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Nutrient Digestibility and Economic of Production of Grower Rabbits Fed Graded Levels of Soyabean Cheese Waste as Replacement of Full-Fat Soya Bean Seed Meal

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Abstract

An experiment was carried out for forty-two days on the effect of feeding graded levels soyabean cheese waste as a replacement for full fat soyabean on the nutrient digestibility and economic of production of grower rabbits. Thirty (30) rabbits of mixed breeds and sexes with an initial body weight of 1160.00-1206.67g were randomly assigned to five dietary treatments of six rabbits per treatment with two rabbits per replicate in a Completely Randomized Design (CRD). The experimental diets were: T1 with 0% soyabean cheese waste as the control, while T2, T3, T4 and T5 contained 25, 50, 75 and 100% soyabean cheese waste respectively. Feed and water were provided ad libitumduring the period of the research. The parameters measured were nutrient digestibility and economic of production. The results showed that nutrient digestibility were significantly (P<0.05) influenced and better for the soyabean cheese waste-based diet. The nutrient digestibility of crude fibre and ash increases as the level soyabean cheese waste increases and the increase of soyabean cheese waste can reduce the cost of production at 75% inclusionin rabbits rearing. The results showed soyabean cheese waste can be included in rabbit diet at 75% levels without any effect to rabbits

Key words: soya bean, cheese, rabbit, waste, digestibility

Description of Problem

Food and Agricultural Organization (FAO) recommended an average of 35g animal protein intake per day for a healthy person living in the developing countries (1). Therefore, this recommendation is an indication that the well-being of the people is directly dependent on the amount of animal protein consumption. FAOSTAT (2) and Bolarin*et al* (3) reported that most of the consumption of meat in Nigeria, especially in the urban and peri-urban areas comes from animal species such as ruminants, pigs, poultry, which account for 7.5g of animal protein intake by an average Nigerian which is far below the recommended 35g per day for an adult for proper health. (4) stated that the average estimated crude protein requirement for an adult Nigerian is between 65g and 85g per person daily, 35g of which should come from animals like cattle, sheep, goats, pigs and poultry (5).

The prospects of achieving self-sufficiency in animal protein supply is by closing up the gap (6) through exploring other less cost and potential sources of animal protein such as rabbits. Rabbit rearing has been reported as an effective and quick approach of bridging the demand and supply of animal protein gap in Nigeria and other developing countries (7). Rabbit have several characteristics that if properly handled can be used to bridge the gap in protein intake. The small in size, short generation interval, rapid growth rate, genetic diversity and high reproductive capacity are characteristics which make rabbits suitable as meat producing mini-livestock in developing countries (8).

The major constraint of the livestock industry is meeting consumers demand for its products is dependent to a major extent on the availability of regular supplies of cost effective and safe animal feeds (9;10) because animal feed resources have become critical component of the integrated food chain with wide industrial applications.Feed account for about 70-80%of the total cost of livestock production (11;12). This is due to over dependence on conventional feed ingredients used for animal feed, most

especially grains such as maize, sorghum, soyabean, which are scarce and expensive due to high competition between humans and livestock(13); Also, the poor knowledge of nutritional endowment of alternative and cheap sources of feed ingredients and limitation on the use of Agro-industrial by-products. Feeding by-products of crops and processing waste limit dependency of livestock on grains and eliminate the need for costly waste management programs (14). Thus the need for utilizing alternative feed ingredients from Agro-industrial by-products such as soyabean cheese waste.

Soyabean cheese waste (SCW) is an Agro-industrial by-product from soyabean. It is used in feeding animals. It has the potential for reducing cost of concentrate intake in rabbits (15). Soyabean cheese waste could provide a suitable sustainable and cost-effective alternative to traditional feed source.

Materials and methods

Experimental site

This study was conducted at the Rabbitry Unit of the Teaching and Demonstration Farm, Animal Science Department of the Faculty of Agriculture, Nasarawa State University, Keffi,Shabu-Lafia campus. The experimental site lies in the guinea Savannah zone of middle belt of Nigeria on Latitude $8^0 35^{'}$N and longitude $8^0 33^{'}$E.The average minimum temperature is 23 °C and average maximum temperature is 36.9 ^{0}C.

