NUTRIENT DIGESTIBILITY AND haematological RESPONSE OF WEANER RABBITS FED REPLACEMENT LEVELS OF SOYBEAN CURD RESIDUE FOR GROUNDNUT CAKE

[1]Saleh Izzaddeen, [1]Abdulkadir Khuzaifa, [2]Murtala Isma'il Umar and [1]Ukonu, E.C.
[1]Livestock and Fisheries Department, National Agricultural Extension and Research Liaison Services, Ahmadu Bello University (NAERLS/ABU), Zaria
2Department of Agric Science Education, Federal College of Education (Technical), Bichi, Kano State
*Corresponding author: izzaddeensaleh@gmail.com; +2348068981489

ABSTRACT
The Experiment was conducted to determine the performance of weaner rabbits fed soybean curd residue-based diets. In Experiment 1, a total of 30 weaner rabbits (8 weeks old) with average initial weight of 534.7g arranged in a completely randomized design (CRD) were used. Soybean curd residue (SCR) was added at 0, 25, 50, 75 and 100 % to replace groundnut cake. The results indicated that nutrients digestibility coefficients were not significant (P>0.05) for all the parameters except crude fibre which differed (p<0.05) significantly. Values obtained from haematological studies varied significantly (P<0.05) for Haemoglobin (Hb), Red Blood Cell counts (RBC), Packed Cell Volume (PCV), White Blood Cell counts (WBC), Mean Corpuscular Haemoglobin (MCH) and Mean Corpuscular Haemoglobin Concentration (MCHC), while Total Protein (TP) and Mean Corpuscular Volume (MCV) were not affected. It was therefore concluded that SCR can be used to replace groundnut cake at 100% in diets of growing rabbits without deleterious effect. Thus, SCR can be use in place of groundnut cake as a cost saving alternative and for better performance.
Keywords: Soybean curd residue, Rabbit, Haematology

INTRODUCTION

The contribution of food from animal origin to the world population is well documented (Bwibo *et al.,* 2003 and Ndolovu, 2010). Livestock products accounts for almost 30% of human protein consumption (Steinfields *et al.,* 2004). Over 50% of Nigerian farmers are engaged in the livestock industry (NAERLS, 2015). Growing population, Urbanization and Economic growth in developing countries are contributing to growing demand for livestock and livestock products (Hall, 2009). Globally, human population is expected to increase from around 6.5 billion to at least 8.2 billion by 2050 (Rosegrant *et al*., 2009). More than 1 billion of this increase will occur in Africa (Swanepoel *et al*., 2010). Soybean is one of the most important legumes in the world. In 2010, the annual world output of soybean exceeds 261 million tons of which 1.5 million were in Africa. Nigeria is the largest producer of soybean in sub-Saharan Africa, followed by South Africa (IITA, 2009). Soybean curd residue (SCR) is the main surplus material from soybean products and it is often regarded as waste. About 1.1 kg of fresh soybean curd residue (SCR) is produced from every kilogram of soybeans processed into soymilk or tofu (Khare *et al*, 1995). In Japan, about 700,000-800,000 tons of SCR are disposed-off annually as by-products of tofu production (Shuhong, *et al*, 2013). SCR is a loose material consisting of a good source of nutrients, including protein, oil, dietary fibre, minerals, along with un-specified monosaccharide and oligosaccharides. By-products from tofu processing, sometimes known as soybean-curd lees or tofu-cake, are left over when tofu (soybean curd) is made from soybeans. The filtrate, contains protein and fat, and is made from milled and boiled soybean mash, is called soymilk, while tofu wastes are the soybean curd residue. Protein supplementation is often important to improve livestock performance, and this needs to be done with respect to the requirements of the animal in addition to the balance of other nutrients available (Odunsi, 2003). Soybean meal, groundnut cake and fish meal have been widely and successfully used as conventional protein sources for livestock. However, the prices of these protein sources have been escalating continuously in recent times, whilst availability is often erratic. The problem has been worsened due to the increasing competition between humans and livestock for these protein ingredients as food. According to Odunsi, (2003) the rapid growth of human and livestock population, which is creating increasing needs for food and feed in the less developed countries, demands that alternative feed resources must be identified and evaluated.

