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PERFORMANCE AND DIGESTIBILITY RESPONSE BY RABBITS FED DIETS CONTAINING COWPEA HAULMS (Vigna unguiculata) REPLACING RICE OFFAL AT GRADED LEVELS

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ABSTRACT

An 84-day feeding trial was conducted with weaner rabbits to investigate the feeding value of cowpea haulms (Vigna unguiculata) on growth performance and nutrients digestibility. Thirty-six (36) weaner rabbits with initial live weight range of 427.33 – 474.50g were randomly allocated to six (6) dietary treatments and each treatments replicated six (6) times in a complete randomized design. Each treatment was made up of three (3) males and three (3) females with each as a replicate. The rabbits were fed diets with cowpea haulms replacing rice offal at 0%, 20%, 40%, 60%, 80%, and 100% levels according to treatments T1, T2, T3, T4, T5, and T6 respectively and T1 with 0% cowpea haulms as the control diet. The result of proximate composition and energy values of experimental diets revealed a crude protein value of 16.62% for T2 less than a similar value of 17.50% for T3, T4, T6 and T1 and T5 with a value of 18.38%. Crude fibre values ranged 12.43 to 21.00% increased across T1 –T6 as cowpea haulms (CH) level increased in the diet. Ether extract however decreased from T1 –T6 with increase in the level of CH with moisture following no particular trend. Ash was seen to decrease with increase in the diet CH, dry matter values 89.91% (T1) to 91.77% (T5) and NFE values 56.28 (T1) to 62.82 (T4) were in no particular trend. Also, ME values 3139.59 (T4) to 2731.32% (T1) did not follow a definite trend among the experimental treatments. The final weight (FW) was shown to decrease across the treatments with T1 having the highest final weight. T4 and T6 had the similar final weights. The nutrient digestibility across the six treatments revealed significant ($P<0.05$) differences in the digestibility of Crude protein (CP) and Ether extract (EE), the digestibility of crude protein was observed to be significantly ($P<0.05$) lower in the rabbits on diets T4 and T5 while T1 being control diet was significantly ($P<0.05$) lower in ether extract digestibility. The digestibility of dry matter (DM), nitrogen free extra (NFE) and crude fibre (CF) were not significantly ($P>0.05$) different. With these results from this study, it was concluded that, the bulky wastage of cowpea haulms after the seed harvest could be reduced by replacing rice offal with cowpea haulms in rabbit diets as a major crude fibre source. Cowpea haulms had no negative effects on the general growth performance of rabbits. Therefore, it is safe for farmers and feed manufacturers to include cowpea haulms to replace 100% of rice offal as a major source of crude fibre in rabbit diets.

Keywords: Cowpea Haulms, Rice offals, Growth performance, Digestibility Growing Rabbits.

1. INTRODUCTION

Rabbits have remarkable digestive tract that can convert fibrous materials into animal protein and they are known to have the ability to thrive on forages and non-conventional feed resources which are not directly consumed by man (Shaahu *et al*., 2014). They appear to be the most sustainable means of producing high quality animal protein for the expanding population of developing countries. Therefore, maximum rabbit production is one of the sure ways of meeting the animal protein requirement of the present and future Nigeria's population (Iyeghe-Erakpotobor *et al.,* 2006).

Rabbits require about 10-16% crude fibre to produce volatile fatty acids, over all gut health and motility, ceacotrophy and increased voluntary feed intake (FDA, 2011 and Lebas, 1989). Thus, the inclusion of rice offal in rabbit diets as a major source of crude fibre. However, Makinde and Inuwa (2015) reported rice offal to cause a decrease in the voluntary feed intake, protein digestibility, impaired absorption of other nutrients in the ingesta, thereby, resulting to depressed weight gain and other performances. This is as a result of the presence of phytate, enzyme inhibitors, high fibre content and rice offal can undergo oxidative rancidity. Thus, the use of cowpea haulms (18.1 – 44.8% CF), as a readily available agricultural by-product, with low anti-nutritional factors (Feedipedia, 2016 and Anele *et al*., 2012) to replace rice offal (33% CF) in rabbit diets, will not only enhance nutrients digestibility, improve growth performance, but also reduce food challenges as well as solve environmental pollution.

