

REVIEW ARTICLE

REPRODUCTIVE PERFORMANCE OF RABBITS FED GRADED LEVELS OF CASHEW PULP WITH WHEAT OFFAL AS ABSORBENT

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ABSTRACT

In a 12-week trial, thirty mixed breed does comprising New Zealand White, Chinchilla and California breeds weighing 1.40–2.00kg and aged 1-2 years were equally allocated to five dietary treatments of six does each in a completely randomized design to evaluate and determine the reproductive performance of the rabbits fed graded levels of cashew pulp with wheat offal as absorbent (CpWO). The proximate analysis of processed CpWO showed that it contained values of 24.02%, 94.72%, 5.93%, 53.41%, 5.28%, 5.22%, 1.42% and 89.50% for Crude protein (CP), Dry matter (DM), Crude fibre (CF), Nitrogen-free extract (NFE), Moisture content (MC), Ash content, Ether extract (EE) and Organic matter (OM), respectively. Five dietary treatments were formulated with CpWO replacing corn bran at graded levels of: 0% CpWO (T₁), 10% CpWO (T₂), 20% CpWO (T₃), 30% CpWO (T₄) and 40% CpWO (T₅), respectively. The reproduction parameters evaluated were initial weight of doe, mean daily feed intake of gestating and lactating does (g), weight at parturition (kg), gestation length, parturition weight of doe, litter size at birth, litter weight at birth, mean weight at weaning/kit and average mortality (%). There were no significant differences ($p > 0.05$) in the reproductive performance parameters of the rabbits fed graded levels of cashew pulp with wheat offal as absorbent, except in percentage mortality. The average mortality percentage of T₁ was significantly ($p < 0.05$) higher than that of T₄, T₃ and T₅, respectively. The mortality of the kits was not due to the inclusion of graded levels of the test ingredients. It could be concluded that cashew pulp with wheat offal as absorbent can be included up to 40% in the diets of rabbits without any deleterious effect on their reproductive performance.

KEYWORDS

Rabbits, cashew pulp, wheat offal, reproductive performance, absorbent

1. INTRODUCTION

Rabbit (*Oryctolagus cuniculus*) is a unique animal with small size, rapid growth rate, highly prolific, short gestation interval, ability to utilize forages and agricultural by-products with no competition with human for feed (Bassuny et al., 2005; Oloruntola et al., 2015). There is inadequate protein supply in the diet of people in developing countries like Nigeria according to the report of Igwebuikwe et al., 2005. There is a need to meet the nutritive requirement of rabbits in order to improve their growth and reproductive performance, making rabbit meat more available through improved production for human consumption. The major constraint in livestock production is constant feed supply and ever increasing cost of conventional feedstuffs such as maize and corn bran due to competition between man and livestock for grains (Amefule et al., 2004; Obun et al., 2010). This necessitated constant research by animal nutritionists for readily available alternative feedstuffs such as underutilized agro-industrial waste and indigenous bioresources which can be incorporated in diet of rabbits at lower cost, stored and utilized mostly during dry season when there will be decrease in the quantity and quality of forages. One of such agro-industrial by-products is cashew pulp which is mostly dumped and pollutes the environment (Ominiski et al., 2021). Cashew (*Anacardium occidentale*) is one of the indigenous bioresources in Ogbomoso, Oyo State, Nigeria. Cashew pulp is about 5-10 times the size of the nuts or nearly 90% of cashew (Filgueiras et al., 1999). Less than 10% of it is utilized in Nigeria while the rest is left to rot on the farm (Oduwale 2001; Joseph et al., 2020). The cashew pulp is about 6-9 cm long and has a smooth, shiny skin that turns from green to bright red, orange or yellow in

color as it matures (Ahaotu and Ihekoronye, 2019). Cashew pulp as non-conventional feed sources) can be used to improve the growth and reproductive performance of livestock, reduce cost of production, convert waste to wealth and create job opportunity thereby alleviating some of the global problems facing livestock production. Wadhwa et al., 2015 reported that unconventional feed resources are good alternative to maize/corn bran and other feed constituents that compete with human for food. The researcher reported that cashew pulp can be processed into unconventional feedstuff by mixing it with wheat offal as absorbent. Thus, this study sought to evaluate reproductive performance of rabbits fed graded levels of cashew pulp with wheat offal as absorbent (Olosunde et al., 2023).

