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GROWTH RESPONSE AND CARCASS CHARACTERISTICS OF WEANER RABBITS FED DIETS CONTAINING CASSAVA PEEL MEAL AS SUBSTITUTE OF MAIZE AS SOURCE OF ENERGY

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Abstract

Eighty (80) weaner rabbits of mixed sexes and breeds (Chinchilla, California and New Zealand white), aged 5 weeks were used to examine the effect of substituting sun-dried cassava peel meal (CPM) for maize as an energy source on growth performance and carcass characteristics of rabbits using a Completely Randomized Design (CRD). The rabbits were divided into four groups designated 1, 2, 3, and 4 and allotted into four dietary treatments formulated with ratios 100:0, 75:25, 50:50 and 25:75% for maize: sun-dried CPM, respectively. All diets were formulated with equal amounts of non-test ingredients. Parameters measured were growth performance and carcass traits. Results obtained showed no significant differences (P>0.05) in daily weight gain, daily feed intake and feed conversion ratio. Slaughter, dressed weight and dressing percent were not significantly (P>0.05) affected by dietary treatments. The weights of the heart, lungs/trachea, liver and kidney were not significantly (P>0.05) affected with the inclusion of CPM in the diets. The results of the study showed that sun-dried CPM can be included in diets of growing rabbits up to 75 percent, with no adverse effect on growth performance and carcass characteristics. From all indications and within the experimental conditions of the present study, diet 4 (75% CPM inclusion) appears to have had a comparative growth performance and carcass characteristic traits. It may, therefore, be recommended that farmers could include up to 75% sun-dried cassava peel meal as a replacement for maize in diets for the feeding of rabbits. However, further research may be necessary to investigate the effect of including up to 100% sun-dried CPM, instead of maize, to the diets of rabbits.

Key words: cassava peel meal; carcass; growth performance; Rabbit, organs weight

1. Introduction

In Nigeria, the state of nutrition of the populace is predominantly marked by inadequate animal protein intake both in quality and quantity (Taiwo, *et al*., 2005). This animal protein intake is regrettably low owing to several factors such as poverty, illiteracy and corruption. World Bank report has noted that the number of poor persons in Nigeria will rise to 95.1 million at the end of 2022 from 89.0 million in 2020. This would mean that 6.1 million more persons would have fallen beneath the poverty line of 137,430 naira ($381.75) per year between 2020 and 2022, a 6.7% increase (CBN 2019). The implication of this is malnutrition, poor development of the growing child with consequent reduction in expression of human capacity. There is also the problem of stillbirth, poor fetal development and other complications in pregnant women.

Animal protein sources such as meat, milk, eggs and other products are very important for improving the nutritional and health status of the individual, especially pregnant women and children. As a result of these, greater efforts should be directed at providing more animal protein to eschew this situation.

An annual 5-7% growth rates for meat consumption has been estimated to reduce this situation (FAO, 2013). Such growth rates are not attainable with the large animals in view of their slow production cycles, but may however, be met by short cycles animals like rabbits, poultry and pigs (Aduku and Olukosi, 1990). The production of rabbit meat can help supply the adequate protein intake and attempt to meet the requirement for the ever-increasing human population. The domestic rabbit (*Oryctolagus cunniculus*) is an important non-ruminant herbivore for meat production. Rabbit meat is a source of healthful food as it is low in cholesterol, 50 g/100 g, fat 4 g/100 g, and energy 124 kcal/100 g but high in protein, 22 g/100 g. The meat compares favourably with chicken and beef of good grade (Aduku and Olukosi, 1990). Rabbits are induced ovulators, and will breed within 24 hours of parturition. Thus, it is theoretically possible to produce over 11 liters per year, with the additional advantage of small body size that requires small land space and the utilization of non-competitive feeds, such as forages, like ruminants. The Rabbit has a rapid growth rate that make it grow much faster than larger livestock (Cheeke, 1986), in addition to a high reproduction potential. Rabbits and other small animals could make an important contribution to meat production in developing countries where the needs for maximizing food production are greatest. It has potential for genetic improvement that makes it have much variability in traits such as maternal ability, fecundity, resistance to heat stress among others. This activity is very promising given the fact that rabbit breeding provides good quality meat and requires a small capital and investment.

