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GROWTH PERFORMANCE AND ECONOMIC BENEFITS OF FEEDING CRUSHED WHOLE COTTONSEED AND BAKER'S YEAST (*SACCHROMYCES CEREVISIAE*) INCLUSION IN THE RATIONS OF RED SOKOTO BUCKS

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ABSTRACT

The study was conducted to evaluate growth rate and profitability of Red Sokoto bucks fed *Sacchromyces cerevisiae* inclusion in diets containing varied levels of Crushed Whole Cotton Seed (CWCS). A total of 20 bucks weighing an average of 12 kg±0.25 kg were randomly assigned to five experimental diets formulated to contain 14% crude protein in complete diets at varied levels of 10% CWCS without yeast inclusion and 10, 15, 20 and 25% CWCS with500 g yeast (Y) inclusion across these four (4) treatment groups. Bucks were fed at 3.5% of their body weights throughout the trial period that lasted for 90 days in a completely randomized design. Feed intake was highest at 15% CWCS +Yeast (26.11 kg) inclusion level likewise; Total weight gain (3.25 kg) and Average daily gain (290.13 g). Cost/kg of feed and cost of feeding increased as CWCS inclusion increased. Cost/kg gain (839.94 naira) and value of gain (2275.00 naira) were best at 15% CWCS. Yeast supplementation at 15% crushed whole cotton seed inclusion gave higher values of weight gain, cost per kilogram gain and value of gain of bucks thus yeast supplementation can be encouraged amongst goat farmers feeding whole cottonseed in diets.

Keywords: cottonseed, goats, growth, profitability, yeast

INTRODUCTION

With the growing demand for animal protein to meet the need of the teaming populace in Nigeria, there's need to diverse means to frequently bridge the rising gap, thus the use of farm by products with high competitive advantage with humans is one way to go. Animal feeding is a key factor of production as its affects animal productivity, health and welfare, product quality and safety, land use and greenhouse gas emission (Makkar and Beever, 2013) as such the importance of the practice of sustainable diet which put into cognisance the animal, environment, society and also its ability to generate socio-economic benefits driven towards food security and poverty alleviation cannot be overemphasized.

Whole cotton seed (WCS) is unique in that it represents the chemical composition of forage, grain and protein supplement and can substitute within limits those three components (Heuze, 2015). The fat is largely unsaturated and of benefit to ruminant but can reduce fiber digestion and milk fat test if fed at too-high levels (Patrick, 2014). Yakubu *et al.,* (2017) reported an increase in total weight gain in Red Sokoto bucks fed WCS at 10, 20 and 30% inclusion levels with declined digestibility of nutrient as WCS inclusion increased in complete diets in a comparative study using WCS and cotton seed cake (CSC).The decrease in nutrient digestibility could have resulted from gossypol toxicity as a depressant of nutrient absorption. Literature illustrates different methods of alleviating gossypol toxicity of which the use of feed additives such as sodium selenite (Haschek, et al., 1989), vitamin E and/or calcium hydroxide (Kannan et al., 2013) and probiotics (Cao et al., 2013) amongst others were reported.

Probiotics are live microorganisms that confer health benefit on the host by modifying the intestinal microflora (FOA, 2005). Ashima *et al.,* (2016) defined probiotics as effective strategy towards improving an animal's health and performance. Ghazenfar *et al.,* (2015) reported an improved growth rate when a diet with commercial *Saccharomyces cerevisiae* was administered to growing dairy heifers. Yeast inclusion in diets of ruminants has led to increase consumption of dry matter, utilization of fiber and other nutritive substances, improve daily gains, improve absorption and digestibility of minerals, Yirga, (2015). Therefore, this study was conducted to evaluate the effectiveness of yeast supplementation in CWCS based diets as it affects bucks performance.

MATERIALS AND METHODS

Experimental site

The research was conducted at the Teaching and Research Farm, Department of Animal Science, Ahmadu Bello University, Zaria. Zaria is located within the Northern Guinea Savannah Zone between latitudes 110º 12' N and longitudes 70º 33' E; at an altitude of 610 m above sea level. Rainfall occurs from May to September with a mean annual rainfall of 700 – 1400 mm per annum. Dry season commences around the middle of October and ends in February. (IAR, 2019).

