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Effects of cotton seed oil sludge on the performance and carcass characteristics of young rabbits

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Abstract

A feeding trial lasting 63 days was conducted using 60 weaned rabbits of mixed sexes and breeds with an average initial live weight of 487.50g. The rabbits were allotted to 5 dietary treatments of 12 replicates each. Cotton seed oil sludge (CSOS) was included at 0, 3, 6, 9 and 12% levels of the experimental diets respectively. The diets were isonitrogenous (20% CP). The results showed that feed intake, weight gain and feed efficiency were significantly different ($P<0.05$) across the dietary treatments. The highest weight gain was observed on rabbits fed diet containing 12% level of cotton seed oil sludge (CSOS). The use of cotton seed oil sludge in rabbit diet was cost effective. The percentage reduction in feed cost per kilogram of diet for the 3,6,9 and 12% level of inclusion were 2.90, 6.43, 12.04 and 15.25% respectively. The dressing percentage and percent belly fat increased significantly ($P<0.05$) with increase in the level of cotton seed oil sludge. A non-significant but slight increase was observed with the carcass weight and weight of the major organs ($P>0.05$) as the level of cotton seed oil sludge increased in the diet. It was concluded that cotton seed oil sludge (CSOS) can be included up to 12% level in the diets of young rabbits without adverse effects on performance and carcass characteristics.

Key words: Cotton seed, oil sludge, young rabbits, carcass, performance.

Introduction

The domestic rabbit is one of the animal species with high potential for filling the gap between the demand and supply of animal protein in developing countries like Nigeria. This is because of its high genetic potential, short generation interval, high fecundity, rapid growth rate, high prolificacy and relatively low cost of production (Oyawoye, 1989). However, one of the major problem affecting the rabbit industry is the chronic shortage of feeds and fodder especially during the dry season (Vasanthakumar *et al*, 1999). Feed accounts for 70 – 80% of the total cost of production in rabbit farming (Gowda *et al*. 1998).

In developing countries of the tropics, the conventional energy feedstuffs such as cassava, maize, guinea corn and millet are not only scarce but expensive. In addition, they constitute a major regular source of food for humans. There is therefore the need to source for cheaper alternative energy sources for optimum rabbit production. One of such energy supplement is cotton seed oil sludge. Cotton seed oil sludge is primarily oil and is obtained as a result of screw -pressing cotton seed to extract oil for human consumption. Apart from using it locally for soap making, it is still an industrial waste. Unlike palm oil, ground nut oil and cotton seed oil, it is not widely used as cooking oil in human diets. It is very cheap and there is high potential of having

surplus cotton seed oil sludge for inclusion into livestock diets. Presently, cotton is one of the major cash crop in the Northern part of Nigeria where so many cotton seed oil mills are located. Each of the mills has a crushing capacity of 989,000 metric tons. Work on the use of cotton seed oil sludge in livestock diets is still scanty. This study was therefore designed to assess the potential of cotton seed oil sludge as an energy source in the diets of young rabbits.

Materials and Methods

Location of Experiment

The experiment was conducted at the rabbitry unit of the Ahmadu Bello University, Teaching and Research Farm, Zaria. Zaria is located in the Northern Guinea Savanna Zone of Nigeria with an altitude of 610mm.

Source of Cotton Seed Oil Sludge

The cotton seed oil sludge used for this study was obtained as an industrial waste product of Sun Seed Oil Mill Company Nigeria Limited, Zaria along Zaria – Jos road, Nigeria. It is a by-product of screw-pressing cotton seed to extract oil for human consumption.

Experimental Diets

Five experimental diets were formulated as shown in Table 1. Diet 1 was a maize – soybean control diet while diets 2, 3, 4 and 5 contained cotton seed oil sludge included at 3, 6, 9 and 12% levels of the diets respectively.

Experimental Animals and their Management

Sixty weaned rabbits of mixed breeds (New Zealand white, California and Dutch) and sexes with an average initial weight of 487.50g were randomly allotted to five groups of twelve animals per group in a complete randomize design. Prior to the experiment, each of the rabbits was given 0.2mls of ivomec intra muscular against ecto and endoparasites.

