoxemia.

The significant ($P<0.05$) differences observed in the proximate composition of processed *Leucaena leucocephala* leaf showed that different methods of processing *Leucaena* leaf were effective, this observation agreed with the findings of Okorie and Amechi (2003), who reported the proximate composition of some selected processed tropical legumes, it equally agrees with the finding of Jiya (2012), who reported significant ($P<0.05$) differences in the proximate composition of energy content of raw, cooked and fermented tallow (*Detarium microcarpum*) seeds.

The positive effects of the processing methods observed in the reduction and /or elimination of most anti-nutritional factors are in line with the reports of Soetan and Oyewole (2009), Fayemi *et al,* (2011) and Jiya (2012). They reported significant ($P<0.05$) reduction in the contents of tannin, phytate, saponin, cyanogenic glycoside and trypsin inhibitor when cooking and fermentation were used to alleviate toxic substances in feed ingredients. Kumar (1998) also reported that many anti-nutritional factors are liable to heat and that heat treatment and simple washing with water will alleviate some anti-nutritional factors. The finding also corroborated the work of Nuttaporn and Naiyatat (2009), who reported an overall 94% reduction of mimosine and 99.33% of Tannin after processing *Leucaena leucocephala* leaf meal in both, fresh and hot water for 72 and 48 hours respectively. They however indicated that the nutritive quality of soaked leaf meal appears to be limited by other nutritional factors, such as the lack of certain amino acids.

REPRODUTIVE PERFORMANCE

The results of the reproductive performance of rabbits fed differently processed *Leucaena leucocephala* leaf meal showed that there were significant ($P<0.05$)

differences in all the parameters measured except the average number of pregnancy and average mortality per doe. The weight of the does increased across the treatment groups from mating to pregnancy period and dropped in the same proportion after kindling. The body weight changes were similar to the observation of Ajayi *et al*, (2005) who reported relative body changes in does by stage and parity (from day bred to 28 days after breeding) when rabbits were fed unautoclaved maize-milling waste. The number of conception was not significantly ($P> 0.05$) different among the treatment groups, however the average number of kindling per doe was significantly ($P<0.05$) affected by the diets. The rabbits fed air dried *Leucaena leucocephala* leaf meal had significantly ($P<0.05$) higher number of pregnancy absorbed per doe during the trial period. This agrees with the report of Tike *et al*, (1988) who observed that conception continued in rabbits fed fresh *Leucaena leucocephala adlibitum.*but that kindling did not occur through the trial period. The figure obtained in this study for T_2 though very low could be attributed to the effect of the processing employed that removed little percentage of mimosine in the leaf meal. Muir and Massaete (1995) also reported that does fed *Leucaena leucocephala* based diets had 22% fewer kindling than the females on other diets

The average litter size at birth obtained in this study showed that the value of 1.67 for T_2 was significantly ($P<0.05$) lower than 6.17, 7.50, 7.61 and7.72 obtained for T_1, T_5, T_4 andT_3 respectively. The values except for T_2 were higher than 5.09 reported by Mai (2005); 3.00-5.60 reported by Ijaiya (2003) when rabbits were fed cassava peel meal (CPM) as replacement for maize and 4.06-5.81 reported by Odeyinka et al, (2008) when Moringa oleifera was fed as replacement for *Centrosema pubescens* during reproductive study on New Zealand white and Chinchilla breeds.

The average mortality per doe did not differ significantly ($P>0.05$) among the treatment groups. This is an indication of the good mothering ability of the does an attribute of rabbit production and adequate management practice (Das and Yadav, 2007). The low average mortality agreed with the findings of Iyeghe-Erakpotobor *et al,* (2008) who reported low mortality of 10-16% for rabbit does on concentrate to forage (*Stylosanthes hamata*) combinations in three of the diet treatment and no mortality for rabbit does kits on 20:80 treatment after birth to 7 days postpartum. Omole (1982) reported that protein level of diet of does during pregnancy has been shown to affect kit mortality. The finding therefore is an indication of the high quality protein in *Leucaena leucocephala* leaf meal.

The co-efficient of milking capacity of 0.04-0.14 obtained in this study were higher than 0.03-0.04 reported by Ijaiya (2003) when rabbit does were fed maize and cassava peel meal based diets, this can be attributed to the nutritional worth of *Leucaena leucocephala* leaf meal when adequate processing methods are employed to detoxify the mimosine content. The average weight of kittens at birth was significantly ($P<0.05$) affected by the processing methods, the values ranged between 15.00g for T_2, 51.93g for T_5, 57.25g for T_1, 58.56g for T_4 and 68.58g for T_3. These values except that of T_2 were similar to 61.6-62.0g reported by Adama and Ayanwale (2000) when rabbits were fed cooked and uncooked corms. The values were however higher than 48.80g- 53.52g and 41.37 – 50.73g reported by Iyeghe-Erakpotobor *et al*, (2008) and Ijaiya (2003) respectively. The weight of the kittens at 21 days after kindling were also similar to 155.45g- 256.37g reported by Ijaiya (2003) but higher than 179.6- 185.8g reported by Adama and Ayanwale (2000).

The average weight of kittens at weaning (42 days postpartum) was statistically ($P<0.05$) lower in T_2 but similar among other treatment groups. The values agreed with weaning weights of 343- 415g, 318- 473g and 432.9- 439.3g reported by Iyeghe-Erakpotobor and Muhammed (2007), Ijaiya (2003) and Adama and Ayanwale (2000) respectively. The average weight gain of 285.16- 397.50g per kit also agreed with findings of the authors.

Conclusion

It is concluded that different methods of processing *Leucaena leucocephala* leaf meal had significant effects on all the reproductive parameters measured. Soaking *Leucaena leucocephala* leaves in fresh water for 36 hours at room temperature, soaking the leaves in 60^0C hot water for 24 hours and fermentation of the leaves for 5 days were effective in reducing anti-nutritional factors in the leaves and were recommended for use at 40 % inclusion in rabbit production.

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