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PRELIMINARY INVESTIGATIONS ON THE EFFECT OF PAWPAW PEEL MEAL ON ORGAN WEIGHTS, REPRODUCTIVE TRACT MORPHOMETRY AND THE HEMATOLOGY OF FEMALE RABBITS

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ABSTRACT

Grower female rabbits were fed either a complete concentrate diet or a pawpaw peels based diet at 20% to obtain preliminary information for use in further instigations to establish paw-paw peels as a feed for rabbits. While the animals on the control diet had significantly longer ovaries ($P<0.05$) and a higher population of monocytes ($P<0.05$) than the animals on the pawpaw peels diet; growth rate, all other reproductive tract morphometric characteristics, visceral organ weights, endocrine gland weights, and other hematological parameters were unaffected ($P>0.05$) by dietary treatment.

KEYWORDS: Rabbits, pawpaw peels, growth, reproductive tract, endocrine, hematology.

INTRODUCTION

Rabbit production is fast gaining acceptance in the hot humid tropics not only as an economic source of protein and income but also as a delicacy. In spite of the increasing awareness of the potential of rabbits to mitigate the problem of protein shortage and malnutrition in these regions of the world based on its attributes and advantages over other classes of livestock (Owen, 1981; Cheeke, 1984; Schlolant, 1985; Abe, 1989; Aduku and Olukosi, 1990); the high cost of feeding rabbits, estimated to account for 70% of the total cost of a given rabbit venture (Ekpenyong,1988) still hinders not only production but also improvement programmes. In the guinea savannah particularly, the
seasonal fluctuations in forage quality and availability coupled with the annual practice of "bush burning" during the dry season place a limitation on profitable rabbit production. With cereal grains being competed for by humans and other classes of livestock like poultry, cheap crop residues and agro-industrial by-products present the best alternative sources of nutrients for rabbits in subsistence agriculture in the humid tropics.

The pawpaw plant (*Carica Papaya, Linn),* grown widely in most tropical countries especially Nigeria, provides a cheap, nutritious by-product of the processing of its fruits known as pawpaw peels. Pawpaw parts have been shown to be high in protein and other nutrients (Oyenuga, 1968, Aduku and Olukosi,1990). All parts of the pawpaw plant however, contain the enzyme papain, contained in the latex. The wide spread industrial applications of papain (Pawpaw) including the Canning, Brewery, Medical, Pharmaceutical and Tanning industries would therefore ensure a constant availability of pawpaw peels for the feeding of rabbits. Papain however has been implicated in the removal of the zona pellucida of mouse eggs (Gwatkin, 1964) and shown to have anti-implantation activity in rats (Grag et al, 1970). There is therefore the need to determine safe levels of incorporation of pawpaw parts in the diets of rabbits.

While Egbunike et al (2000) reported adverse effects of dietary inclusion of pawpaw leaves, seeds and peels on sperm production and storage potentials and epididymal transit in rats, Bitto and Gemade, (2001) found no significant effect of dietary pawpaw peel meal on growth, organ weights (except the liver) testicular morphometry and the hematology of male rabbits.

Such information on the physiology of reproduction and the hematology of female rabbits is at present lacking. We therefore proposed this preliminary investigation to provide information of the effect of pawpaw peel meal an organ weights, reproductive tract morphometry and the hematology of female rabbits.

MATERIALS AND METHODS

Location: This study was conducted at the Teaching and Research Farm of the University of Agriculture Makurdi, Makurdi – Nigeria; located at latitude 7° 14N and longitude 8° 31E; with an animal rain fall ranging from 1270 – 13s97mm and a temperature range of 21°C – 42°C.

Animals and Management: Eight grower does of mixed breeds (Chinchilla x California x New Zealand While) born and raised at the Rabbitary of the Teaching and Research Farm University of Agriculture Makurdi were randomly selected for this study. They were between 4 and 5 months of age and weighed between 1.00kg and 1.24 kg.