Rabbit meat is high in protein and low in fat (Holmes *et al.*, 1984), particularly when the animals are raised on a high forage and low energy diet. There are few, if any, cultural biases or religious prohibitions against the consumption of rabbit meat. The skins can be used in the production of toys, craftwork and garments, and in cottage industries for such purposes (Leach and Barrett, 1984). Rabbit production can as well be well-integrated, into small farming systems.

Based on these potentials, there is need, therefore, to increase their production as to increase the animal protein intake. However, the limitation to the increased commercial production of the Rabbit is the high cost of feed. There is increasing competition between man and livestock for available feedstuff for food, feed, and industrial raw materials (Yashim *et al., 2016).* This limitation imposed by this stiff competition with human for food have forced animal nutritionists to exploit alternative protein/energy feed ingredients that are locally available, cheaper and can meet the nutrient requirement of animals.

The feed industry is on the decline due to the high cost of feed materials especially energy sources leading to the closure of several feed mills. Maize, a principal energy source in livestock feeding is in short supply and expensive. According to News Agency of Nigeria (2012), a University Lecturer was reported to say that livestock production has suffered untold hardship in Nigeria because of high cost of feeds and high competition for conventional feed materials and industries that convert them to secondary products.

Since there is stiff competition for maize between humans and animals which has made its cost to skyrocket leading to increasing cost of finished feed and subsequently the cost of animal products, there is a serious need to reduce the cost of livestock feed ingredients and thereby increase animal protein intake among the populace using unconventional feed resources, such as cassava peel. The prospect of the market that may be dominated by cassava peel at lower cost instead of maize at higher cost should stimulate increase in rabbit production due to lower cost of the feed. Hence, more rabbit products made available to consumers at a more affordable price.

Cassava peel meal is one of the emerging non-conventional feedstuff for rabbits as earlier reported by Aduku and Olukosi (1990). It could serve as a cheap source of energy for farm animals but should be fortified with additional protein sources because of its low protein level (Obioha and Anikwe, 1982). Cassava peel meal has been successfully included in rabbit diets with no adverse effects (Aduku and Olukosi, 1990). Oke, *et al.* (1986) reported that 15% sun dried cassava peel meal in diets fed to rabbits produced weight gain equal to rabbits fed the control diet. Fermented cassava peel meal has been used to replace up to 60% of the dietary maize portion (Adegbola and Oduoza, 1992) and 100% of the dietary maize (Ijaiya, *et al*., 2005) without adverse effects on the performance of rabbits.

However, scanty information is available on the effect of sundried cassava peel meal on performance and carcass characteristics of rabbits. This study was, therefore, designed with the objectives of evaluating the growth performance and carcass characteristics of rabbits fed with sun-dried cassava peel meal inclusion

2. Materials and methods

2.1 Experimental site

The study was carried out at a privately owned Standard Rabbitry in Obubra, approved for research by the Department of Animal Science, Faculty of Agriculture and Forestry, Cross River University of Technology, Obubra Campus. Obubra has a latitude 6^0 5’8.47”$_N$ and longitude 8^0.

19'40.83"^{0}E of the equator (GPS Coordinates of Obubra), with a warm weather and ambient temperature of about 21 – 30^{0}c and an annual rainfall of 500 – 1070 mm (Google Map).

2.2 Experimental Animals, Housing and management

A total of Eighty (80) weaned rabbits of mixed breeds and sexes (Chinchilla, California and New Zealand white) between the ages of 4 and 5 weeks' old were used for the feeding trial in a completely randomized design. The rabbits were weighed and randomly allocated to four treatments with twenty (20) animals per treatment with five replicates. Four animals represented a replicate. The rabbits were housed in a wire mesh/wood cage of 60 cm x 60 cm x 40 cm raised 50 cm above the concrete floor in an open sided building screened with wire gauze for protection. After thoroughly cleaning and drying the cages, the rabbits were introduced into them for an adaptive period of seven (7) days before the commencement of the experiment. The cages were equipped with metal feeders and plastic/concrete drinkers. The rabbits in each treatment were fed weighed amount of their group diet to appetite daily and fresh water given *ad-libitum* for 3 months (90 days).