2. MATERIAL AND METHODS

2.1 Location of the Study

The study was conducted at the Rabbitary Unit of Oracle Farms Limited, Makurdi, Benue State. Makurdi lies on latitude 7º 41' 0" North, 8º 37'0" East and is within the Southern Guinea Savannah Agro Ecological Zone of Nigeria. In this zone climate is characterized by two distinct seasons; the wet and dry seasons. The wet season starts in April and end in October while the dry season lasts from November through March. High ambient temperature is experienced in February, March and April, while the harmattan with cool chilly weather is experienced from December to early February. Annual temperature ranges between 21º C in January and 35ºC in March, with an annual rainfall of 1500mm to 1800mm. Relative humidity ranges between 69% in August/September and 39% in January (Anon, 2004).

2.1.1 Test Materials

Cowpea haulms were harvested as by-products of cowpea seed production from farms within Makurdi, dried for two weeks under shade then milled using Hammer mill. Maize and Brewers dried grain (BDG) were purchased from markets within Makurdi. Soybean meal was purchased from a soyabean milling company (Hule and Sons Nigeria Limited) in Tarkaa, Benue State. Rice offal was gotten from small scale rice mills within Makurdi and other feed ingredients; bone meal, common salt (NaCl), synthetic lysine and methionine, vitamin/mineral premix and drugs required for medications were purchased from a Veterinary and Livestock feed shops within Makurdi metropolis.

2.1.2 Experimental Animals, Design of Study and Management of Animals

Thirty-six (36) cross-bred weaner rabbits with the initial live weight range of 427.33 – 474.50g were obtained from a reputable, disease free rabbit farm. The rabbits were reared in individual cages made of metal/wire netting measuring 60 cm x 60 cm x 90 cm, raised 60cm above the floor. The rabbits were allowed to acclimatize to the new environment after which six (6) rabbits each were being randomly allocated to six treatment groups, each treatment was made up of three (3) males and three (3) females with each rabbit serving as a replicate. Live weight differences between treatments were minimized through randomization. The experimental design used is the Completely Randomized Design, (CRD). Standard rabbit husbandry practices including, medications against common external and internal parasites, recommended sanitary measures and other health practices were strictly adhered to throughout the 84 days feeding trial experimental period.

2.1.3 Experimental Diets

Six experimental diets were compounded such that T_1, T_2, T_3, T_4, T_5 and T_6 contained 0, 20, 40, 60, 80 and 100 percentages (%) of cowpea haulms meal added respectively as shown in Table 1.
Maize and soya-bean meal were the major sources of energy and protein supply respectively in the whole experiment. The replacement of rice offal with cowpea haulms has effect on the percentage (%) of crude protein and crude fibre content of the feed across the treatments.

2.1.4 Parameters Measured

The parameters measured during this experiment include; Proximate composition of the experimental diets, Growth performance, Nutrient digestibility, Economics of production, Haematological parameters, Serum biochemistry, Carcass Characteristics and Visceral of Rabbits fed diets containing Cowpea Haulms replacing Rice offal at graded levels.

2.1.5 Proximate Composition

Proximate composition of cowpea haulms is being determined using the methods described by A.O.A.C. (2002).

2.1.6 Growth Performance

a. Feed intake.

Total feed intake: this was calculated as the feed intake multiply by the total number of days the rabbits were fed.

Feed intake (g) = Feed supplied – Feed left over.

Average daily feed intake: During the experiment a known quantity of feed was offered to each rabbits and the left over feed at the end of every week was weighed and the feed consumed i.e Average daily feed intake was calculated by difference.

$$ADFI = \frac{FO - LOF}{Duration\ of\ Study}$$

Where; ADFI = Average daily feed intake, FO = feed Offered, LOF = left over feed.

b. Weight Gain

Total weight gain: This was calculated by subtracting initial weight from the final weight of the rabbits.

Total weight gain (g) = final weight – initial weight

Average Daily Weight Gain: this was computed by subtracting the initial weight from the final weight, then divided by duration of study.

$$ADWG = \frac{FWt - IWt}{Duration\ of\ study}$$

Where; ADWG = Average daily weight gain, FWt =Final weight, IWt =Initial weight.

c. Feed conversion ratio.