The animals were housed in individual cages measuring 1.5mx 1m x 1m with corrugated roofing sheets and wire mesh floor with wooden frames. They were all fed a maize based concentrate diet for a week of acclimatization after which 4 does were placed on a control diet without pawpaw peel meal and the other 4 were placed on the same basal diet with 20% pawpaw peel meal inclusion. The diets were isocaloric and isonitrogeneous while feeding was *ad libitum* with cool clean drinking water supplied always. The animals were fed the test diets for an initial 2 weeks of adjustment after which they were maintained on the diets for a further period of 5 weeks. The animal were individually weighed weekly.

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Pawpaw Peels: Unripe pawpaw fruits were obtained from the Agriculture Development Corporation (ADC), Ministry of Agriculture Makurdi, and the Federal Housing Authority Makurdi. The peels were removed from the pulp immediately after harvest and sun dried for 7 rain free days and there after ground.

Samples of pawpaw peel meal (PPM) and the test diets were analysed for nutrient composition by the AOAC (1990) procedures.

Sampling: After the experimental feeding period, all the rabbits were starved for 12 hours and sacrificed by stunning and decapitation.

Blood samples were obtained at slaughter into clean dry hematological tubes containing a pinch of anticoagulant (EDTA).

Hematological evaluations were done by conventional laboratory methods (Baker and Silverton, 1978).

The carcasses were then opened and the visceral organs, some endocrine glands and the reproductive tract *intoto* removed for investigation. All weights were taken using a digital highly sensitive balance.

Statistical analysis: The data were subjected to the student's "t" test (Steel and Torrie, 1980) for comparism.

RESULTS AND DISCUSSION

The gross compositions of the experimental diets and the proximate compositions of the diets and PPM are presented in Tables 1 and 2 respectively while Fig 1 shows the growth curves of the animals on the respective diets after acclimatization to the end of the experiment. Diet had no effect on growth rate.

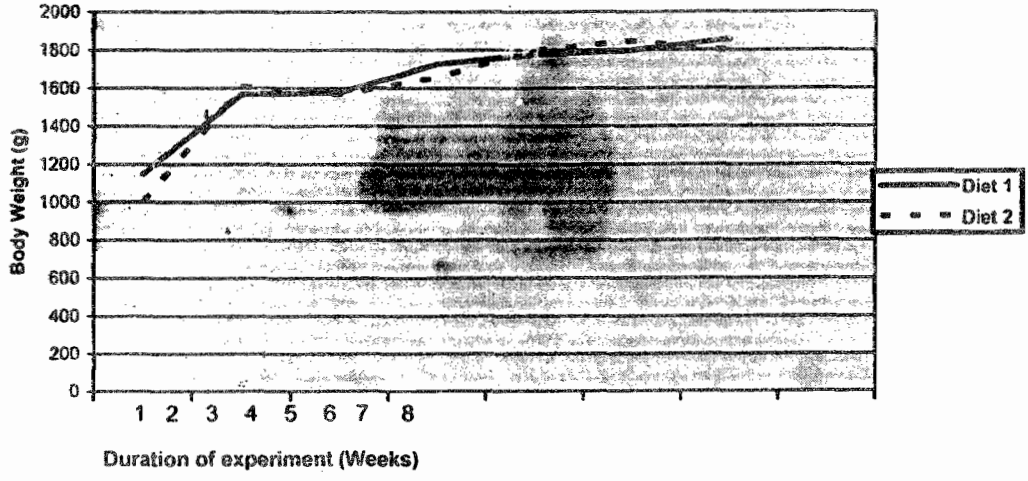

Fig 1: Growth curves for rabitts fed the experimental diets

Table 1: Gross composition of the experimental diets

Ingredients	Diet 1	Diet2
Maize	58.00	50.00
Soyabeans	30.00	20.00
Pawpaw peels	-	20.00
Rice bran	9.00	8.00
Bone meal	2.00	1.00
Salt	0.50	0.50
Vit premix *	0.50	0.50
Total	100.00	100.00