Experimental diets and treatments

Complete diets comprised of maize offal, brewer's dried grain, *Digitaria smutsii*, molasses, bone meal, common salt, premix, Crushed Whole Cotton Seed (CWCS) and commercial baker's yeast (yeast) inclusion. The WCS was coarsely crushed before incorporating into the diets with the lint, likewise *Digitaria smutsii* hay was chopped to smaller sizes of 5-8 mm and the experimental diets was formulated to contain 14% CP with varied inclusion levels of CWCS at 10, 15, 20 and 25%; and each with an inclusion of 500 grams of commercial baker's yeast; and 10% CWCS without yeast as control diet. The experimental diets are labelled as treatment A, B, C, D and E as shown in Table 1. Data collection period lasted for 90 days.

Experimental design, animals and management

A Completely Randomized Design (CRD) was used for the study. Twenty (20) Red Sokoto bucks (RSB) within the ages of 8 to 12 months and weighing an average of 12 kg±0.25 kg were sourced from Giwa market in Giwa Local Government

Area Council, Kaduna State. On arrival of the animals, they were quarantined for two weeks (2) and vaccinated against peste des petits ruminants (PPR) with tissue culture rinderpest virus (TCRPV).

Table 1: Ingredient composition of graded levels of crushed WCS diets supplemented with yeast

Parameters	Treatment				
	A	B	C	D	E
Maize offal	28.75	28.25	28.25	28.30	27.25
Crushed WCS	10.00	10.00	15.00	20.00	25.00
Digitaria smutsii	30.00	30.00	30.00	30.00	30.00
Brewer's dried grain	27.00	27.00	22.00	17.00	13.00
Molasses	2.00	2.00	2.00	2.00	2.00
Bone meal	1.50	1.50	1.50	1.50	1.50
Salt	0.50	0.50	0.50	0.50	0.50
Premix	0.25	0.25	0.25	0.25	0.25
Yeast (*S.cerevisae)*	-	0.50	0.50	0.50	0.50
Total	100	100	100	100	100
CP (%)	14.00	14.00	14.00	14.00	14.00
EE (%)	4.14	4.14	4.27	4.40	4.54
CF (%)	19.42	19.42	19.58	19.74	19.93
ME(KJ)	2651.61	2674.08	2522.28	2446.44	2499.87

Y=yeast, WCS= whole cotton seed, ME(KJ)= metabolizable energy(kilojoules)

The animals were treated against internal and external parasites with ivermectin (ivomec®) and also Tetracycline LA was administered against bacterial infections as prophylaxis. The bucks were randomly allocated to five dietary treatments, with four animals per group. Each group of animals were housed in group, in pens with the dimension of 6 m by 2.5 m (length by width); made of concrete floors and roofed with aluminium sheet, equipped with feed and water troughs for feed and water respectively. The bucks were adjusted to the diets for two weeks before the commencement of the study. Fresh clean water was supplied *ad libitum* throughout the feeding trial. The feed intake was computed daily from the difference of feed offered and the left over and feed conversion ratio was recorded at the end of the trial. The initial weight of the bucks was measured at the beginning of the feeding trial while the subsequent weight was recorded fortnightly.

Cost per kg live weight gain

Cost benefit analysis was conducted to determine the profitability of feeding experimental diets to RSB. Inputs and products cost was based on the cost at the prevailing producers market price of the commodities in the year 2019. Value of gain and cost over gain were determined. Cost/kg of feed reflects the cost of producing feed per kilogram, Total feed consumed is the summation of feed intake throughout the experimental period. Cost of feeding is a product of cost/kg of feed and total feed consumed/intake which indicates the cost implication of each feed. Live weight gain reflects the increase in weight derived by the animal from each feed administered. It is the difference between final weight gain and initial weight gain after feed trial (i.e. final weight of animal – initial weight of animal). Cost/kg live weight gain is the product of cost of feeding by live weight gain of animal (i.e. cost of feeding divide by live weight gain) which reflects the cost implication of producing a kilogram of meat. Value of gain reflects the profitability of the feed; it is the value obtained from multiplying live weight gain and prevailing selling cost per kilogram live weight of goat.

Statistical analysis

Data collected on feed intake weight gain changes were analysed using the GLM procedure of SAS (2002). Means with significant differences were separated using Duncan Multiple Range, as sited in (Dafaallah, 2019). The following model was used,

$$\mathbf{Y_{ij}= \mu + C_i+ e_{ij}}$$

Where

Y_{ij}= the score of i^{th} observation on the j^{th} treatment level of varied Whole Cotton Seed

μ= Overall mean

C_j= the effect of varied level of Crushed Whole Cotton Seed

e_{ij}= random error

RESULTS AND DISCUSSIONS

Result of chemical composition of experimental diets, crushed whole cotton seed and *Digitaria smutsii* is shown in Table 2.