The rabbits were housed individually in an all wire cage (40 x 40 x 60cm) located in an open-sided building. Each of the individual cages was well equipped with watering and feeding facilities. The animals were individually fed with weighed quantities of feed twice daily at 8.00 and 16.00 hours and had unrestricted access to water. Refused or wasted feed was collected daily, air-dried and weighed. Rabbits were weighed weekly and feed intake, live-weight and feed intake per unit gain were determined. The experiment lasted for 63 days.

Carcass Evaluation

At the end of the feeding trial, five rabbits whose weights were close to the mean weight of rabbits on each experimental diets were selected and starved overnight to clear the guts. Live weights were recorded before stunning and sacrificing by cutting the jugular vein. The tail was cut very close to the base before removing the pelt after removing the head and feet. Evisceration of the rabbit carcasses were carried out and all internal organs were weighed separately and expressed as percentage of dressed carcass weight. The weights and lengths of the components of the gastro-intestinal tracts (GIT) were also taken. The carcasses were then divided into primal parts. Each part was expressed as a percentage of the dressed carcass.

Analytical Procedures

Proximate analysis of the experimental diets were carried out using the method of AOAC (1990) as presented in Table 2. All data generated from the study were subjected to analysis of variance employing a complete randomized design as described by Steel and Torrie (1980) and where statistical significance were observed, the means were compared using the Duncan's Multiple Range Test according to SAS (1995).

Table 1 Compositions of the experimental diets

Ingredient	Graded levels of cotton seed oil sludge %				
	0	3	6	9	12
Maize	46.65	43.35	39.09	35.29	31.33
Soyabean	39.90	39.22	40.46	61.26	42.22
Maize Offal	10.00	10.00	10.00	10.00	10.00
Cotton seed oil sludge	0.00	3.00	6.00	9.00	12.00
Bone meal	2.50	2.50	2.50	2.50	2.50
Limestone	1.00	1.00	1.00	1.00	1.00
Vitamin - Mineral Premix*	0.20	0.20	0.20	0.20	0.20
Salt	0.35	0.35	0.35	0.35	0.35
Total	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**
Calculated Analysis					
C.P %	20.00	20.00	20.00	20.00	20.00
Metabolizable Energy, (ME KCal/kg)	3164.70	3284.10	3400.80	3518.9	3636.7
Calcium (Ca) %	1.39	1.39	1.39	1.389	1.392
Phosphorus (P) %	0.78	0.78	0.78	0.76	0.76
Ca: P %	1.77	1.79	1.804	1.82	1.84
Methionine (Meth) %	0.51	0.50	0.501	0.49	0.43
Cysteine (Cyst) %	0.285	0.281	0.281	0.280	0.278
Meth + Cyst %	0.793	0.784	0.782	0.777	0.706
Crude fiber (Cf) %	4.23	4.18	4.13	4.07	4.01
Cost/Kg diet (N)	28.32	27.50	26.70	24.91	24.00

* contributed the following per kg of diet
Vitamin A, 12,000 I. U; Vitamin D_3 1, 2000 I. U; Vitamin E, 3.6 U; Vitamin K, 1.8mg; Vitamin B_2 3.6mg; Nicotinate, 18mg; Calcium-d- Pantothenate, 9.6mg; Biotin, 0.36mg; Vitamin B_{12}, 0.012mg; Choline chloride, 120mg; Chlotetracycline, 4.8mg; Manganese, 24mg; Iron 48mg; Zinc, 96mg; Copper 60mg; Iodine 1.8mg; Cobalt, 48mg.

Table 2 Proximate composition of the experimental diets

Parameter	Graded levels of cotton seed oil sludge %				
	0	3	6	9	12
Dry matter %	92.31	92.08	92.34	92.48	93.46
Crude protein %	20.56	21.10	20.75	20.72	20.34
Crude fiber %	6.29	6.26	6.05	6.83	6.78
Oil %	4.48	4.55	4.76	4.85	5.35
Ash %	6.23	6.10	6.65	7.12	7.24
N.F.E. %	62.44	62.59	62.79	63.78	63.41

Results

The results of the performance of rabbits fed the experimental diets are presented in Table 3. The final live weight of the animals increased as the level of the cotton seed oil sludge increased in the diets. The difference across the dietary treatments were however not statistically significant ($P > 0.05$). The feed intake was not affected by the level of dietary treatments ($P > 0.05$). The amount of feed consumed however decreased slightly as the level of cotton seed oil sludge increased in the diets. The average daily weight gain differed significantly ($P < 0.05$) across the dietary treatments. The rabbits gain more weight as the dietary level of cotton seed oil sludge increased. Rabbits fed Diets 2, 3, 4 and 5 utilized their feed efficiently as those fed the control diet. The cost per Kg gain decreased