Each kg of the Vit. premix contains: Vit. A (IU) 4,000.000; Vit D(IU) 1,000,000; Vit E(iU) 48,000; Vit. K(g) 0.8; Vit. B,(g) 0.4; Vit, B_2 (g) 0.18; Vit. B_6 (g) 1.2; Nicotinic acid (g) 4.8; Folic acid (g) 0.12; Ascorbic acid (g) 4.8; Choline Chloride (g) 4.8; Mn (g) 40.0; Fe (g) 20.0; Zn (g) 0.80; I(g) 0.62; Co (g) 0.09; Se (g) 0.04.

The morphometric characteristics of the reproductive organs (Tables 3 and 4) showed similarities (P>0.05) between the diets in all parameters except in the length of the ovary where there was a superiority of the control diet over the PPM diet (P<0.05). This result appears to agree with earlier reports on the deleterious effect of papain in pawpaw on aspects of the

Table 2: Proximate Composition of Pawpaw peel meal and the test diets.

Parameter(%)	Diets 1		PPM* 2
Dry matter	95.00	97.50	97.20
Crude protein	21.88	21.86	17.50
Crude fibre	8.90	8.18	13.30
Ether extract	9.00	8.60	8.75
Ash	9.10	9.23	9.10
Moisture	5.00	2.50	2.80
Metabolizable Energy (kcal /kg)**	3159.96	3249.05	3073.00

* PPM = Pawpaw peel meal
** = Calculated from Pauzenga (1985)

Table 3. The effect of Pawpaw peel meal on reproductive tract morphometry (Means ± sem)

Parameter		Diets	
		1	2
1. Weights:			
Weight of uterus	(g)	7.04±2.10	9.36±1.86
Weight of left ovary	(g)	0.16±0.04	0.1±0.14
Weight of right ovary	(g)	0.16±0.045	0.13±0.02
Weight of paired ovaries	(g)	0.32±0.001	0.29±0.02
Weight of left oviduct	(g)	0.14±0.008	0.33±0.01
Weight of right oviduct	(g)	0.16±0.003	0.27±0.06
Weight of paired ovaries	(g)	0.30±0.001	0.60±0.04
Weight of left infundibulum	(g)	0.09±0.01	0.08±0.015
Weight of right infundibulum	(g)	0.15±0.05	0.08±0.022
Weight of paired infundibulum	(g)	0.24±0.03	0.16±0.00
2. Linear measurements:			
Length of left ovary	(cm)	1.30 ± 0.10^{a}	0.65 ± 0.13^{b}
Length of right ovary	(cm)	1.40 ± 0.05^{a}	0.63 ± 0.20^{b}
Width of left ovary	(cm)	0.55±0.06	0.50±0.07
Width of right ovary	(cm)	0.50±0.07	0.40±0.07

Sem = standard error of mean
a.b = valves in the same row bearing different superscripts differ significantly ($P<0.05$)

Table 4. The effect of Pawpaw peel meal on derivations from reproductive tract morphometry (Means ± sem)

	Diets	
Parameters	1	2
Ratio of left to right ovaries	100±0.00:113.9±4.16	100±0.00:106.65±5.62
Ratio of left to right oviducts	100±0.00:105.88±21.89	100±0.00:156.84±53.18
Paired ovaries (%)	$0.17 \times 10^{-3} \pm 0.00$	$0.15 \times 10^{-3} \pm .00$
Paired oviducts (%)	$.16 \times 10^{-3} \pm 0.00$	$0.19 \pm 10^{-3} \pm 0.00$

Sem = Standard error of mean

physiology of reproduction in female animals (Gwatkin, 1964 and Grag *et al*, 1970); and implies that PPM at levels up to 20% inclusion could affect sensitive reproductive processes like oogenesis and ovulation in these animals.