2. MATERIALS AND METHODS

2.1 Study Area

The experiment was carried out at the rabbit section of the Bioresources Development Centre (BIODEC) Ogbomoso, Oyo State. The experiment lasted for twelve weeks.

2.2 Processing of CpWO

Ripe and dropped Cashew fruits were picked up early in the morning under the cashew trees at Bioresources Development Centre, Ogbomoso. The nuts were removed and the pulps collected into empty 20 litres bucket and weighed. The cashew pulp was grind and mixed thoroughly with wheat offal at ratio 1:1 by hand until the fluid from Cp was not superfluous and subsequently sun-dried for 3 days (Makinde and Sonaiya, 2007). Sun

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drying was be done by spreading thinly on black polythene sheets (0.7 mm thickness) on concrete floor. Samples were analyzed for proximate composition and incorporated in the rations. The animals were fed 4% of their body weight on dry matter basis daily.

1.3 Experimental Animal and Diets

Five dietary treatments were formulated with CpWO replacing corn bran at graded levels of: 0% CpWO (T₁), 10% CpWO (T₂), 20% CpWO (T₃), 30% CpWO (T₄) and 40% CpWO (T₅). Thirty mixed breed does comprising New Zealand White, Chinchilla and California weighing 1.40 – 2.00kg and aged 1-2 years were equally allocated to five dietary treatments in a completely randomized design. The thirty (30) does were weighed and randomly distributed into 5 treatments (6 rabbits per treatment) and fed experimental diets at 4% of their body weight on dry matter basis. The experimental animals were housed individually and maintained in cages with wire screen floors raised to a height of 90cm from the concrete. Row cages of size 76cm x 62cm x 42cm each were used. Routine health management and sanitation were strictly adhered to. The rabbits were allowed to acclimatize for 2 weeks. Experimental diets were analyzed for proximate composition, anti-nutritional factors and minerals components. Proximate composition was analyzed using the methods of AOAC (2000).

1.4 Data Collection and Analysis

After two weeks of flushing, does were introduced to the bucks for mating early in the morning before feeding. The kindling boxes were washed, disinfected and placed in the cages with the does one week to the expected kindling date. After kindling the kits born were counted and weighed. The does' weight and litter weights at parturition were recorded. The kits were weaned at 4 weeks of age. Data collected were initial weight of doe, mean daily feed intake of gestating and lactating does (g), weight at parturition (kg), gestation length, parturition weight of doe, litter size at birth, litter weight at birth, litter size at weaning, mean weight at weaning/kit and percentage mortality. All data obtained were statistically analyzed with the general linear model of SAS (2013) and the Duncan multiple range tests were used to detect significant differences among means

3. RESULTS

Table 1 shows the chemical composition of CpWO. The values obtained for CpWO in this study were 94.72% DM, 24.02% CP, 5.93% CF, 1.42% EE, 5.22% ash, 53.41% NFE and 89.50% OM. Table 2 shows the five dietary treatments with 0% CpWO (T₁), 10% CpWO (T₂), 20% CpWO (T₃), 30% CpWO (T₄) and 40% CpWO (T₅). Table 3 shows the proximate composition of the experimental diets. There is no significant difference (P>0.05) in dry matter, crude protein and nitrogen free extract content of the experimental diets. The dry matter content of T₁ (96.43%) was the highest, while T₅ (95.15%) had the least. The dry matter content indicates that all

Table 1: Chemical composition of CpWO

Parameter	CpWO
Dry matter	94.72
Analysis % of DM	
Crude protein	24.02
Crude fibre	5.93
Ether extract	1.42
Ash	5.22
Nitrogen free extract	53.41
Organic matter	89.50