Sources of experimental feed ingredients

The soybean cheese waste (SCW) was sourced from local soybean processors into cheese known as awara within Mangu Local Government Area of Plateau State. The soybean cheese waste (residue) was collected, sun dried for 2-3 days (during the dry season) to reduce the moisture content and also to avoid the growth of mold and rancidity. Other feed ingredients were procured from feed suppliers in Lafia metropolis of Nasarawa State, Nigeria.

Experimental diets

Five (5) experimental diets were formulated to provide approximately 2500 kcal/kg and (15% CP) with five (5) levels of inclusion of soybean cheese waste 0%, 25%, 50%, 75%, and 100% representing T1, T2, T3, T4 and T5 respectively. T1 contain 0% soybean cheese waste and it served as control.

Experimental animals and management

Thirty (30) grower rabbits of mixed breeds and sexes aged 9-10 weeks with initial group mean weight ranging between 1203.33 and 1206.67g were procured from National Animal Production Research Institute (NAPRI), Shika-Zaria. They were housed according to the five treatments in a well-ventilated house in open-sided wire mesh hutches with facilities for drinking and feeding. The house and hutches were washed and disinfected before the animals arrived and the animals were treated against internal and external parasites by subcutaneous injection of Ivermectin at 0.2ml/rabbit. A broad spectrum antibiotic (oxytetracycline) was also administered at the rate of 0.2ml/ rabbit and other routine management practices were carried out regularly.

Experimental design

The thirty rabbits were randomly assigned to the five dietary treatments and each treatment was replicated three (3) times with each replicate having two rabbits in a Completely Randomized Design (CRD) at both the weaner and grower phase.

Data collection

Data on nutrient digestibility and economic of production were taken

Nutrient Digestibility trial

Digestibility study was conducted at the end of the experiment to evaluate the nutrient utilization of diets containing different dietary levels. Faecal droppings were collected daily over a period of seven consecutive days from empty poultry feed bags placed below the hutches. The faeces were oven-dried at 105°C for three hours after each collection. The dried samples for each treatment were bulked, ground, thoroughly mixed and taken for proximate analysis. The analysis was carried out at International Institutes for Tropical Agriculture (IITA), Ibadan, Nigeria according to (16).

The apparent nutrient digestibility was calculated using the formula:

$$\text{Nutrient digestibility (\%)} = \frac{\text{Nutrients in feed consumed} - \text{Nutrients in faeces voided out}}{\text{Nutrients in feed consumed}} \times \frac{100}{1}$$

Economics of production

Parameters included the following:Cost of feed per kilogram; Cost of feed per kilogram; Weight gain- This is calculated as: $\frac{\text{Cost of feed}}{\text{Weight gain (g)}}$

Data analysis

Data collected were subjected to one-way analysis of variance (ANOVA) using SPSS version 22 while significant means were separated using Duncan's multiple range test at 5% level of significance (17).

Table 1: Gross composition of experimental grower rabbit's diets/100kg

Ingredients (%)	T1(0%SCW)	T2(25%SCW)	T3(50%SCW)	T4(75%SCW)	T5(100%SCW)
Maize	37.00	37.00	37.00	37.00	37.00
Maize offal	12.00	12.00	12.00	12.00	12.00
GNC	5.00	5.00	5.00	5.00	5.00
Rice offal	25.75	25.75	25.75	25.75	25.75
Bone meal	2.00	2.00	2.00	2.00	2.00
Full fat soya	12.00	9.00	6.00	3.00	0.00
SCW*	0.00	3.00	6.00	9.00	12.00
Palm oil	2.00	2.00	2.00	2.00	2.00
Fish meal	3.00	3.00	3.00	3.00	3.00
Common salt	0.25	0.25	0.25	0.25	0.25
Premix	0.25	0.25	0.25	0.25	0.25
Methionine	0.25	0.25	0.25	0.25	0.25
Lysine	0.25	0.25	0.25	0.25	0.25
Toxin binder	0.25	0.25	0.25	0.25	0.25
Total	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**
Calculated	***Analysis***				
ME Kcal/Kg	2550.49	2568.22	2585.96	2603.70	2621.44
CP (%)	15.82	15.27	15.03	14.78	14.39
Lys (%)	0.98	0.91	0.84	0.76	0.69
Meth (%)	0.54	0.53	0.53	0.52	0.51
EE (%)	8.75	8.28	7.80	7.33	6.35
CF (%)	8.01	8.29	8.31	8.43	8.54
Ca (%)	0.73	0.73	0.72	0.72	0.72
P (%)	0.91	0.81	0.84	0.80	0.86
Feed cost (₦/kg)	131.880	125.880	119.880	113.880	107.880