Crushed whole cotton seed had dry matter value of 93.79%, organic matter of 89.83%, crude protein of 18.07%, acid detergent fibre 30.57% and neutral detergent fibre 43.50%. *Digitaria smutsii* had values for dry matter of 93.51%, organic matter 86.65%, crude protein 9.95%, acid detergent fibre 45.26% and neutral detergent fibre 75.13%. Dry matter values for experimental diets ranged from 88.45% in treatment E as the lowest value and 93.84% in treatment C as the highest value, organic matter ranged from 81.27% in treatment A to 85.82% in treatment D. Crude protein values ranged from 12.53 in treatment B to 14.54% in treatment E. Acid detergent fibre and Neutral detergent fibre were lowest at treatment E while ADF value was highest in treatment D and NDF in treatment E.

Table 2: Chemical Composition of Experimental Diets supplemented with yeast, Crushed whole cotton seed and *Digitaria smutsii* hay

Parameters	Treatment					CWCS	*D.s*
	A	B	C	D	E		
Dry Matter	92.86	93.57	93.84	93.36	88.45	93.79	93.51
Organic Matter	81.27	82.19	83.16	85.82	81.97	89.83	86.65
Crude Protein	13.75	12.53	12.8	14.21	14.54	18.07	9.95

Ether extract	1.96	1.16	1.24	1.29	1.4	18.94	0.96
Ash	11.59	11.38	10.68	7.54	6.48	3.96	6.86
NFE	55.89	59.62	54.88	51.16	52.07	45.17	54.13
ADF	32.89	39.53	38.46	41.25	28.57	30.57	45.26
NDF	32.81	30.65	25.93	28.57	25.76	43.50	75.13

Y=yeast, ADF= acid detergent fibre, NDF= neutral detergent fibre, Crushed Whole cotton seed = CWCS, NFE= nitrogen free extract, D.s= *Digitaria smutsii.*

Effect of crushed whole cotton seed supplemented with baker's yeast on performance of growing Red Sokoto bucks

Table 3 shows the effect of crushed whole cottonseed supplemented with baker's yeast on performance of growing Red Sokoto bucks. Feeding bucks with diets containing Baker's yeast with varied levels of CWCS significantly (P<0.05) influenced total feed intake, daily feed intake, final weight, total weight gain and average daily weight gain. Feed intake increased significantly (P<0.05) with the introduction of yeast. Bucks fed treatment C diet had the highest feed intake (26.11 kg) which is statistically (P<0.05) similar with treatment B (25.46 kg) and the least feed intake was recorded in bucks fed treatment A diet (18.05 kg). Feed intake values obtained in this study were higher as against the report of (Yakubu *et al.,* 2017) who fed Red Sokoto bucks complete diets with whole cotton seed inclusion although without yeast or probiotics. The increased feed intake with yeast supplementation across treatment groups in this study could be attributed to the dietary composition and most likely the addition of yeast in the diets as compared to the control diet.

Table 3: Effect of CWCS supplemented with baker's yeast on the Performance of Growing Red Sokoto bucks

Parameters(kg)	Treatment					SEM
	A	B	C	D	E	
Total Feed intake(kg)	18.05^{c}	25.48^{a}	26.11^{a}	24.05^{b}	23.79^{b}	0.54*
Daily Feed intake(g)	200.54^{c}	283.14^{a}	290.13^{a}	267.25^{b}	264.21^{b}	5.96*
Initial weight (kg)	12.00	11.75	12.25	12.38	12.50	0.29^{ns}
Final weight (kg)	13.00^{b}	13.13^{b}	15.50^{a}	13.75^{b}	13.38^{b}	0.48*
TWG (kg)	1.00^{b}	1.38^{b}	3.25^{a}	1.25^{b}	1.00^{b}	0.43*
ADG (g)	11.11^{b}	15.28^{b}	36.11^{a}	13.89^{b}	11.11^{b}	4.77*
FCR	18.05^{b}	18.53^{b}	8.03^{a}	19.24^{b}	23.78^{c}	0.65*

^{a,b,c}Means with different super script along same row differed significantly (P<0.05), SEM = Standard error of means, * significant at P<0.05, ADG-average daily gain, FCR=feed conversion ratio.