METHODOLOGY

The experiment was conducted at the National Agricultural Extension and Research Liaison Services' (NAERLS) Skills Acquisition farm, Ahmadu Bello University, Zaria. The farm is located at latitude 1109'45"N and longitude 7038'8"E at an altitude of 610m above sea level (Ovimaps, 2014). The analysis of the SCR was carried out according to procedures described by AOAC (2000). This was done in order to ascertain the nutritional composition of the SCR used for the study. Five experimental diets were formulated to meet the nutritional requirement of rabbits. The diets contained 20% crude protein and 2739.7kcal ME/kg for diets 1,2,3,4 and 5. SCR

was included at 0, 25, 50, 75, and 100% as replacement for groundnut cake in the diets as shown in table 1. A total of 30 weaner rabbits (8-week-old) of 534.7g average initial weights were used for the study. Each treatment consists of 6 rabbits and each rabbit was a replicate. The rabbits were assigned randomly in a completely randomize design (CRD). They were housed individually in wire cages of 40 x 60 x 60cm dimension. Feed and water were provided *ad libitum*. The rabbits were allowed one-week adjustment period before the trial commenced. Ivermectin was administered subcutaneously at 0.2mls per rabbits as prophylactic measure against endo and ecto-parasites. Blood samples (2mls) were collected from rabbits for haematological indices assay. After the jugular vein was severed, a sample bottle containing Ethylene Diammine Tetraacetic Acid (EDTA) was used to collect blood sample. Blood samples were analysed for total protein (TP), Haemoglobin (Hb) concentration; red blood cell counts (RBC), white blood cell count (WBC), and pack cell volume (PCV) as described by Ewuola and Egbunike (2008)). The analysis was carried out at the Clinical Pathology Laboratory, Faculty of Veterinary Medicine, Ahmadu Bello University, Zaria. At the end of the experiment, three rabbits were selected from each treatment and were housed individually in separate cages for faecal and urine collection. The trial lasted for 7 days. Plastic sheet was placed under each cage to allow for faecal and urine collection. Daily urine output was collected from the plastic sheets containing 10mls $0.1NH_2SO_4$ placed under the metabolic crate. During the collection, fur and feed were removed from the faeces on the plastic sheet on daily basis. Daily feed intake per rabbits was recorded during the period. Urine samples collected was transferred into 25ml bottles containing 5mls of tetraoxosulphate (VI) acid (H_2SO_4). Faecal samples of the rabbits were then bulked, oven-dried at 70^0C for 72 hours and then weight. Data obtained from the experiments was subjected to analysis of variance (ANOVA) using the general linear model procedure (SAS, 2002). Differences between means among the dietary treatments were separated using Duncan multiple range test

RESULTS AND DISCUSSION

Nutrient Digestibility by Weaner Rabbits Fed Replacement Levels of Soybean Curd Residue for Groundnut Cake

The results of nutrients digestibility of weaner rabbits fed soybean curd residue as replacement for groundnut cake are shown on Table 2. The results indicated that all the parameters considered were not affected significantly ($P>0.05$) by the test material except crude fibre which differ at ($P<0.05$) significantly among treatments. The values of crude fibre for rabbits on diet 1 (67.3%), diet 3 (72.4%) and diet 5 (72.7%) did not differ statistically between each other but statistically different ($P<0.05$) with those on diet 4 which recorded the highest value. In other words, animals on diet 2 and diet 4 (70.8 and 80.2% respectively) differ significantly ($P<0.05$) between each other but statistically similar with other treatments. Rabbits on diet 4 (75%SCR) had the highest value for crude fibre digestibility. This may be the optimum level for efficient nutrient utilization. The values for nutrient digestibility obtained from this study can be compared with values reported by Iyayi *et al.* (2003), Bamikole *et al.* (2005), Iyaghe-Erakpotobor *et al.* (2005), the values contrast with Iyaghe-Erakpotobor *et al.* (2006) in terms of crude fibre digestibility probably due to a little variation in the diets. The values are also lower than the values reported by Adedeji *et al.* (2013).