The feed conversion ratio was computed by dividing the Average daily feed Intake by the Average daily weight gain of the animals thus;

$$FCR = \frac{ADFI}{ADWG}$$

Where; FCR = Feed Conversion Ratio, ADFI = Average daily feed intake, ADWG = Average Daily weight gain.

2.1.7 Nutrient digestibility.

At the end of the feeding period being 12 weeks, a digestibility trial was carried out and feacal collection was for a period of five days. Three rabbits, with live weight most closely to the treatment mean from each treatment were selected and used for the trial. A known quantity of feed was offered to the rabbits during this period. The rabbits housed in cages with netting floors measuring 60cm x 60cm x 90cm raised 60cm above the ground made it easy for the collection of feaces voided by placing net under the cages which allowed separation of feaces from their urine thereby, preventing contamination of the feaces with urine, this lasted for a period of five days. The collection was performed at approximately 7:00hours each morning before the next daily ration was fed to the rabbits. Collected feaces was being oven dried at 60°C for 24hours to a constant weight, then weighed and milled for proximate analysis using A.O.A.C (2002) procedure to determine dry matter (DM), organic matter (OM), crude protein (CP) and crude fibre (CF) content. The apparent digestibility coefficient was determined as thus,

$$\text{Apparent digestibility} = \frac{Nutrient\ intake - Nutrient\ voided}{Nutrient\ intake} \times 100$$

Table 1: Ingredients Composition of experimental Diets of weaner Rabbits Fed Graded levels of Cowpea Haulms in % as Replacement for Rice offal.

Ingredients	Dietary Treatments					
	T_1 0%	T_2 20%	T_3 40%	T_4 60%	T_5 80%	T_6 100%
Maize	20.00	20.00	20.00	20.00	20.00	20.00
Soybean Meal	12.53	12.53	12.53	12.53	12.53	12.53
Brewers Dried Grains	19.00	19.00	19.00	19.00	19.00	19.00
Palm Kernel Cake	25.00	25.00	25.00	25.00	25.00	25.00
Rice offal	19.47	15.58	11.68	7.79	3.89	-
Cowpea Haulms	-	3.89	7.79	11.68	15.58	19.47
Bone Meal	3.00	3.00	3.00	3.00	3.00	3.00
DL-Methionine (synth)	0.25	0.25	0.25	0.25	0.25	0.25
L-Lysine (synth)	0.25	0.25	0.25	0.25	0.25	0.25
Table Salt (Nacl)	0.25	0.25	0.25	0.25	0.25	0.25

Premix (Vit-Min)	0.25	0.25	0.25	0.25	0.25	0.25
Total	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**
Analyzed composition.						
Crude Protein	17.50	16.62	17.50	17.50	18.38	17.50
Crude fibre	12.43	13.81	15.66	16.05	18.93	21.00
Ether extract	6.13	5.97	5.74	5.63	5.56	4.71
Ash	11.97	11.39	11.13	12.16	10.35	9.89
NFE	56.28	61.59	57.20	62.82	61.66	60.35
DM	89.91	91.40	91.20	91.72	91.77	91.65
Moisture	10.09	8.60	8.80	8.28	8.23	8.35
ME (Kcal/Kg)	2731.32	2841.15	3024.27	3139.59	2950.50	2856.77

®Vit-Min Premix (BEAUTS C0. Inc. Man, U.S.A) To supply per Kg. Vitamins A 220,000; Vitamin D, 66,000; Vitamin E 44,014; Vitamin K 88mg; Vitamin B12 0.76mg; Niacin 1122mg; Calcium 27%; Phophorus 10%; Iron 0.6%; Zinc 0.35%; Maganese 0.25%; Copper 0.06%; Iodine 0.002%; Cobalt 26ppm; Selenium 4ppm.

ME = metabolisable energy calculated according to the formula; ME= Metabolizable Energy (Pauzenga; modified by Carew *et al.*, 2020) = 37 x %CP + 81.1 x %EE + 35.5 x %NFE + 35.5(0.22) %CF

Where, ME = Metabolizable Energy, CP = Crude Protein; EE = Ether Extract, and NFE = Nitrogen Free Extract, DM = Dry Matter.