Table 3 Effects of graded levels of cotton seed oil sludge on carcass characteristics of young rabbits

Graded levels of cotton seed oil sludge %							
Parameter	**0**	**3**	**6**	**9**	**12**	**SEM**	**Level of Significance**
Average Initial weight (g)	487.50	487.50	487.50	495.00	488.75	44.113	NS
Average final weight (g)	1,600.00	1,550.00	1,600.00	1612.50	1,665.00	55.632	NS
Average Daily feed Intake (g)	51.00	51.10	50.88	49.50	49.43	0.89	NS
Average Daily weight gain (g)	17.68^{ab}	16.50^{b}	17.73^{b}	18.56^{ab}	19.53^{a}	0.76	*
Feed efficiency (g)	2.86^{ab}	3.12^{b}	2.88^{ab}	2.68^{a}	2.53^{a}	0.14	*
Cost per Kg gain in weight (g)	82.23^{b}	80.83^{b}	76.94^{ab}	66.65^{a}	62.93^{a}	3.81	*
% saving on feed cost (N/gwt gain)	-	2.35	6.45	18.93	23.47	-	-

a, b - Means value on the same row with different super scripts differ significantly (P<0.05)
SEM - Standard Error of mean
NS - Non Significant
* - Significant (P<0.05)

significantly as the level of cotton seed oil sludge increased from 6 to 12%. Results of the carcass characteristics of the experimental animals fed the dietary treatments are presented in Table 4. The pre slaughter weight, carcass weight and intestinal length were not significantly affected by the dietary treatments. The dressing percentage of the animals were significantly improved (P< 0.05) with increase in the level of dietary cotton seed oil sludge. The belly fat and kidney expressed as the percent of carcass weight increased significantly (P<0.05) as the level of oil sludge increased in the diet.

Discussion

Generally, the performance of the rabbits fed cotton seed oil sludge in this study has shown that the use of cotton seed oil sludge in monogastric diets could have some beneficial effects. Feed intake was not adversely affected as the level of cotton seed oil increased in the diets. This suggest the absence of odour and toxic factors in cotton seed oil sludge unlike that reported by Fajimi et al, (1993) with rubber seed

Table 4 Effects of graded levels of cotton seed oil sludge on carcass characteristics of young rabbits

Parameter	Graded levels of cotton seed oil sludge % 0	3	6	9	12	SEM	Level of Significance
Pre-slaughter wt (g)	1,600.00	1,550.00	1,600.00	1612.50	1,665	55.63	NS
Carcass wt (g)	1,100.00	1,000.00	1,100.00	1,100.00	1,300.00	78.67	NS
Dressing percentage (%)	$68,75^{b}$	64.52^{b}	68.75^{b}	68.22^{b}	78.08^{a}	2.088	*
Large intestine (cm)	20.100	29.933	27.400	19.567	28.133	2.828	NS
Intestine + Caecum (cm)	315.00	355.00	325.00	290.00	365.00	2.637	NS
% of Empty Carcass wt, %							
Belly fat	5.050^{b}	4.267^{b}	5.233^{b}	6.433^{ab}	8.700^{a}	0.764	*
Lungs	3.300^{b}	4.067	4.333	4.900	4.917	0.643	NS
Kidney	2.000^{ab}	2.233^{ab}	2.300^{a}	1.667^{b}	1.933^{ab}	0.145	*
Liver	10.100	11.267	11.433	9.300	9.450	0.582	NS
Head	15.100	15.567	17.167	13.400	13.167	1.013	NS
Tail	5.100	5.667	5.733	4.900	4.917	0.267	NS
Thigh	31.333	33.833	36.067	34.433	29.933	1.875	NS
Shoulder	39.933	36.600	38.600	35.367	34.133	2.270	NS
Loin	22.467	25.333	27.133	19.400	28.567	2.569841	NS

a,b means in the same row with different super scripts differ significantly ($P<0.05$)

NS – Not significant, * - Significant ($P<0.05$).