At the commencement of the experiment, all the animals were provided with anti-stress (Vitalyte) agents, 2 g each. They were also dewormed and given cocciodiostat using piperazine citrate and proccox, respectively. Each rabbit was given 0.02 ml of 1vomec Subcutaneous against ecto- and endo-parasite, as prophylactic treatment.

The rabbits were individually weighed using Camry top loading weighing scale, grouped in such a way as to ensure uniformity of initial body weights in all the groups and allotted to different treatments in agreement with the design of the study.

2.3 Feed ingredients, sources, Processing and Chemical Analysis

Composite cassava peel (CP), was sourced within the campus's environs, washed and sun dried intensively on a concrete slap for a period of 7 days and roughly crushed with a hammer mill for inclusion in the test diets. Cassava peel meal was served as the test ingredient while the major feed ingredients were maize, full-fat soybean, Rice offal and palm kernel cake. All feed ingredients were sourced from markets around the University communities. Micro nutrients were added in equal amount to the diets so as to improve palatability and to meet nutrient requirements. The proximate chemical composition of sun dried cassava peel meal and major ingredients is presented in Table 1, using the A.O.A.C. (2010) methods.

Table 1: Proximate Chemical Composition of Feed Ingredients on dry matter basis

Parameters%	Ingredients				
	CPM	Maize	FFSBM	Rice offal	PKC
Dry matter	92.55	88.50	82.00	83.00	78.25
Crude protein	5.80	8.89	38.88	6.55	18.35
Crude fibre	10.52	2.30	6.10	35.98	12.90
Ether extract	5.70	3.80	18.10	7.80	11.00
Ash	7.50	1.22	4.68	10.55	4.50

NFE	63.03	72.29	32.24	22.12	31.15
ME(Kcal/kg	2,913.87	3,203.03	3,305	1,442.61	2,675.78

CPM: Cassava Peel Meal, FFSBM: Full-fat soybean meal, PKC: Palm Kernel Cake, NFE: Nitrogen Free Extract; ME(kcal/kg): calculated from Pauzenga equation (1985) ME= (37 X %CP)+(81 X %EE)+(35 X %NFE)

2.4 Experimental diets and its calculated nutrients

Based on the results of the Proximate chemical composition of the test and major ingredients, four (4) experimental diets were formulated to contain sun dried cassava peel meal (CPM) at 0%, 25%, 50% and 75% in the ratio of 100:0, 75:25, 50:50 and 25:75 for maize: sun dried cassava peel meal, respectively. The dietary treatments were designated as 1, 2, 3 and 4 respectively. Treatment 1 served as the control diet. The diets were formulated to obtain crude protein range of 14.12-15.28% and a Metabolizable energy of range 2,693.87-2,802.31 kcal\kg as shown in Table 2.

Table 2. Composition of the experimental diets and calculated nutrients

	Dietary levels of the cassava peel meal inclusion (%)			
Ingredients %	T1 100 MM 0 CPM	T2 75 MM 25 CPM	T3 50 MM 50 CPM	T4 25 MM 75 CPM
Maize	50.00	37.50	25.00	12.50
Cassava peel meal	00.00	12.50	25.00	37.50
Full-fat soybean	20.00	20.00	20.00	20.00
Rice offal	15.00	15.00	15.00	15.00
Palm kernel cake	11.30	11.30	11.30	13.30
Bone meal	3.00	3.00	3.00	3.00
Vit-min premix+	0.25	0.25	0.25	0.25
Common salt	0.25	0.25	0.25	0.25
Methionine	0.10	0.10	0.10	0.10
Lysine	0.10	0.10	0.10	0.10
Total	100.00	100.00	100.00	100.00
Calculated values:				
Crude protein%	15.28	14.89	14.50	14.12
Crude Fibre %	9.23	10.26	11.29	12.32
ME(Kcal/kg	2,802.31	2,766.16	2,730.02	2,693.87