CpWO: Cashew pulp with Wheat Offal as absorbent

Table 2: Composition of experimental diets

Ingredients (%)	T ₁	T ₂	T ₃	T ₄	T ₅
Corn Bran	40	30	20	10	0
CpWO	0	10	20	30	40
Soybean milk residue	5.5	5.5	5.5	5.5	5.5
Palm kernel cake	30	30	30	30	30
Rice bran	12	12	12	12	12
Groundnut cake	5	5	5	5	5
Fish meal	3	3	3	3	3
Bone meal	2	2	2	2	2
Salt	2	2	2	2	2
Lysine	0.25	0.25	0.25	0.25	0.25
Methionine	0.25	0.25	0.25	0.25	0.25
Total	100	100	100	100	100

CpWO: Cashew pulp with Wheat Offal as absorbent; T₁: 0% CpWO; T₂: 10% CpWO; T₃: 20% CpWO; T₄: 30% CpWO; T₅: 40% CpWO

Table 3: Chemical composition of experimental diets

Parameter	T ₁	T ₂	T ₃	T ₄	T ₅	SEM (±)	Probability
Dry matter	96.43 ^a	96.16 ^a	96.03 ^a	96.16 ^a	95.15 ^a	0.16	0.07
Crude protein	24.76 ^a	24.70 ^a	19.15 ^a	26.40 ^a	26.21 ^a	1.16	0.28
Crude fibre	9.49 ^d	10.60 ^b	11.57 ^a	9.80 ^c	9.88 ^c	0.25	<0.0001
Ether extract	6.32 ^a	3.65 ^b	2.85 ^c	2.67 ^d	0.87 ^e	0.48	<0.0001
Ash	11.79 ^c	10.06 ^e	13.82 ^a	12.12 ^b	10.46 ^d	0.45	<0.0001
Nitrogen free extract	48.64 ^a	50.99 ^a	52.61 ^a	49.11 ^a	52.58 ^a	0.94	0.63
Organic matter	83.64 ^c	86.10 ^a	82.21 ^d	84.01 ^{bc}	84.69 ^b	0.43	0.001

Mean within each row with different superscript are significantly different (p<0.05)

CpWO: Cashew pulp with Wheat Offal as an absorbent; T₁: 0% CpWO; T₂: 10% CpWO; T₃: 20% CpWO; T₄: 30% CpWO; T₅: 40% CpWO ;

SEM: Standard error of mean experimental diets had less than 10% moisture content. There is significant difference (P<0.05) in the crude fibre, ether extract, ash and organic matter content of the different

treatments. The crude fibre content of T₃ (11.57%) was significantly (P<0.05) higher than the mean values of 10.60, 9.88, 9.80 and 9.49%, obtained for T₂, T₅, T₄ and T₁, respectively. T₁ ether extract content was significantly (P<0.05) higher than that of others while the organic matter content of T₂ was significantly (P<0.05) higher than that of others. The ether extract of the experimental diets decreases with increase in the inclusion levels of CpWO with T₅ having the least EE content of 0.87%. The ash content of T₃ (13.82%) was significantly (p<0.05) higher than that of others. T₃ (13.82%) had the highest (p<0.05) ash content, while T₂ with value 10.06% was the least. There was no significant difference (P>0.05) in the nitrogen free extract contents of the different experimental diets. There was significant difference (p<0.05) in organic matter content of the experimental diets. The organic matter content of T₂ (86.10%) was significantly (p<0.05) higher than that of others. Table 4 shows the mineral composition of experimental diets. There was significant