SCW* Soya cheese waste inclusion levels. The vitamin- mineral premix supplied the following per 100kg of diet: vitamin A15,000 I.U, vitamin D3 300,000 I.U. vitamin E 3,000 I.U., vitamin K 2.50mg, vitamin B_1(thiamin) 200mg, Riboflavin (B_2) 600mg, pyridoxine (B_6), Niacin 40.0mg, vitamin B_{12} 2mg, Pantothenic acid 10.0mg, folic acid 100mg, Biotin 8mg, choline chloride 50mg, anti-oxidant 12.5mg, manganese 96mg, zinc 6mg, Iron 24mg, Copper 0.6mg, Iodine 0.14mg, Selenium 24mg, cobalt 214mg. Using Feedwin software version 1.01

Results and discussion

Apparent nutrient digestibility of grower rabbits fed soybean cheese waste

The effect of replacement value of full-fat soybeans with soybean cheese waste (SCW) on apparent nutrient digestibility of grower rabbits is presented in Table 2. The result showed significant ($P<0.05$) differences in all the measured parameters. The nutrient digestibility showed significant difference ($P<0.05$) in dry matter of rabbits in treatment T2 having the highest value and treatment T1 had the lowest value. Rabbits fed diet treatment T4 were highest in digestibility value of crude CP while T3 was lowest. Ash was highest in T4 and T1 had the lowest. EE was highest in T1 than other treatment groups. T5 had the highest digestibility values for CF while T2 was highest in NFE digestibility with the lowest value in T5. The significant ($P<0.05$) increase in the digestibility of dry matter and nitrogen free extract for rabbits fed 25%, crude protein and ash for rabbits at 75%, as well as crude fibre for rabbits at 100% soybean cheese waste diets, is

an indication that soybean cheese waste had better nutrients digestibility compared to the control. However, control diet had better ether extract digestibility compared to other treatment groups. Decreased digestibility of ether extract in the soybean cheese waste-based diets is an indication that rabbits on these diets will have less fat accumulation in the muscles. The present digestibility values of dry matter of T2; crude protein of T4 and T4 and of ether extract of T1 are generally higher than others as reported earlier by (18) who evaluated the growth rates of three breeds of rabbits raised in Northern guinea savanna of Nigeria. Poor digestibility of crude fibre in the control than the soybean cheese waste groups may be attributed to the masking effect of microbes in the animal's gut (19).

Table 2: Effect of replacement of full-fat soybeans with soybean cheese waste (SCW) on apparent nutrient digestibility of grower rabbits

Parameters	Dietary levels of SCW (%)						
	$T1_{(0)}$	$T2_{(25)}$	$T3_{(50)}$	$T4_{(75)}$	$T5_{(100)}$	SEM	LOS
DM (%)	73.40^{d}	77.25^{a}	73.42^{d}	74.37^{c}	74.69^{b}	0.47	*
CP (%)	88.42^{b}	86.15^{d}	83.53^{e}	89.27^{a}	86.76^{c}	0.66	*
ASH (%)	52.69^{e}	55.42^{d}	57.53^{c}	65.16^{a}	62.70^{b}	1.53	*
EE (%)	96.18^{a}	91.33^{c}	90.51^{d}	91.69^{b}	89.71^{e}	0.75	*
CF (%)	24.49^{e}	29.49^{c}	26.68^{d}	41.43^{b}	56.02^{a}	4.27	*
NFE (%)	79.25^{b}	82.79^{a}	77.66^{c}	76.95^{d}	74.72^{e}	0.89	*