MM= maize meal, CPM=Cassava peel meal, ME= Metabolizable energy, + Each 1 kg of vitamin/mineral premix manufactured by BEAUTS Co. Inc. Man, U.S.A., contains Vitamin A 220,000, Vitamin D 66,000, Vitamin E 44, 014; Vitamin K 88 mg; Vitamin B 12; 0.76 mg; Niacin 1122 mg, Calcium 27%, Phosphorus 10%, Iron 0.6%, Zinc 0.35%, manganese 0.25%, Copper 0.06%; Iodine 0.002%, Cobalt 26 ppm, Selenium 4 pp. ME = Metabolizable Energy

2.5 Experimental procedure

Each rabbit was offered a weighed quantity of feed daily. The rabbits were fed in the morning hours between 7.00-8.00 am. Feeding was *ad-libitum* and had access to fresh and clean drinking water always. Left over feeds were collected into clearly labelled envelopes and weighed with a sensitive scale daily. The feed intake was computed by deducting from the quantity offered the amount left over. The animals were weighed individually at the beginning of the experiment and weekly thereafter. The body weight gain was determined by differences. A sensitive weighing scale was used

Feed conversion (FCR) was calculated as the ratio of feed intake to body gain.

FCR= (weight of feed\weight gain).

2.6 Carcass evaluation

At the end of the feeding trial, four rabbits per treatment, with live weights which approximate their treatment mean live weight, were selected for slaughter and their carcasses were evaluated. The rabbits were starved for 18 hours before slaughter to reduce the volume of the gut contents and therefore reduce the risk of contamination of the carcass during dressing. Each rabbit was weighed and then slaughtered by cutting transversely across the trachea, esophagus, large carotid arteries and jugular veins with a sharp knife and allowing the rabbits to bleed to death under gravity. The carcasses were eviscerated and singed and weighed. The visceral organs which includes; the heart, lung, kidney, liver, pancreas, intestines and spleen were carefully removed and weighed using an electronic balance. The visceral organs weight was expressed as percentage of the live weight. The length of the carcasses was also measured.

3.2 Statistical analysis

All data obtained were subjected to one-way Analysis of variance (ANOVA) using mini-tab statistical software (2016). Where significant differences occurred, means were separated using Fisher’s least significant difference (LSD) as contained in the statistical package.

3. Results and discussion

3.1 Proximate composition of the test ingredients and the formulated experimental diets.

The proximate chemical composition of cassava peel meal, maize, full-fat-soya bean, rice offal and palm kernel cake recorded in this study (Table 3) showed comparable values in crude protein, crude fiber, ether extract, ash, and Nitrogen free extract with values by Omole *et al*. (2005), Obioha (1992) and Aduku (2012). Cassava peel meal from the results has lower protein and higher fibre content than maize, hence the need to fortify cassava peel meal diets with additional protein sources to meet up their dietary requirements. The crude protein content of diets (15-16 percent) was within the recommended level of 16-18 percent for weaner rabbits under tropical conditions, as recommended by Spreadbury (1978) and Omole (1992). The crude fibre level ranged from approximately 14-16 percent and similar to the 14 percent reported by Lebas (1980). The energy content of diets ranged from 2,438-2,822 kcal/kg. The energy content decreased with increasing levels of cassava peel meal in the diets. The energy content was slightly higher than the recommended level of 2400 kcal/kg (Lebas, 1980). There was, however, no evidence of harmful effects on the rabbits. As slight excesses of energy have been reported to cause no deleterious effects on rabbits, except for extra deposition of fats (Esonu, 2000).

Table 3: Proximate composition of the formulated experimental diets.