differences (p<0.05) in all the minerals considered in the different inclusion levels of the cashew pulp with wheat offal as absorbent. The calcium content in the experimental diets decreases with increase in the level of the CpWO inclusion. The calcium content of T₁ (9.50 mg/100g) was the highest (p<0.001), with T₅ (1.05 mg/100g) having the lowest calcium content. The value of magnesium of T₁ was significantly (p<0.05) higher than that of others. T₁ had the highest levels of magnesium (4.55 mg/100g). The mean value of potassium in T₅ (57.70 mg/100g) was significantly (p<0.05) higher than that of others. T₁ had the lowest value of potassium content (41.22 mg/100g). The sodium content of T₄ (20.25 mg/100g) was significantly (p<0.05) higher than that of T₂, T₃ and T₁ but not significantly (P<0.05) different from T₅. The iron, copper and manganese content of T₅ was significantly (P<0.05) higher than the mean values of others while T₄ was significantly (p<0.05) higher in zinc content.

Table 4: Mineral Composition of experimental diets

Minerals (mg/100g)	T ₁	T ₂	T ₃	T ₄	T ₅	SEM (±)	Probability
Calcium	9.50 ^a	3.50 ^b	2.53 ^c	2.10 ^d	1.05 ^e	1.00	<0.0001
Magnesium	4.55 ^a	2.10 ^b	1.50 ^c	0.85 ^d	0.25 ^e	0.50	<0.0001
Potassium	41.22 ^e	55.60 ^c	43.80 ^d	56.64 ^b	57.70 ^a	2.34	<0.0001
Sodium	15.65 ^d	20.20 ^b	15.70 ^c	20.25 ^a	20.22 ^{ab}	0.80	<0.0001
Iron	1.87 ^e	3.21 ^b	2.40 ^c	2.36 ^d	3.33 ^a	0.16	<0.0001
Zinc	1.25 ^e	4.30 ^b	3.50 ^d	4.72 ^a	3.54 ^c	0.40	<0.0001
Copper	0.13 ^{bc}	0.15 ^b	0.11 ^c	0.15 ^b	0.20 ^a	0.01	0.01
Manganese	0.35 ^c	0.40 ^b	0.42 ^{ab}	0.22 ^d	0.45 ^a	0.03	<0.0001

Mean within each row with different superscript are significantly different (p<0.05)

CpWO: Cashew pulp with Wheat Offal as an absorbent; T₁: 0% CpWO; T₂: 10% CpWO; T₃: 20% CpWO; T₄: 30% CpWO; T₅: 40% CpWO; SEM: Standard error of mean

Table 5 shows the anti-nutritional factors in experimental diets. There were significant differences (P<0.01) in the saponin, alkaloids, flavonoid, tannin, polyphenol, cyanide, phytate and oxalate content of different

experimental diets. The saponin (10.87%) content in T₅ was significantly (P<0.05) higher than that of others. Tannin (10.21mg/100g) and polyphenol (8.80mg/100g) in T₅ were significantly (p<0.05) higher than the values obtained from other diets. The alkaloids (6.43%) and phytate (86.24mg/g) contents in T₃ and flavonoid (8.70%) content in T₂ were significantly (P<0.05) higher than the mean values of others while T₂ was significantly (P<0.05) lower in cyanide content.

Table 5: Antinutritional factors in experimental diets

Parameter	T ₁	T ₂	T ₃	T ₄	T ₅	SEM (±)	Probability
Saponin (%)	10.11 ^c	9.47 ^d	8.94 ^e	10.73 ^b	10.87 ^a	0.23	<0.0001
Alkaloids (%)	6.31 ^b	5.56 ^d	6.43 ^a	5.98 ^c	6.32 ^b	0.11	<0.0001
Flavonoids (%)	7.44 ^b	8.70 ^a	6.90 ^c	5.74 ^e	6.08 ^d	0.35	<0.0001
Tannin (mg/100g)	6.83 ^e	8.47 ^d	9.26 ^b	8.94 ^c	10.21 ^a	0.37	<0.0001
Polyphenol (mg/100g)	5.49 ^e	7.89 ^b	7.80 ^c	6.96 ^d	8.80 ^a	0.37	<0.0001
Cyanide (mg/kg)	2.55 ^a	1.26 ^e	1.32 ^d	2.23 ^c	2.32 ^a	0.18	<0.0001
Phytate (mg/g)	84.52 ^d	83.27 ^e	86.24 ^a	85.36 ^b	84.94 ^c	0.33	<0.0001
Oxalate (mg/g)	16.10 ^a	11.37 ^d	10.97 ^c	12.29 ^c	12.52 ^b	0.61	<0.0001