SEM= Standard error means, LOS= Level of significant, a, b, c, e = Means on the same row bearing different superscript differ significantly (P<0.05); SCW= soybean cheese waste; DM= percentage dry matter; CP= percentage crude protein; EE = ether extract; CF = crude fibre; NFE= nitrogen free extract

Production economics of grower rabbits fed soybean cheese waste

The effect of replacement value of full-fat soybeans with soybean cheese waste (SCW) on Production Economics of grower rabbits is shown in Table 13. The result showed significant (P<0.05) differences in the feed cost/kg weight gain, cost of feed consumed and total cost of production. For the feed cost/kg weight gain, T3 had the highest cost than other treatment groups with T4 having the least cost, cost of feed consumed (CFC) and total cost of production (TCP) were highest for T2 while T4 and T5 had the lowest cost. T4 had the lowest of total cost of production. The revenue and gross margin were not significantly (P>0.05) influenced, though numerically, T4 had highest value and T3 was lowest for revenue and gross margin respectively. This indicated that rabbits fed diets T4 were produced at low cost and result to higher revenue.

Table 3: Effect of replacement value of full-fat soybeans with soybean cheese waste (SCW) on Production economics of grower rabbits

Parameters	Dietary levels of SCW (%)						
	$T1_{(0)}$	$T2_{(25)}$	$T3_{(50)}$	$T4_{(75)}$	$T5_{(100)}$	SEM	LOS
FC (₦/kg)	131.88	125.88	119.88	113.88	107.88	2.27	-
FC/kg WG (₦/rabbit)	786.44^{b}	1214.74^{a}	1582.01^{a}	734.53^{b}	829.23^{b}	120.62	*
CFC (₦/kg)	276.24^{b}	336.58^{a}	261.05^{b}	265.26^{b}	235.80^{b}	10.49	*
TCP(₦/rabbit)	1576.24^{ab}	1636.58^{a}	1561.05^{ab}	1531.93^{b}	1535.80^{b}	13.37	*
Revenue (₦)	3033.33	2900.00	2786.67	3166.67	2986.67	92.53	NS
Gross margin (₦)	1457.09	1263.42	1225.62	1634.74	1450.86	94.06	NS

SEM= Standard error means, LOS= Level of significant, a, b, c, = Means on the same row bearing different superscript differ significantly (P<0.05); SCW= soybean cheese waste, FC = Feed cost, FC/kg WG = Feed cost/kg weight gain, CFC = Cost of feed consumed, TCP = Total cost of production

Comparison between feed cost per kilogram, cost of feed consumed, cost of feed/kg weight gain and total cost of production indicate that feed cost/kg decreased as the inclusion levels of

soybean cheese waste in the diets increases from 0- 100%. Cost of feed consumed was similar for 0, 50, 75 and 100% inclusion levels while 25% had the highest cost. Feed cost/kg weight gain was highest in T2 and T3 and others were similar to control diet. Rabbit fed 25% had highest total cost of production while 75 and 100% had the lowest cost. The significant ($P < 0.05$) increase in the cost of feed consumed for rabbits fed the 25% soybean cheese waste and concomitant higher total cost of production might probably be due to the high feed intake which did not reflect on the growth rate and feed conversion ratio of rabbits in this group. The significant ($P < 0.05$) reduction in the feed cost per kilogram weight gain, cost of feed consumed and total cost of production for rabbits fed 75 and 100% shows that the more the soybean cheese waste in the diets, the lower the cost of production.

Conclusion and Application

Digestibility of crude fibre and ash increased as the level of soybean cheese waste increased at T5 with 100% having superior values. Economic of production showed that rabbits can profitably be produced at 75% inclusion level of soybean cheese waste in place of full-fat soybeans.