Parameters%	T1 100 MM 0 CPM	T2 75 MM 25 CPM	T3 50 MM 50 CPM	T4 25 MM 75 CPM
Moisture	8.20	10.50	12.30	13.00
Dry matter	91.80	89.50	89.70	87.00
Crude protein	14.78	14.39	14.00	13.62
Crude fibre	9.03	10.06	11.09	12.12
Ether extract	4.15	4.22	4.88	5.10
Ash	2.08	6.50	6.88	7.00
NFE	61.76	54.33	50.85	49.16
ME(Kcal/kg)	3,075.49	2,802.97	2,718.46	2,662.22

CPM: Cassava Peel Meal, MM: Maize meal, NFE: Nitrogen Free Extract; ME(/kcal/kg), calculated from Pauzenga equation (1985): ME= (37 X % CP) + (81 X % EE) + (35 X %NFE)

3.3 Effect of Substituting Sun-Dried Cassava Peel Meal for Maize as an Energy Source on performance of growing rabbits: Performance parameters

The data on feed intake, weight gain, feed conversion ratio and mortality are presented in Table 4. The rabbits were equalized in weight before they were assigned to the various diets. The average daily feed intake (ADFI) obtained in this study ranged from 47.04-52.14 g/rabbit/day and no particular trend was followed. Results for ADF were not significantly (P > 0.05) affected by the dietary treatments.

The average daily weight gain (ADG) obtained in this study did not show any significant difference (P > 0.05) among dietary treatments. An average value range of 18.60-21.18 g/rabbit/day was recorded. The highest value was recorded in the control diet and the lowest value in the diet with 50% percent inclusion of cassava peel meal.

The feed conversion ratio (FCR) in this study ranged from 2.46-2.67 with no significant difference (P > 0.05) among dietary treatments.

Table 4: Effect of Substituting Sun-Dried Cassava Peel Meal for Maize as an Energy Source on performance of growing rabbits: Performance parameter

Parameters	T1	T2	T3	T4	SEM

	100 MM 0 CPM	75 MM 25 CPM	50 MM 50 CPM	25 MM 75 CPM	
Av. Initial Weight (g)	1070.00	1028.00	1080.00	1052.00	
Av. Final Weight (g)	1906.00	1674.00	1700.00	1702.00	53.88
Av. Daily Feed Intake (g)	52.15	47.02	50.38	48.80	1.20
Av. Daily Weight Gain (g)	21.18	18.60	18.89	18.91	0.59
Feed conversion Ratio	2.46	2.53	2.67	2.58	0.04
Mortality (%)	0	0	0	0	0

Av. = Average, SEM = Standard Error of Mean, MM= maize meal, CPM=Cassava peel meal

The average daily feed intake (ADF) obtained in this study ranged from 47.04-52.14 g/rabbit/day and no particular trend was followed. Results for ADF were not significantly (P > 0.05) affected by the dietary treatments. ADF values obtained in this present study showed that 75 percent sun dried cassava peel meal included in the diets of rabbits produced feed intake level equal to rabbits fed the control diet. The fluctuation in ADF with increasing levels of CPM in the diets could be as a result of the high energy content of the diets. This is because growing rabbits can adjust their voluntary feed intake in response to dietary energy density and fibre levels (Scholant, 1987). The ADF values are comparable to the results obtained by Ikurior and Akem (1993), who in their study had daily feed intake range of 50.09-56.78 g/rabbit/day when they fed brewer's yeast slurry and cassava root meal based diets to rabbits. The ADF values obtained in the study were slightly lower than the results of Anthony (2002) that fed *tridax procumbens* in cassava based rations to growing rabbits, with a range of 52.96-58.87 g/rabbit/day. The low values obtained in this study may be attributed to the dusty and powdery nature of cassava peel meal and may also be due to its high content of ash and crude fibre which may limit intake (Oke *et al*., 1986).

The average daily weight gain (ADG) obtained in this study did not show any significant difference (P > 0.05) among dietary treatments. An average value range of 18.60-21.18 g/rabbit/day was recorded. The highest value was recorded in the control diet and the lowest value in the diet with 50% percent inclusion of cassava peel meal. The ADG values are higher than the findings of Anugwa, *et al*; (1998), Attah and Ekpeyong (1998), Oyawole and Nelson (1998) and Ijaiya, *et al*; (2005) who recorded 7.53-12.23; 7.37-12.66; 7.1-14.6 and 9.90-11.50 g/rabbit/day respectively as ADG values for various cassava based studies with growing rabbits. However, agreed with reports by Aduku *et al*. (1988) who reported the growth rate of rabbits to be between 18-20 g/rabbit/day in Nigeria.