2.1.8 Statistical Analysis.

The data collected (with exception of results of chemical analysis of test ingredients and diets) were analyzed by one-way Analysis of Variance (ANOVA) and where significant differences occur, treatment means were separated using Duncan's Multiple Range Test (DMRT) using computer software known as Statistical Package for Social Science (SPSS) 16th version.

3. RESULTS AND DISCUSSION

3.1 Proximate Composition of Experimental Diets / Test Ingredients

The proximate composition and energy values of experimental diets, cowpea haulms (CH) and rice offal (RO) is presented in Table 2. Crude protein values of 16.62 % were obtained for T_2 which has less value than the other treatments, a similar value of 17.50 % was obtained for T_3, T_4, T_6 respectively while T_1 and T_5 also has a similar value of 18.38 %. Crude fibre values 12.43, 13.81, 15.66, 16.05, 18.93, 21.00 % increased across T_1-T_6 as the cowpea haulms (CH) level increased in the diet, Ether extract however decreased from T_1-T_6 with increase in the level of CH with moisture following no particular trend. Ash was seen to decrease with increase in the diet CH, dry matter values 89.91 (T_1) to 91.77 % (T_5) and NFE values 56.28 (T_1) to 62.82 (T_4) were in no particular trend. Also, ME values 3139.59 (T_4) to 2731.32% (T_1) did not follow a definite trend among the experimental treatments.

The Crude Protein value obtained in this study for rice offal was higher than 6.00 %, 6.00-7.00 % reported by Aduku and Olukosi (1990), Harris and Staples (2003) and 4.38 % reported by Sani (2014). Crude Fibre value was lower than 33 %, 34.73% reported by Aduku and Olukosi (1990) and Sani (2014), and 36.9 % reported by Carew *et al*. (2005) for rice bran obtained in a single stage rice milling (SSRB) but similar to 28 % reported by Harries and Staple (2011). Ash content of 16.77 % obtained in the present study was similar to the report of Aduku and Olukosi (1990) but higher than 11.3 % reported by Carew *et al*. (2005). This was however lower than 24.21 % reported by Sani (2014).

The proximate composition observed in this study for cowpea haulms was 8.75 % CP, 44.31 % CF, 0.36 % EE, 7.63 % Ash, 34.89 % NFE and 95.94 % DM. These values were similar to a range of values, 6.9 -18 % CP, 18.1-44.8% CF, 1.3 – 3.7 % EE and 6.8 -15.9 % Ash reported by Anele *et al.* (2012). The variety, stage of harvest and amount of leaves will account for variations in the values reported by other studies. Supporting this observation, Mullen (1999) reported that, the protein and other nutritional values depends on the stage of maturity and seasonal climatic variation. Haulms tend to be of lower quality (CP less than 18% DM) since the plant is more mature and the residues contains more fibrous materials. There are seasonal differences in the quality of haulms so that attention must be given to handling of haulms to minimize the amount of leaves lost during the wet season (Anele *et al.*, 2012). Indeed, protein content differs widely between leaves (22% DM) and stems (8% DM) (Mullen, 1999; Singh *et al.*, 2010). When only few leaves remain after drying, the protein content may decrease from 18-19% down to 6-8% DM, transforming cowpea haulms into a source of fibre low in protein (Mokoboki *et al.*, 2000; Singh *et al.*, 2003) justifying the high fibre obtained in the present study.