oil, and Adeyemi (1998) with thevetia oil. However, the slight reduction in feed consumption of rabbits fed the cotton seed oil sludge could be related to increase in energy density of the diets due to oil inclusion (Odunsi and Gbadamosi 2001). Monogastric animals are expected to consume less of high energy diet in attempt not to overshoot their energy requirements. In the present trial the caloric density of the diets increased as the level of the dietary oil increase (Table 1). A similar report by Aduku and Nuhu (1996) on broilers fed diets containing oil sludge showed a slight but non significant ($P>0.05$) decrease in feed intake as the dietary oil level increased. Longe and Adekoya (1988) had earlier observed that addition of oil to a diet that is otherwise adequate in energy, lowers feed intake.

The trend of the daily weight gain result showed a tendency towards improved weight gain with cotton seed oil sludge supplementation. Oils and fat generally have been found to enhance growth by improving the utilization of the dietary nutrients (Mairorino *et al*, 1986). Fats and oil slow down the rate of passage of diet through the digestive tract which would allow longer contact with the digestive enzymes and possibly

microorganisms necessary for fermentation of indigestible fraction of feed like the fiber. The improved weight gain of rabbits fed diets containing 9 and 12% cotton seed oil sludge compared to the control diet supported earlier reports of Ibiyo and Atteh (2005). These authors attributed the improvement in weight gain of birds fed diets with supplemental palm oil relative to those without to the extra caloric effect of fat accompanied with a reduced passage time in the gastro intestinal tract. The trend of increase in weight gain as the level of cotton seed oil sludge increased was also similar to the report of Yeing and Markharjee (1984) who observed a higher weight gain and feed efficiency for chicken fed 9 or 12% palm oil than those on 6% palm oil diet. The final live weight result followed a similar trend with that of the daily weight gain.

Inclusion of oils at 9 and 12% resulted in a slightly better feed efficiency than for rabbits in 3% cotton seed oil sludge diets. This supported the views of Adeyemi (1998) and Freeman (1983) that 'oils generally improved feed conversion ratio. Sell *et al* (1979) had earlier observed improved feed efficiency by added fat. The earlier reports by Aduku and Nuhu (1996) that cotton seed oil sludge can be utilized at levels up to 12.5% without any adverse effect on the efficiency of feed utilization of broilers was also confirmed in this study.

There was cost savings associated with the use of cotton seed oil sludge in diets of rabbits. The use of cotton seed oil sludge resulted in potential savings of N0.82, N1.62, N3.41 and N4.32 per Kg feed for the 3, 6, 9 and 12% cotton seed oil sludge diets, respectively. This amount to savings of N820.00, N1, 620.00, N3, 410.00 and N4, 320.00 per tonne of feed for the 3, 6, 9 and 12% cotton seed oil sludge diets respectively. The cost of producing a unit of weight gain in the rabbits decreased significantly ($P<0.05$) with increase in the level of dietary oil sludge. The decrease in the cost per Kg of diet (Table 1) as the level of oil sludge increased in the diet might be responsible for the significant lowering of the cost per Kg gain in weight.

The significant increase up to 12% ($P<0.05$) in the dressing percentage as the level of oil sludge increased up to 12% in the diet could be a reflection of the increase in efficiency and utilization of the diet to yield more carcasses as the level of oil sludge increased in the diet. The significant increase ($P<0.05$) in belly fat expressed as percentage of the carcass weight as the level of oil sludge increased in the diet is expected. Usually excess energy and fat in the body are stored in form of fat around the belly and some major organs in the body. The slight but non-significant increase in carcass weight with increase in the level of oil sludge also supported the results of (Iyeghe - Erakpotobor *et al* 2000). These authors used palm oil at 0, 3 and 5% in diets of rabbits and observed a non-significant increase in the percent carcass and organ weights of growing rabbits as the level of palm oil increased from 3 to 5%. Iyayi and Ngodigha (1991) also reported a non-significant increase in the liver, kidney and heart weights of rabbits fed graded levels of palm oil.

Conclusion

The results of this study have shown that cotton seed oil sludge up to 12% level of inclusion in diets can be adequately utilized by rabbits and can successfully reduce the amount of maize in a practical rabbit diet without adverse effect on performance and carcass characteristics. As an industrial waste, its incorporation in monogastric diets as a feed ingredient especially for large scale operations would results in substantial cost savings.

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