Mean within each row with different superscript are significantly different (p<0.05)

CpWO: Cashew pulp with Wheat Offal as an absorbent; T₁: 0% CpWO; T₂: 10% CpWO; T₃: 20% CpWO; T₄: 30% CpWO; T₅: 40% CpWO; SEM: Standard error of mean

Table 6 shows the reproductive performance of the experimental rabbit does. There were no significant differences (p>0.05) in the reproductive performance parameters of the rabbits fed graded levels of cashew pulp with wheat offal as absorbent, except in % mortality. There were no significant differences (p>0.05) in the initial weight of does (1.69-1.75kg), mean daily feed intake of the gestating and lactating does (75.25-80.52g) and weight at parturition (1.89-1.97kg) across all the treatments. The

average gestation length was between 31.00 and 31.50 days with does on T₁ having the highest gestation length. Does in T₂ have the highest litter size at birth (4.50). There were no significant differences (p>0.05) in the litter size at weaning and mean weight at weaning per kit across the treatments. The percentage mortality of T₁ (0% inclusion of CpWO) was significantly (p<0.05) higher than that of T₄, T₃ and T₅, respectively. The percentage mortality of T₂ was not significantly higher than T₁. The survival rate 63.33%, 79.40%, 92.78%, 95.10%, 96.62% and 97.14% of the kits increased with the different inclusion levels of CpWO for T₁, T₂, T₄, T₃ and T₅, respectively.

Table 6: Reproductive Performance of the Experimental rabbit does

Parameter	T ₁	T ₂	T ₃	T ₄	T ₅	SEM (±)	Probability
Initial weight (kg)	1.71 ^a	1.72 ^a	1.73 ^a	1.69 ^a	1.75 ^a	0.04	1.00
Mean daily feed intake of gestating and lactating does (g)	80.52 ^a	75.25 ^a	77.80 ^a	78.23 ^a	76.23 ^a	1.76	0.92
Weight at Parturition (kg)	1.97 ^a	1.89 ^a	1.94 ^a	1.94 ^a	1.90 ^a	0.05	0.98
Gestation length (days)	31.50 ^a	31.33 ^a	31.00 ^a	31.00 ^a	31.00 ^a	0.15	0.80
Mean Litter Weight at birth (g)	51.70 ^a	49.28 ^a	49.44 ^a	48.28 ^a	42.71 ^a	0.24	0.32
Mean Litter size at birth	4.33 ^a	4.50 ^a	4.29 ^a	4.11 ^a	4.29 ^a	1.35	0.99

Table 6 (cont): Reproductive Performance of the Experimental rabbit does

Mean weight at weaning/kit (g)	274.22 ^a	222.10 ^a	186.61 ^a	192.24 ^a	224.29 ^a	10.22	0.06
Mean Litter size at weaning	2.83 ^a	3.50 ^a	4.00 ^a	3.78 ^a	4.14 ^a	0.25	0.57
Percentage mortality	36.67 ^a	20.60 ^{ab}	4.90 ^b	7.22 ^b	2.86 ^b	3.38	0.01

Mean within each row with different superscript are significantly different (p<0.05)

CpWO: Cashew pulp with Wheat Offal as an absorbent; T₁: 0% CpWO; T₂: 10% CpWO; T₃: 20% CpWO; T₄: 30% CpWO; T₅: 40% CpWO; SEM: Standard error of mean

4. DISCUSSION

The lower moisture content of (5.28%) favored the storage of CpWO since moisture content >12% is not desirable pertaining to good keeping quality (Rozis, 1997). High moisture content support microbial growth and spoilage of feedstuff (Afolayan et al., 2019). Maize is the most common cereal used in feed formulation in Africa, like most other places (Dei, 2017). Due to maize importance in many sectors and increase in demand, cost of maize is regularly on an ascending scale, thereby causing the high cost in livestock production. This necessitated research into alternative and non conventional feed ingredients that can replace maize and its products.