The increased intake with yeast supplementation across treatment groups in this study could be attributed to the dietary composition and most likely the addition of yeast into the diet as compared to the control diet. Diets with *S. cerevisiae* tend to influence feed intake positively. This could be associated to the pleasant odour (one of fungal yeast characteristics) obtainable in yeast which produces glutamic acid that influences taste of foodstuffs. Bucks fed treatment 3 diet with yeast recorded significantly (P<0.05) higher total weight gain (3.25 kg), compared to other treatment groups. Average daily gain (ADG) and final weight followed similar pattern as total weight gain. Animals fed treatment C diet had a better FCR (8.03) as compared to the control and other treatment groups. Final weight gain (FWG) and average daily gain (ADG) obtained in this study were slightly higher but similar to the earlier report of (Yakubu *et al.,* 2017) who reported total weight of bucks to be 0.75, 2.00 and 0.63 kg at 10, 20 and 30 % inclusion of whole cotton seed respectively without yeast/additive supplementation. The low values of TWG recorded in this research as compared to the earlier report of (Yakubu *et al.,* 2017) and the control diet despite their age and weight differences could be attributed to the variations in animal physiology, environmental conditions (season) and/or change of feeds. However, the values recorded at treatment C diet signifies improvement with the use of yeast in the diet which agrees with Ghazenfar *et al.,* (2015) who reported an improved growth rate with *S. cerevisiae* inclusion in diets fed to growing heifers.

Cost per kilogram live weight gain of feeding crushed whole cotton seed supplemented with baker's yeast to growing Red Sokoto bucks

The result of cost per kilogram live weight gain is presented in Table 4. Cost/Kg of feed increased with increase in Crushed Whole Cotton Seed (CWCS) inclusion, treatment E cost higher than the control diet (94.46 naira). Cost of feeding also increased with higher inclusion of CWCS

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Table 4: Cost per kilogram live weight gain of Feeding CWCS supplemented with baker's yeast (*S. cerevisae*) to Growing Red Sokoto bucks

Parameters	Treatment				
	A	B	C	D	E
Cost /Kg of Feed (N)	94.46	99.46	104.55	109.75	114.99
Total Feed Consumed (Kg)	18.05	25.68	26.11	24.05	23.78
Cost of Feeding (N/buck)	1705.00	2534.24	2729.80	2639.49	2734.46
Live Weight gain (Kg)	1.00	1.38	3.25	1.25	1.00
Cost /Kg live weight gain (N)	1705.00	1836.41	839.94	2119.59	2734.46
Value of Gain (N)	700.00	966.00	2275.00	875.00	700.00
Cost over gain	2.43	1.90	0.37	2.42	3.90

Cost/kg of feed=a, Total feed consumed=b, cost of feeding=a*b=c, live weight gain=d, cost/kg gain=c/d =e value of gain=weight gain*700/kg live weight=f, cost over gain= e/f

The cost of feeding a buck was higher (P<0.05) at treatment E (2734.46 naira) as compared to the control group (1705.00 naira). Cost/Kg gain was observed to be best at treatment C (839.94 naira) and the lowest at treatment E (2734.46 naira). The value of gain followed similar trend with cost/kg gain. The increase observed may indicate the direct relationship of cost/kg of feed with the cost of feeding an animal over a period of time (meaning, the lower the prices of feed stuff in the market, the better/lower the cost of feeding) which ultimately influences the value of gain of producing a buck as shown in this study. Total feed consumption of 26.11 kg was higher (P<0.05) at treatment C as compared to the control (18.05 kg). The inclusion of baker's yeast improved the value of gain of producing a buck in this study as reflected in the live weight gains. This is contrary to previous studies of Absalan *et al.* (2011) and Yakubu *et al.* (2017), who advised minimal inclusion of cotton products in goat diet. The result of this study clearly shows that the addition of baker's yeast in cotton products based diets improved weight gain that translate to more economic gain to the farmer. Similarly, Mijinyawa *et al.*, (2020) reported an increase in weight gain with higher inclusion (7 g) of yeast in bagasse based diets when fed to Yankasa rams. Alltech, (2018) listed the benefit of yeast inclusion in animal diets to be an increase in returns through better performance.

CONCLUSIONS

From the result of the study, it could be concluded that: total feed intake increased in treatment 3 by 8.06 kg and 89.9 g for daily feed intake, likewise total weight gain was improved in treatment C by 2.25 kg and 25 g for average daily gain as compared to the control group. Similarly, the value of gain of feeding dietary treatments to bucks was best at treatment C (2,275 naira). Therefore, feeding RSB diets with 15% CWCS with yeast supplementation can be adopted by farmers for better productive performance and economic gain.

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