Table 2: Nutrient Digestibility (%) of Weaner Rabbits Fed Replacement Levels of Soybean Curd Residue for Groundnut Cake

	Replacement of Soybean curd residue for Groundnut cake (%)					
Parameters	0	25	50	75	100	**SEM**
Dry matter	62.8	60.2	70.5	74.0	66.4	7.07
Crude protein	75.7	73.1	77.5	79.9	74.5	3.98
Crude fibre	67.3^{ab}	65.8^{b}	72.4^{ab}	75.2^{a}	72.7^{ab}	4.03
Ether extract	78.7	76.8	80.8	83.4	82.0	3.22
Ash	64.6	60.3	68.3	71.4	65.5	3.98
Nitrogen free extract	62.3	57.2	67.8	71.2	61.1	7.59

^{abcd} Means on the same row with different superscript are significantly ($P<0.05$) different. SEM = standard error of mean

Hematological Parameters of Weaner Rabbits Fed Graded Levels of Soybean Curd Residue as Replacement for Groundnut Cake

Results for haematological parameters of weaner rabbits fed graded level of SCR as replacement for GNC are presented on Table 3. The results indicated that all the parameters considered were significantly ($P<0.05$) affected by the test ingredient except total protein (g/dl) and mean corpuscular volume (fl). Haemoglobin values for animals fed diet 2 (25.0% SCR) recorded the highest value (12.80 g/dl) and was statistically superior ($P<0.05$) than those on diet 1 (0.0% SCR) and diet 5 (100% SCR). Parked cell volume and red blood cell of the animals followed

similar trend. Rabbits fed diet 1 (0.0% SCR) had the highest value of white blood cells (5.2 $x10^9$/l), followed by those fed diet 3 (4.10 $x10^9$/l). They were statistically different (P<0.05) from rabbits on diet 2 (50% SCR), diet 4 (75% SCR) and those fed diet 5 (100% SCR) with 2.60, 2.20 and 3.17 values respectively. Highest value for Mean corpuscular Haemoglobin (pg) (20.47) was recorded for rabbits fed diet 5 (100% SCR) and was statistically different (P<0.05) from animals fed diet 3 (75.0%) which is the least (19.72). Mean corpuscular Haemoglobin concentration (g/dl) followed similar trend except that the least (32.83) was recorded for rabbits fed diet 2 (25.0%SCR). The PCV, Hb and RBC values of rabbits fed graded levels of SCR ranged from 29.67-39%, 9.97-12.8g/dl and 4.87-6.47$x10^{12}$/l respectively. However, the highest value was observed for rabbits fed 25%SCR and the least values was obtained for rabbits fed 100%SCR. It appears that there is more efficient erythropoiesis in rabbits on diet 2 (25%SCR) as this may be responsible for higher PCV values compared to other groups. The ranges of Hb values (9.97-12.80 g/dl) observed being within normal ranges for rabbits indicates the normal physiological relationship of Haemoglobin with oxygen in the transport of gasses to and from the tissue of the body (Njidda *et al*., 2006). The values were all within the normal ranges (PCV 30-50, Hb 8-17.5, TP 5.4-7.5, RBC 4-8, WBC 5-12) and (PCV 33-50, Hb 10-17, RBC 5-8, MCV 58-67, MCH 17-24, MCHC 29-37, WBC 5-12.5) reported by Hillyer (1994) and Mercks Veterinary Manual (2005). However, rabbits on diets 2 and 4 (25% and 75%SCR) showed poor results in terms of WBC while those on diets 1 and 3 (0.0% and 50%SCR) seemed to be the best. The fact that WBC values for both groups fall within the normal ranges indicated a normal antibody production which help in maintaining strong disease resistance. This is evident by the fact that no mortality was recorded during the experiment. MCH and MCHC were highest (P<0.05) for rabbits on diet 5 (100%SCR) while those on other treatments showed no difference (P>0.05) statistically. WBC values for rabbits fed diets 2 and 4 (25% and 75%SCR) were lower than those reported by Olabanji *et al.* (2007). MCV and TP does not show any significant differences (P>0.05) in all the treatment groups. The values obtained for MCV and MCH were in agreement with Omoikhoje *et al.* (2006). All other haematological values obtained from this study were within the range reported by Olabanji *et al.* (2007), Mercks Veterinary Manual (2005), Hillyer, (1994) and Ahamefule *et al.* (2008)