The values of dry matter (94.72%), crude protein (24.02%), crude fibre (5.93%) and ash (5.22%), of CpWO were higher than the values of dry matter (88.75%), crude protein (8.92%), crude fibre (1.93%) and ash (1.90%) of maize (conventional feedstuff) reported by (Ahaotu and Ihekoronye, 2019). The crude protein content of CpWO is higher than 9.8% and 8.75%, also reported for maize (Abiose and Ikujenlola, 2014; Ape et al. 2016). CpWO can be used to replace conventional feed ingredient such as maize at graded levels due to the rich chemical composition. The values were also higher than the values of dry matter (86.90%), crude protein (7.76%), crude fibre (3.90%) and ash (3.62%) of fresh cashew apple reported by (Castillo and Gerpacio, 2005). The authors reported higher values for nitrogen free extract (64.00%) and ether extract (3.90%). The values of dry matter, crude protein, crude fibre, ash and organic matter of the CpWO were higher than values for the sun-dried cashew waste (CAW), dehydrated cashew apple meal (DCAM), dried cashew pulp (DCP), dried cashew apple meal (DCAM) reported by researcher respectively (Fanimo et al., 2003; Gomes et al., 2018; Ahaotu and Ihekoronye et al., 2019; Boateng et al., 2021). The researcher reported that the values of dry matter, crude protein, crude fibre, ash and organic matter were 81.00%, 8.60%, 3.80%, 3.80% and 43.00%, respectively (Ahaotu and Ihekoronye, 2019). The crude fibre and ether extract reported in this study are lower than the values obtained by (Okpanachi et al., 2016). The authors reported 88.78% and 89.20 % DM, 13.82% and 16.96% CP, 6.71% and 7.08% CF, 2.85% and 2.48% ash and 54.79% and 52.28% carbohydrate for sun-dried yellow and red varieties of cashew pulp, respectively.

The dry matter, crude protein and ash content of cashew apple waste (CAW) by the researcher were lower than that of CpWO obtained in this study (Adebowale, 2021). The authors reported higher crude fibre content of 9.71%. Methods of processing cashew pulp into feedstuff might have resulted in these differences in chemical composition. CpWO could be incorporated in the feed of livestock as protein supplement. The values of the nutrient contents of CpWO agreed with the report that cashew apple or pulp is a rich source of essential nutrients (Deckers et al., 2001)

These moisture contents are adequate for preventing mold growth and promoting shelf-life of the diets (Rozis, 1997). The crude protein range (19.15-26.40%) was higher than the range 17-20% reported by (Lebas et al.1997). In this study, all crude protein values were above 18% CP recommended for gestation and lactating rabbits (Lebas, 1980). Feeds containing 20% or more of crude protein (CP) are protein supplements, while those with less than 20% CP are energy feeds. The crude fibre content of T₅, T₄ and T₁ were below 10-12% CF requirement for pregnant and lactating does. Generally, rabbits require 2-3.5% ether extract in diets (Onukwru et al., 2022). T₅ is the only diet with ether extract value lower than the recommended values. The ash content of all the experimental diets were than 4-6.5% dietary ash recommended for growing rabbits (MSUBT, 2017). The nitrogen free extract values obtained in this study (48.64-52.61%), were higher than 43-47% NFE requirement for growing rabbits (MSUBT, 2017).