The feed conversion ratio (FCR) in this study ranged from 2.46-2.67 with no significant difference (P > 0.05) among dietary treatments. These values disagree with the range of 3.39-8.53 reported by Ijaiya, *et al*. (2005), who fed up to 100 percent fermented CPM to weaner rabbits. Rabbits fed the control diet (100 percent maize) recorded the lowest value of FCR compared to other rabbits fed diets with varying dietary levels of CPM and maize. The control diet was better utilized than the cassava peel meal diets indicating higher weight gain per unit of feed consumed. The increase in values of FCR obtained as sun dried CPM content increased could be explained with the earlier observations of Montilla *et al*. (1970), Muller *et al*. (1974) and Oke *et al*. (1986) that the increase in the value of feed conversion ratio as the percentage of CPM inclusion increased could be as a result of the dusty nature of CPM and also due to its high contents of ash and crude fibre. The values, however, agree much with the lower range of FCR, 2.62-4.78 reported by Anthony (2002) that fed mixtures of *Tridax procumbens* and cassava root meal to growing rabbits. This could be attributed to better utilization of the diets resulting from the inclusion of *Tridax procumbens* in that earlier study.

The zero mortality recorded in this study showed that sun-dried cassava peel meal (CPM) had no deleterious effect on the performance characteristics of the rabbits. This may be attributed to the low level of cyanide in all dietary treatments due to the processing of the CPM. It may probably be that the residual cyanide in the sun-dried CPM was rapidly detoxified by rhodanase of the liver. Ijaiya *et al*. (2005) reported that the rabbit liver contents 8-9 mg/g rhodanase, which is surpassed only by the rhodanase content of the rat liver which is 14-28 mg/g.

3.4 Carcass evaluation

Effect of Substituting Sun-Dried Cassava Peel Meal for Maize as an Energy Source on performance of growing rabbits: Carcass characteristics

The results of the effect of substituting sun-dried cassava peel meal for maize as an energy source on Carcass characteristics ofrabbitsis presented in Table 5. The replacement of maize with cassava peel meal as energy source had no significant effect (p>0.05) on slaughter weight, dressed weight and dressing percentage. However, the higher dressing percentage was observed on rabbits fed 75% replacement of maize with cassava peel meal.

Table 5: Effect of Substituting Sun-Dried Cassava Peel Meal for Maize as an Energy Source on performance of growing rabbits: Carcass characteristics

Parameter	T1 100 MM 0 CPM	T2 75 MM 25 CPM	T3 50 MM 50 CPM	T4 25 MM 75 CPM	SEM
Slaughter wt (g)	1974	1801	1701	1775	57.77
Dressed weight (g)	1198.60	1095.00	1037.85	1108.50	33.27
Dressing Percentage %	60.72	60.79	61.01	62.45	0.41

SEM = Standard Error of Mean, MM= maize meal, CPM=Cassava peel meal

The average dressed weight was not significantly different (P> 0.05) among treatments. This shows that, there was no decrease in growth rate of the experimental rabbits as 75% maize replacement with CPM was attained. The dressing percentage tended to increase as the level of CPM inclusion increases though did not differ significantly (P > 0.05, which may suggest that they were able to tolerate the residual cyanide in the CPM in the diets. A range of 60.48-62.45 percent dressing percentage was recorded for this trial. This was lower than the 74 percent obtained in Nigeria (Aduku *et al*., 1986). The observed difference occurred because of the dressing method used in this study. The heads were removed from the roasted carcasses in this study. The head, skin and feet contribute about 10, 11, 3 percent respectively to the dressing percentage (Aduku and Olukosi, 1990). The dressing percentage recorded in the study were slightly higher than 54.05 - 60.05% reported by Gboshe *et al*., (2019), when they worked on the effect of graded levels of maize cob meal as replacement for dietary maize on the carcass characteristics of growing rabbits. It was also higher than 52.87-57.05 percent reported by Igwebuike *et al.* (2001) in an experiment to study the effect graded levels of soaked *Alcacia albida* pons on the performance, organ weight of growing rabbits but was however, almost similar with 58-60% obtained by Garcia *et al*. (1993) for rabbits weighing 2.0-2.5 kg. The dressing percentage of rabbits on the experimental diets were slightly higher than those on the control diet. This may suggest that irrespective of maize or CPM as dietary energy source of rabbit up to 75 % level of replacement, the availability of rabbit meat for human consumption is practically the same.