Table 3: haematological Parameters of Weaner Rabbits Fed Graded Levels of Soybean Curd Residue as Replacement for Groundnut Cake

	Percent Replacements of Soybean curd residue for Groundnut cake					
Parameters	**0**	**25**	**50**	**75**	**100**	**SEM**
TP (g/dl)	6.70	5.80	6.00	6.70	6.00	0.487
Hb (g/dl)	10.97^{bc}	12.80^{a}	12.17^{a}	12.00^{ab}	9.97^{bc}	0.741
RBC (x 10^{12}/L)	5.40^{bc}	6.47^{a}	6.17^{ab}	6.00^{ab}	4.87^{c}	0.380
PCV (%)	33.00^{bc}	39.00^{a}	36.67^{ab}	36.00^{ab}	29.67^{c}	2.241
WBC($x10^9$/L)	5.20^{a}	2.60^{c}	4.10^{ab}	2.20^{c}	3.17^{bc}	0.518
MCH (pg)	20.35^{ab}	19.97^{ab}	19.72^{b}	20.01^{ab}	20.47^{a}	0.309
MCHC (g/dl)	33.23^{ab}	32.83^{b}	33.18^{ab}	33.33^{ab}	33.58^{a}	0.256
MCV (fl)	61.22	60.29	59.43	60.04	60.96	0.905

^{abcd} Means on the same row with different superscript are significantly (P<0.05) different. PCV= packed cell volume, Hb=Haemoglobin level, WBC=white blood counts, TP=total protein, SEM = standard error of Mean

CONCLUSION

It was therefore concluded that SCR can be used to replace groundnut cake at 100% in diets of growing rabbits without deleterious effect. Thus, SCR can be use in place of groundnut cake as a cost saving alternative and for better performance

REFERENCES

Adedeji, O. S., Amao, S. R., Ameen, S. A., Adedeji, T. A. and Ayandiran, T. A. (2013) Effects of Varying Levels of *Leucaena Leucocephala* Leaf Meal Diet on the Growth Performance of Weaner Rabbits. *Journal of Environmental Issues and Agriculture in Developing Countries*, *Vol. 5, No. 1, April 2013 p5-9*

Ahamefule, F.O., Obua, B.E., Ukweni, I.A., Oguike, M.A and Amaka, R.A. (2008). Haematological and biochemical profile of weaner rabbits fed raw or processed pigeon pea seed meal based diets. *African Journal of Agricultural Research,*3(4):315-319.

AOAC., (2000). Official Methods of Analysis, Association of Official Analytical Chemists. Washington D. C., USA.

Bamikole, M.A., Ikhatua, M.I., Ikhatua, U.J. and Ezenwa, I.V. (2005). Nutritive Value of Mulberry (*Morus spp*) leaves in growing rabbits in Nigeria. *Pakistan Journal of Nutrition, 4(4): 231-236.*

Bwibo, N., Murphy, S.P. and Allen, L.H. (2003). Role of animal source food to improve dietary quality, growth and development of Kenyan schoolers. *Journal of Nutrition,* 133:3941-3949.

Ewuola, E.O., G.N Egbuinike (2008): Haematological and serum biochemical responses of growing rabbits bucks fed dietary fumonisin B_1 *Afr. J. Biotechnol.* 7, 4304-4309

Halls, A.E. (2009). Nutritional Requirements of Rabbits. Shur-Gain, Nutreco Canada Inc.

Hillyer, E.V.(1994).Rabbits.Small Anim Pract., 24:25-65.

IITA (2009). International Institute of Tropical Agriculture, PMB 5320, Ibadan, Oyo State, Nigeria.

Iyayi, E. O., Oluwakemi, O. and Odueso, M. (2003). Response of some metabolic and biochemical indices in rabbits fed varying levels of dietary cyanide. *African Journal of Biomedical Research,* 6(1): 43-47.