Calcium values of T₂ to T₅ were lower than 4.50-7.50 mg/100g recommended for pregnant and lactating does by (NRC, 1977). There is need to fortify calcium content of experimental diets T₂-T₅ in order to prevent rickets due to deficiency of calcium. Magnesium values of T₁ to T₅ were higher than 0.40 mg/100g recommended for pregnant and lactating does by (Lebas, 1980). Pregnant and lactating does require 6.00-9.00 mg/100g dietary potassium (Tanuvus, 2012). The potassium values for all the diets in this study, where above the range recommended for rabbits. Sodium plays important role in maintaining the health of the heart in rabbits. The sodium values in this study were higher than 2.00-4.00 mg/100g recommended for pregnant and lactating does (NRC, 1977; Lebas, 1980). The values of iron, copper and zinc contents of the different

experimental diets were below the recommended values for pregnant and lactating rabbits. The manganese contents of the T₅ (0.45 mg/100g), T₃ (0.42 mg/100g), T₂ (0.40 mg/100g) and T₁ (0.35 mg/100g) were higher than those needed by pregnant and lactating does. Manganese is a co-enzyme in amino acid metabolism and cartilage formation (Matteos, 2020). Cashew pulp is rich in minerals as reported by (Ahaotu and Ihekoronye, 2019). The variation in the values of the minerals observed in this experiment could be due to graded levels of inclusion of CpWO in the experimental diets of the rabbits, associated effects and interactions among feed ingredients.

The study reported that rabbits preferred high saponin alfalfa at low (20% or less) dietary levels, while at 35% or higher, the low saponin type was preferred (Cheeke et al., 1977). It is also reported that saponin at the low level (<10%) is harmless, while higher concentrations can result in dysentery, diarrhea and gastroenteritis (Agbaire, 2012). The rabbits were fed experimental diets at 4% of their body weight on dry matter basis. T₅ having the highest saponin (%) at 1.90kg weight will consume 0.076kg/day of experimental feed containing 0.44% saponin. This is lower than the toxic level. The tannin range (6.83-10.21 mg/100g) obtained in this study was lower than the range 60-100 g/kg DM considered to depress feed intake and growth in livestock (Barry and Duncan, 1984). Studies evaluated by researcher was sub-lethal toxicology of *Monodora myristica* Geartn Dunnel seeds on rabbits using ethyl acetate fraction (EAF) containing 3.40 mg/g flavonoid concentration and 81.34% flavonoid content (Akinwumi, 2014). The administration of the flavonoid fraction at 500mg/kg and 1000mg/kg body weight of the rabbits had no adverse effect on vital organs of the rabbits (the brain, lungs, heart, liver and kidney). The range of the flavonoid (5.74-8.70%) recorded in this study was lower than 81.34% flavonoid reported by (Akinwumi 2014). The cyanide range of 1.32-2.55mg/kg from this study is within the recommended level (0-500 ppm) dry matter basis safe for livestock (Lemus et al., 2009). T₁ 16.10mg/g value for oxalate was significantly (P<0.05) higher than that of the other experimental diets. It has been reported that 20g/kg oxalate can be lethal to chicken (Acamovic et al., 2004). The ranges of flavonoids (5.74-8.70%), tannin (6.83-10.21 mg/100g), polyphenol (5.49-8.80mg/100g), oxalate content (10.97-16.10mg/g) and phytate (83.27-86.24mg/g) in this present study were below the toxic level.

The gestation length fell within 30 and 32 days reported by researcher but higher than 28 - 30 days reported by (Odeyinka, 2008; Lebas et al., 1983; Odeyinka et al., 2016; Onuoha et al., 2020). Litter size at birth of 4.11-4.50 observed in this study was lower than 5.09 who reported 5-9 average litter size (Ozimba and Lukefahr, 1991; Odubote and Akinokun, 1991). The percentage mortality ranges from 2.86 to 36.67%. The mortality of the kits was not due to the inclusion of graded levels of the CpWO. CpWO is rich in antioxidants and contains high nutrient profile which may have positive influence on milk production, thereby enhancing the survival rate.

5. CONCLUSION

It could be concluded that cashew pulp with wheat offal as absorbent could be included up to 40% in the diets of rabbits without any deleterious effect on reproductive performance.

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