Though the diets were formulated to have a similar crude protein (CP) level, save for diet 2, the high CP content in diet 5 was expected which could be explained to the nature of product used. Being a leguminous plant, higher nitrogen is expected in the product compared to the rice offal which is a cereal by-product with lower crude protein (CP) content. This result revealed crude protein, (CP) values of between 16.62- 18.38 %. The CP in this study was also higher than the 14-17 % recommended by Provet (2015) and 13.34 – 17.89% reported by Orayaga *et al.* (2016) but, similar to 16-18 %, 17.55-17.71% and 16.40- 17.60% recommended by Omole *et al*. (2007), Shaahu *et al*. (2020) and Olaleru *et al*. (2019) to be adequate for good performance of weaner rabbits. Findings of this study therefore agrees with the report of these authors as CP values observed in this study were within this range and thus, supported growth. Crude fibre, (CF) values obtainted in this study was also within ranges of 11.79-13.66% and 10.75-15.06% reported by Shaahu *et al*. (2020) and Malik *et al*. (2020) as being adequate for normal digestive physiology in weaner rabbits. The inclusion of cowpea haulms led to an increase in the fibre content of the diets. This could be due to the proportion of the vegetative cover left at the time of harvest. It is observed that when only few leaves remain after drying, the protein content may decrease transforming cowpea haulms into a source of fibre low in protein (Mokoboki *et al.*, 2000; Singh *et al.*, 2003).

Ether Extract observed in this study was higher than the recommendations of 2 % by NRC (1977), 3 % by Lebas (1980), 2-5 % recommended by Halls (2010) and 2-4 % by Provet (2015) but similar to 6.31 – 9.79 % reported by Carew *et al.* (2020) for good performance. Orayaga *et al.* (2016) reported good growth performance of rabbits fed diets containing as high as 12.08% fat. This suggests that the fat content in the diets were within the safe range for the rabbit's normal digestive physiology. Cheeke (1987) reported a typical rabbit diet to contain energy of

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between 2400-2800 Kcal/kg to meet the energy needs of weaner rabbits. Result of this study revealed energy values that were higher than 2400-2800Kcal/kg but agreed with the values of 2916.35-3422.5Kcal/kg, 2674.00-2712kcal/kg and 2610-2780kcal/kg reported by Shaahu *et al*. (2020), Malik *et al*. (2020) and Olaleru *et al*. (2019) respectively.

Table 2: Proximate Composition of Experimental Diets / Test Ingredients.

Parameters	T_1 0% CH	T_2 20% CH	T_3 40% CH	T_4 60 % CH	T_5 80% CH	T_6 100% CH	CH	RO
CP	17.50	16.62	17.50	17.50	18.38	17.50	8.75	7.69
CF	12.43	13.81	15.66	16.05	18.93	21.00	44.31	28.33
EE	6.13	5.97	5.74	5.63	5.56	4.71	0.36	4.40
Ash	11.97	11.39	11.13	12.16	10.35	9.89	7.63	16.77
NFE	56.28	61.59	57.20	62.82	61.66	60.35	34.89	37.06
Moisture	10.09	8.60	8.80	8.28	8.23	8.35	4.06	5.75
DM	89.91	91.40	91.20	91.72	91.77	91.65	95.94	94.25
ME(Kcal/Kg)	2731.32	2841.15	3024.27	3139.59	2950.50	2856.77	1937.60	2178.06

CP= Crude Protein, CF= Crude Fibre, EE= Ether Extract, NFE= Nitrogen Free Extracts, DM= Dry Matter, CH = Cowpea Haulms, RO = Rice Offal, ME= Metabolizable Energy (Pauzenga; modified by Carew *et al.*, 2020) = 37 x %CP + 81.1 x %EE + 35.5 x %NFE + 35.5(0.22) %CF.

3.2 Growth Performance of Rabbit fed Diets Containing Cowpea Haulms Replacing Rice Offal at Graded Levels from 1 to 12 weeks of feeding

The results of the growth response of rabbits to the experimental diets from 1-12 weeks of feeding is presented in Table 3. Average daily feed intake varied (P<0.05) among the treatment group and values were between 58.54 to 73.90 g. T_1, T_2 and T_3 had comparatively higher (P<0.05) values of average daily feed intake, this reduced (P<0.05) in T_4 and T_5. The least average daily feed intake was observed in T_6 (46.96) with the values decreasing with an increase in the level of CH in the diet save for T_3, final weight 1312.00 to 1500.17 g, average daily weight gain 10.20 to 12.28 g and feed conversion ratio 5.86 to 6.65 did not show any significant (P>0.05) variation across the treatments.