Iyeghe-Erakpotobor, G.T, Aliyu, R. and Uguru, J. (2005). Evaluation of concentrate, grass and legume combinations on performance and nutrient digestibility of grower rabbits under tropical conditions. *African Journal of Biotechnology*, 4 (20): 2004-2008.

Iyeghe-Erakpotobor, G.T., Osuhor, C.U. and Olugbemi, T.S. (2006). Performance and digestibility of weaner rabbits fed graded levels of soybean cheese waste / maize offal diet and brachiaria grass hay. *African Journal of biotechnology*, 5(17): 1579-1583.

Khare S.K., Jha K., Gandhi A.P. (1995) Citric acid production from okara (soy-residue) by solid-state fermentation. Bioresour Technol 1995; 54:323–5

Merck Veterinary Manual (2005). *A handbook of diagnosis therapy and disease prevention and control* (9th edition). Merck and Co. Whitehouse Station, New Jersey, United State of America.

NAERLS (2015). National Agricultural Extension and Research Liaison Services Agricultural Performance Survey of 2015 Wet Season in Nigeria. NAERLS, Zaria.

Ndolovu, L. (2010). Food, nutrition and health. In: Swanepoel, F.J.C., Stroebel, A. & Moyo, S. (Eds) *The role of livestock in developing communities*: Enhancing multifunctionality. CTA, Wageningen, The Netherlands.

Njidda, A.A and Ikhimioya (2012). Anti nutritional constituent of browse plants in animal nutrition: A review. *Journal of sustainable Agricultural Environment,* 13 (1): 15-28.

Odunsi, A.A. (2003). Assessment of Lablab (*Lablab purpureus*) leaf meal as a feed ingredient and yolk colouring agent in the diet of layers. *International Journal of Poultry Science, 2(1): 71-74.*

Olabanji, R.O., Farinu, G.O., Akinlade, J.A., and Ojebiyi, O.O (2007). Growth performance, organ characteristics and carcass quality of weaner rabbits fed different levels of wild sunflower (*Tithonia diversifolia* Hemsl A. Gray) leaf-blood meal mix. *International Journal of Agricultural Research 2(12):p1014-1021*

Omoikhoje, S.O., Bamgbose, A.M., Aruna, M.B. and Animashahun, R.A. (2006) Response of Weaner Rabbits to Concentrate Supplemented with Varying Levels of *Syndrella nodiflora* Forage. *Pakistan Journal of Nutrition 5 (6): 577-579, 2006 p577-590*

Ovimaps, (2014). Ovilocation map; Google earth imaginary date.2014.

Rosegrant, M.W., Fernandez, M., Sinha, A., Alder, J., Ahammad, H., de Fraiture, C., Eickhout, B., Fonseca, J., Huang, J. and Koyama, O. (2009). Looking into the future for agricultural and AKST (Agricultural Knowledge Science and Technology). In: Mclyntyre, B.D., Herren, H.R., Wakhungu, J. & Watson, R.T. *Agriculture at crossroads*. Island press, Washington D.C., USA.

SAS (2003). *Statistical Analysis System.* Guide for Personal Computer Version a SAS

Shuhong L., Linbo W., Chunfeng S., Xuansheng H., Hongyi S., Yingnan Y., Zhongfang L., Zhenya Z. (2013). Utilization of soybean curd residue for polysaccharides by wolfiporia extensa (pecs) Ginns in the antioxidant activities in vitro *Journal of the Taiwan Institute of Chemical Engineers* 45(2014) 6-11

Steinfield, H., Gerber, P., Wassenaar, T., Castel, V., Rosales, M. and de Haan, C. (2006). *Livestock's long shadow*: Environmental issues and options. FAO, Nairobi, Kenya

Swanepoel, F., Stroebal, A., and Moyo., S. (2010). **The role of livestock in developing communities**: Enhancing multi functionality. First Edition, Produced by SUN Media Bloemfontein, 59 Brill street, westdone, Boloemfontein, South Africa 9301. Pp213.