3.5 Effect of Substituting Sun-Dried Cassava Peel Meal for Maize as an Energy Source on performance of growing rabbits:Internal organs weight

Internal organ weight of rabbits fed diets containing substituted cassava peel meal for maize is shown in Table 6. The table shows that the diets did not affect the animals organs (heart, liver, lungs/trachea, gall bladder, left and right kidney, spleen and pancreas) significantly (p>0.05).

Table 6: Effect of Substituting Sun-Dried Cassava Peel Meal for Maize as an Energy Source on performance of growing rabbits: Internal organs weight

Relative organ weight (% carcass weight)	T1 100 MM 0 CPM	T2 75 MM 25 CPM	T3 50 MM 50 CPM	T4 25 MM 75 CPM	SEM
Heart	0.33	0.35	0.40	0.33	0.02
Liver	2.80	2.88	2.99	2.76	0.05
Lungs/trachea	0.87	0.99	1.17	1.01	0.06
Gall bladder	0.02	0.02	0.01	0.03	0.00
Left Kidney	0.32	0.30	0.36	0.30	0.01

Right kidney	0.32	0.30	0.34	0.29	0.01
Spleen	0.07[a]	0.05[b]	0.05[b]	0.05[b]	0.01
Pancreas	22.85[a]	22.35[a]	16.41[b]	15.27[b]	1.97

SEM = Standard Error of Mean, MM= maize meal, CPM=Cassava peel meal

The weight of the spleen and pancreas were significantly ($P < 0.05$) higher in rabbits fed diet 1 than those on 2, 3 and 4 diets. The weights of these organs tended to decrease with increasing levels of CPM. Thus, suggesting an adverse effect of CPM on the spleen and pancreas. The range obtained for the weight of the heart, liver, lungs/trachea and kidney did not show significant differences ($P>0.05$) among dietary treatments. The range obtained for the heart, liver and lungs/trachea were similar to the 0.24-0.26, 3.06-3.62 and 0.58-0.72 percent respectively, as reported by Onifade and Tewe (1982). The weight of the heart was, however, higher than the weight of 0.19 - 0.21% recorded by Hon *et al.* (2007), 0.23-0.75% (Ochefu, 2006). The weight of the liver was also higher than the value range of 1.65- 2.04% obtained by Ochefu (2006). They were also higher than the values reported by Gboshe *et al*. (2019). The values of the weight of the lungs 0.51 to 0.72% were higher than 0.57-0.65% (Igwebuike *et al.,* 2001), 0.56-0.68 (Ochefu, 2006) and 0.50 -0.71% (Hon *et al.,* 2007). Since the range of values obtained in the internal organ characteristics were comparable and slightly higher than other researcher's values, it may suggest that none of the organs in the experimental rabbits was damaged by the replacement of maize with CPM up to 75% level. These organs help to ascertain the health status of farm animals.

4. Conclusion

The results of the study showed that sun-dried CPM can be included in diets of growing rabbits up to 75 percent, with no adverse effect on growth performance and carcass characteristics. From all indications and within the experimental conditions of the present study, diet 4 (75% CPM inclusion) appears to have had a comparative growth performance and carcass characteristic traits. It may, therefore, be recommended that farmers could include up to 75% sun-dried cassava peel meal as a replacement for maize in diets for the feeding of rabbits. However, further research may be necessary to investigate the effect of including up to 100% sun-dried CPM, instead of maize, to the diets of rabbits.

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