References

1. Omolaran, A.B. (2004). Intra-household redistribution of income and calorie consumption in South-western Nig. New Haven: Yale University, 23-25.
2. FAOSTAT. (2011). Food and Agricultural Org. Statistics. www.fao/es/ess/foatat/food/security/index/en.htm
3. Bolarin, O., Oni, A.O., Olanite, J.A and Onwuka, C. (2017). Performance, blood indices and carcass yield of grower rabbits fed diets containing *Moringaoleifera, Aspilla Africana* and *Azadirachtaindica* leaf meals. *Nig. Journal if Ani. Prod*. 44(4): 139-149.
4. Adetunji, M. and Adepoju, A. (2011). Evaluation of household protein consumption pattern in orire LGA of Oyo State. *International Journal of Agric. Economics and Rural Dev.* IJAERD, 2011, 4(2)
5. Fasuyi, A.O. (2005). Nutritional evaluation of cassava (*Monihotesculenta, cranz*) leaf protein concentrates (CLPC) as alternative protein sources in rat assay. Pak. J. Nutr. 4:50-56
6. Atsu, D.I. (2002). Contributing role of animal production in national development. 7th Annual Conference of Ani. Sci. Ass. Of Nig. (ASAN), Fed. University of Agric. Abeokuta, September, 15-17, Pp. 13-23.
7. Ajala, M.K and Balogun, J.K. (2004). Economics of Rabbits production in Zaria, Kaduna State. *Tropical Journal of Animal Science*. 7(1): 1-10.
8. Omole, A.J., Omueti, O. and Ogunleke, O.J. (2005). Performance characteristics of weaned rabbits fed graded levels of dry cassava peel fortified with soy corn residue based diet. *Journal of farm Agric. And Environment.* 3:36-38.
9. FAO. (2015). CA Adoption worldwide (online). FAO Agriculture and Consumer Protection Department. Available: http/www.fao.org/ag/ca/6c.html
10. Ari, M.M., Ayanwale, B.A., Adamu, T.Z and Olatunji, E.A. (2012). Effect of fermentation methods on the proximate composition, amino acid profile and some antinutritional factors (ANF) in soyabean*(Glycine max*) fermentation Technology and Bioengineering. 2:6-12.
11. Nworgu, F.C., Olupona, J.A., Oluokon, J.A. and Bamgbose, A.M. (1998). Effect of concentrate and forage legumes on weanerrabbots performance. In: Animal Agriculture in Wes Africa (The sustainable question). Proceeding of the silver Anniversary Conference of Nigeria Society of Animal Prod. (NSAP), 21-26 March, Gateway Hotel, Abeokuta, Pp.598-599
12. Kellem, R.O and Church, D.C. (2010). Livestock feeds and feeding. Boston Massachusetts, by solid-state fermentation Bio-resource Tech. 5(3): 323-325.
13. Kellem, R.O and Church, D.C. (2010). Livestock feeds and feeding. Boston Massachusetts, by solid-state fermentation Bio-resource Tech. 5(3): 323-325.
14. USDA, (2013). Citrus World Market and trade USDA Foreign Agricultural Service.

January 2013 Edition, Washinton DC. Pp 1-62
15. Aduku, A.O.(1992). Nutrient requirement of the chicken: Feed ingredient analtsis table and their uses. In: Revamping poultry production, management and feeding. S.O., Ogundepe, O.O., Oni, A.A., Sekoni (Eds). NAPRI publication. Pp.44-48.
16. AOAC. (2010). Association of Official Analytical Chemists. Official Methods of Analysis, 17th edition, ShalliamTryd press, Richmond, Virginia USA.
17. SPSS (2007). Statistical Package for Social Science 160 Brief Guide: SPSS Inc. 233 South Wacker Drive, 11thFlour Chicago.
18. Iyegde-Erakpotobor, G.T., Osuhor, C.U and Olugbemi, T.S. (2006). Performance and digestibility of weaner rabbits fed graded levels of soyabean cheese waste/maize offal diet and brachiaria grass hay. African Journal of Biotechnology, 5(17):1579-1584.
19. Okwonkwo, J.C., Okwokwo, I.F. and Ummerie, S.C. (2010). Replacement of feed concentrate with graded levels of cassava leaf meal in the diets of growing rabbits: effect on feed and growth parameters. *Pakistan Journal of Nutrition.* 9(2): 116-119.