Visceral organ and endocrine gland weights (Tables 5 and 6), were like- wise unaffected by dietary PPM ($P>0.05$) in agreement with our earlier observation on growth rate (Bitto and Gemade, 2001); indicating a normal development of these organs.

With regard to the hematology, besides the significantly higher population of monocytes in the control diet than in the PPM diet ($P<0.01$), all other hematological indices (Table 7) were unaffected by dietary treatment ($P>0.05$). Monocytes were in fact completely absent in the PPM diet. Being phagocytic in nature, monocytes in the blood of the animals on the PPM diet may have attacked residual papain (in the diet) absorbed into the blood stream leading to their death and depletion. The hematological results also showed a complete absence of basophiles in the blood of all the animals (on both diets) indicating that the animals were not anemic (Dacie and Lewis, 1977).

It is concluded from this preliminary report that 20% level of inclusion of PPM in the diets of female rabbits may not be absolutely safe from a physiological standpoint even though growth and organ development may not be affected. These results could therefore serve only as a guide to further work on optimum levels of PPM inclusion in the diets of female rabbits.

Table 5. The effect of Pawpaw peel meal on visceral organ weights in female rabbits (*Means ± sem*)

Parameter	Diets 1	2
Weight of left kidney (g)	4.379±0.36	3.914±0.38
Weight of left kidney (%)	$0.2x10^{-3}$±0.00	$0.2x10^{-3}$±0.00
Weight of right kidney (g)	4.263±0.33	4.018±0.38
Weight of right kidney (%)	$0.2x10^{-3}$±0.00	$0.2x10^{-3}$±0.00
Paired kidney weight (g)	8.642±0.001	7.932±0.015
Paired kidney weight (%)	0.005±0.00	0.004±0.00
Weight of heart (g)	3.862±0.38	4.611±0.21
Weight of heart (%)	0.002±0.00	0.002±0.00
Weight of lungs (g)	8.194±1.00	6.70±0.52
Weight of lungs (%)	0.004±0.00	0.004±0.00
Weight liver (g)	40.261±2.36	51.359±6.81
Weight liver (%)	0.02±0.00	0.02±0.00
Weight of spleen (g)	0.455±0.05	0.288±0.02
Weight of spleen (%)	$0.2x10^{-3}$±0.00	$0.2x10^{-3}$±0.00

Sem = standard error of mean
* = (P>0.05)

Table 6. The effect of Pawpaw peel meal on the weights of endocrine glands (Means ± sem)

Parameters	Diets 1	2
Right Adrenal gland (g)	0.19±0.07	0.29±0.06
Left Adrenal gland (g)	0.27±0.02	0.29±0.08
Paired Adrenal (g)	0.45±0.09	0.58±0.014
Thyroid gland (g)	0.06±0.001	0.08±0.001
Paired Adrenal (%)	$.21x10^{-3}$±0.00	$.32x10^{-3}$±0.00
Thyroid gland (%)	$.32x10^{-4}$±0.00	$.55x10^{-3}$±0.00

Sem = Standard error of mean

Table 7. The effect of Pawpaw peel meal on the hematology of female rabbits (Means ± sem)

Parameters	Diets	
	1	2
Haemoglobin (g/100ml)	9.75±1.03	10.95±0.055
Packed cell volume (%)	29.25±3.09	32.75±1.60
White blood cells (Conts/mm^3)	5000±64.807	5325±39.869
Leucocyte differential counts:	54.25±1.19	51.75±0.75
Neutrophyis (%)	4.25±0.63	4.25±0.63
Eosinophils (%)	0.00±0.00	0.00±0.00
Basophils (%)	41.00±1.47	41.75±2.39
Lymphocytes (%)	5.00±0.50^a	0.00±0.00^b
Monocytes , (%)		

Sem = Standard error of mean
a,b = Values in the same new bearing different superscripts differ significantly (P<0.01).

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