The findings of this study contradicts the report of Malik *et al*. (2020) who reported similarities in the average daily feed intake (ADFI) of growing rabbits fed varying levels of cowpea milling wastes to the control. Daily feed intake of rabbits fed the test diets were less than 73.90g/day by rabbits fed control. Rabbits fed T_6 had the least. The feed intake of 58.54-73.90g/rabbit/day was higher than 50.9-65.79g/rabbit/day, 15.64-18.32 g/rabbit/day, 48.70-57.02g/rabbit/day reported by Shaahu *et al*. (2020), Odedire and Oloidi (2018) and Dairo *et al*. (2018). Feed intake is a function of feed quality, palatability and especially energy value of the feed and capacity of the gastrointestinal tract. Reduced feed intake by the rabbits at higher levels of cowpea haulms (CH) may be implicated by the palatability of diets, since legumes have been reported to contain some anti-nutritional factors. According to Kumar. (2015), the presence of anti-nutritional factors in most legume seeds and forages limits the use as an animal feed ingredient, for monogastric in particular.

Weight gain of experimental rabbits did not show any significant decrease as the level of CH was increased in diets to replace rice offal. This report agrees with that of Malik *et al.* (2020) who observed a similar growth rate in the rabbits fed diets containing cowpea milling waste with those rabbits on the control. Rabbits fed control diet gained similar weight as those fed diets 2, 3, 4, 5 and 6. Growth is a response to feed quality, adequacy and utilization. Implying therefore, that, the growth trend in this study is directly related to the feed intake by the experimental rabbits. The daily weight gains of 10.20 – 12.28 g/day/rabbit reported in this study was less than 14.59-15.13 and 12.64- 14.98g/rabbit/day, reported by Odedire and Oloidi (2018) and Mohammed *et al*. (2018) respectively. These values however were higher than 5.81 -12.13 g/day/rabbit reported by Shaahu *et al.* (2020) but, within the average daily weight gain values of 10-20g/rabbit/day reported for rabbits reared in tropical environment (Cheeke, 1987). The daily weight gain range of 10-12 g/rabbit/day is common with the rabbits around and within the country of study (Shaahu and Tiough. 2019). The similarity observed in the average daily weight gain (ADWG) is an indication that, the diets containing graded levels of CH supplied the nutrients equivalent to the control to support tissue accretion.

The feed conversion ratio obtained in this study was poor compared to values reported by Shaahu and Tyough (2019) but, within the range 2.67-8.73 reported by Shaahu *et al*. (2014). This study collaborates well with reports of Carew *et al.*, (2020) when rabbits were fed 20% RMBPs and 6.11-7.70 by Malik *et al.*, (2020) who fed rabbits cowpea milling waste at different inclusion level of 0%, 10%, 20%, 30% and 40%. The no difference observed for FCR in this study among treatments indicates that the diets containing CH were utilized as much as the control.

Table 3: Growth Performance of Rabbit fed Diets Containing Cowpea Haulms Replacing Rice Offal at Graded Levels.

Parameters	**T_1 0% CH**	**T_2 20%CH**	**T_3 40%CH**	**T_4 60%CH**	**T_5 80%CH**	**T_6 100%CH**	**SEM**	**P (0.05)**
IW (g)	427.33	474.50	472.67	470.50	469.17	468.33	-	-
ADFI (g)	73.90^{a}	72.01^{a}	71.48^{a}	65.31^{b}	62.93^{bc}	58.54^{c}	1.10	0.00
FW (g)	1500.17	1485.00	1463.33	1341.67	1312.00	1343.00	26.32	0.12
ADWG (g)	12.21	12.28	11.79	10.37	10.20	10.47	0.34	0.24
FCR	6.05	5.86	6.06	6.30	6.17	6.65	0.19	0.79

abc=Means on the same row with different superscripts are significantly ($P<0.05$) different, IW-initial weight, FW-final weight, ADWG-average daily weight gain, ADFI-average daily feed intake, FCR- feed conversion ratio, CH- Cowpea Haulms.

3.3 Nutrient Digestibility by Growing Rabbits Fed Diets Containing Cowpea Haulms Replacing Rice Offal at graded levels.

Table 4 shows the apparent nutrient digestibility of growing rabbits fed diets containing varying levels of Cowpea haulms. Crude protein and ether extract digestibility showed significant ($P<0.05$) differences among treatments. The values of CP varied between 42.11 – 69.76 %. These values were significantly ($P<0.05$) lower in rabbits on T_4 (42.11%) and T_5 (51.83%) and high in T_6 (69.76%). Digestibility of ether extract varied from 78.79 – 90.82% significantly ($P<0.05$) lower in T_1 (78.79%) and higher in T_4 (90.82%) respectively. However, Dry matter (DM), Nitrogen free extracts (NFE) and Crude fibre (CF) showed no significant ($P>0.05$) differences in their digestibility.

This study shows the apparent nutrient digestibility of growing rabbits fed diets containing varying levels of Cowpea haulms. crude protein and ether extract digestibility showed a significant difference among treatments. This result agreed with the report of Orji (2009) who observed significant differences in crude protein digestibility and ether extract in hybrid rabbits fed cowpea hulls (CPH) at 0, 10, 20 and 30 % dietary inclusion levels. Variations in the present study did not show any particular trend. Conversely to this observation, dry matter, nitrogen free extract and crude fibre digestibility did not vary across dietary treatments as reported by Orji (2009).

Values obtained in this study for digestibility of CP and CF were lower than 96.74 – 98.40 % and 83.98 – 93.12 % respectively reported by Shaahu and Tiough (2019) in a study replacing maize with graded levels of sweet potato vine – cassava composite meal. The differences observed for CP and CF digestibility cannot be said to have resulted from the quality, characteristics and concentration of these nutrients in the test materials since no definite trend was established to explain this. The similar digestion in crude fibre implies that the fibre fractions in both rice offal and cowpea haulms were similar in both composition and concentration. This affirms the observation of Aderinola *et al*. (2018) who reported a similar digestion in crude fiber to be as a result of similarities in fibre concentration of grass/legume mixtures. It has been observed by Adegbola and Okonkwo (2002) that, fibres from different sources could vary in the digestibility depending on the proportions of cellulose, hemicellulose and lignin. Similarity in digestion also imply that the nutrient was in the range that support normal digestive physiology and thus also responsible for similar digestion of NFE. This observation validates the observation by Shaahu and Tiough (2019) who also attributed similarity in the digestion of CP to have resulted from fibre content in the diets to be within the normal range and not too high to have affected protein digestibility. Digestibility values for EE reported in this study were lower than 98.09 – 99.20 % reported by Shaahu and Tiough (2019) in a study replacing maize with graded levels of sweet potato vine – cassava composite meal.

Table 4: Nutrient Digestibility by weaner Rabbits Fed Diets Containing Cowpea Haulms Replacing Rice Offal at graded levels.

Parameters	T_1 0% CH	T_2 20%CH	T_3 40%CH	T_4 60%CH	T_5 80%CH	T_6 100%CH	SEM	P (0.05)
DM	56.33	60.97	55.02	58.91	61.57	56.93	1.45	0.78
NFE	58.43	63.97	55.18	62.75	65.58	59.96	1.39	0.28
CP	64.19^a	64.51^a	68.81^a	42.11^b	51.83^b	69.76^a	3.06	0.03
CF	38.49	54.27	40.02	35.02	50.66	36.27	2.89	0.27
EE	78.79^c	81.75^{bc}	87.00^{ab}	90.82^a	86.06^{ab}	81.91^{bc}	1.11	0.01

abc= Means on the same row with different superscripts are significantly (P<0.05) different, CH=Cowpea Haulms, DM= Dry matter, NFE= Nitrogen free extract, CP= Crude Protein, CF= Crude Fibre, EE= Ether extract.

4.CONCLUSIONS AND RECOMMENDATION

Based on the results obtained from this study, it was concluded that, cowpea haulms (CH) supplied the level of fibre needed for normal growth and digestive physiology of the rabbits at levels similar to rice offal. The result of this study also revealed that, the inclusion of CH in the diets of growing rabbits up to 100 % significantly depressed voluntary feed intake. The digestibility by rabbits, the proximate fractions of CH for growth and maintenance was not negatively affected. Rabbit meat producers and sellers are recommended to include 60% of CH in the diets of grower rabbits.

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