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Reviewing the potentials of some unorthodox energy feedstuffs: A panacea to sustainable animal agriculture in Nigeria

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Abstract

Utilization of some lesser known energy feed ingredients in animal agriculture was appraised. Fermented cassava meal and maize offal appeared to be most promising alternative replacement for maize in diets for broilers and laying hens with 100 % dietary inclusion ($p>0.05$). Palm oil sludge, guinea corn and spent grain have also been reported to replace maize up to 50% dietary level in fish and poultry diets without compromising performance; however, it was revealed that raw cocoyam and sweet potato cannot be tolerated beyond 30% dietary inclusion in fish and poultry diets ($p<0.05$) without adverse effect on production. Nevertheless , all the unorthodox feed resources were found to be economically viable alternatives to maize in practical diets for fish and livestock production towards the realization of cheap and sustainable animal protein intake for Nigerians.

Keywords: Potentials, Unorthodox, Feedstuffs, Animal protein, Sustainable.

Introduction

Animal production in developing countries such as Nigeria is faced with various challenges mostly during the dry season of the year. The problem of feed shortage, high prices of feedstuffs and climate variation have been a major discussion in recent times (Belewu *et al.*, 2007) among poultry and fish farmers. The effect of these challenge have reflection on the quality and quantity of animal protein available for human consumption. (Ogbonna *et al.*, 2000; Agbabiaka, 2010).

To overcome some of these problems, attention of Animal nutritionist must be focused on the utilization of lesser known unconventional feedstuffs that are readily available without stiff competition with humans and agro-allied industries. Many attempts have been geared towards the use of non-conventional energy feedstuff in poultry diets to reduce cost of feed with some encouragements, these include palm oil sludge (Esonu, 1996) Cassava root meal (Udedibie *et al.*, 2004), Guinea corn (Edache *et al.*, 2005), maize cob (Anyaehie, 2006), maize offal (Vantsawa *et al.*, 2008), Brewers' grain (Obidinma, 2009), among others.

Some non conventional feed ingredients used in Nigeria

Cassava: Cassava is a major source of calories for Nigerians and could also serve as alternative to maize in livestock feeds. FAO (2005) estimated cassava production in Nigeria in 2004 at 38.2 million metric tons and the largest production in the world. Attempts to use cassava tuber as source of energy in poultry diets as replacement for maize by different researchers have been yielding conflicting results. This is due to the inherent anti-nutritional factor "Linamarin" a cyanogenic glucoside yielding a deadly acetone cyanohydrins which is converted to hydrogen cyanide (HCN) upon ingestion of raw or unprocessed cassava (Sayre, 2007). Several processing/detoxification methods have been tried on cassava including sun-drying (Odukwe, 1994) and fermentation (Udedibie *et al.,* 2004) with fermentation proving to be most

effective. Studies in Australia (Bradbury, 2006) have demonstrated that wetting sun-dried cassava meal for 5 hours before use reduces the cyanide content of the meal to about 33% of the original concentration. Feeding trials with the meal so produced showed that it could completely and safely replace maize in the diets of broiler chicks (Udedibie *et al.,* 2007) but depressed feed intake and egg production of laying hens at 100% replacement of maize (Enyenihi, 2008). Another setback in the utilization of cassava tuber as feedstuff is the powdery nature of the meal which renders poultry feed very dusty, making feed intake of the birds rather difficult (Anyaegbu, 2001; Tewe and Bokanga, 2001). Nevertheless, feeding trial with dried cassava "fufu" meal for laying hens revealed that dried cassava fufu meal can replace maize at 100% inclusion without any significant difference ($P>0.05$) in body weight, feed intake, egg weight, egg production, egg quality, feed conversion ratio and haematological indices, though, there was increase in the weight of the gizzard while the weight of other organs such as liver, heart and kidney as well as abdominal fats remained unaffected ($P<0.05$). (Udedibie *et al.,* 2008).

Sweet potato (*Ipomea batatas)*: The use of sweet potato peels has been studied as part of the efforts to contribute to alleviation of food insecurity, hunger and poverty (Omoregie *et al.,* 2009). The result of this trial showed that sweet potato peels can be incorporated in the diet of Nile Tilapia (*Oreochromis niloticus)* up to 15% as substitute for maize without any deleterious effect but there was decline in growth as the level of inclusion of sweet potato peel increased in the diet beyond 15%.

Cocoyam: The production of cocoyam otherwise called "TARO" is low compared to the other root and tuber crops (Fagbenro and Adebayo, 2002) but only 10% of the world"s population consumes cocoyam as staple food (Lee, 1999). Hence, it could be a cheap source of energy for fish and livestock due to less competition with humans and industries. Aderolu and Sogbesan (2010) reported that boiled cocoyam can replace maize up to 25% in the diet of *Clarias gariepinus* juveniles. In another development, wild variegated cocoyam corn (*Caladium hortulanum*) meal has successfully been used as energy source in poultry diet (Esonu, 2000, Ohamaeyi, 1993).

Cooked wild variegated cocoyam has been reported to replace maize up to 20% in broiler chicken (Esonu, 2000). Nevertheless, *Caladium hortulanum* meal based diets have been found to support growth up to 66% replacement of maize on the performance of catfish (*Heterobranchus bidorsalis*) fingerlings (Agbabiaka *et al.,* 2006).

Agro industrial by-products of cereals as animal feed.

Maize offals: The by-products of cereal crops are the residues that remain after the extraction of raw materials or agricultural products of interest such as starch, germ or oil. The cereal by-products that are used for feeding livestock include wheat bran, wheat offal, wheat middling, rice bran, maize bran, and rice husk (Ukachukwu *et al.,* 2000). According to Anyaehie (2006), maize cob was recommended at dietary inclusion of 15 and 22.40% for broiler starter and finisher diets respectively with exogenous enzyme supplementation at 0.15 and 0.17%. Potentials of maize bran (Dusa) have been widely studied; for instance, Cresswell and Zainuddin (1980) reported that maize offal can replace maize on a weight to weight basis in broiler without any compensation being made for the lower energy content of the bran. Fadugba (1989) reported that industrial maize offal is as good as maize in growers ration. However, Velaso *et al.,* (1985) also reported that maize bran replacement for maize in the diets of 20-week old pullets gave a decreasing live weight as the inclusion level increased. The best egg production and feed gain ratio was achieved at 10% dietary inclusion. Vantsawa *et al.,* (2007) recommended that maize offal (dusa) can replace all maize in the diets of chicks without any adverse effect on performance. Also, Dusa can be used in the diets of pullets without any adverse effect on performance with a 39.03% saving in cost of production (Vantsawa *et al.,* 2008).

Guinea corn: Replacement values of maize with guinea corn have been studied. Edache *et al.,* (2005) reported that guinea corn can replace maize up to 42% level of inclusion in the diets of Quail chicks without negative effect on the growth of the birds. Also, Cullison, (1987) reported that sorghum can replace 50% maize with no adverse effect on animal performance, but weight gain can reduce by up to 10% with higher levels of dietary inclusion.

Spent grain: This is also called brewers' dried grain. It is the by-products of brewery industries; the residue from barley, wheat, maize, rice and oat processing. They contain insoluble materials remaining after the process of soaking, mashing and boiling which include crude fibre fraction, fats, proteins together with starch and dextin (Madubuike, 1988; Aregheore and Abdulrazak, 2005). It is readily available in Nigeria due to non-competition with humans and several numbers of breweries in the country (Madubuike, 1988; Obidinma, 2009). Spent grain has been reported to contain 18-20% crude protein, 48.6% NFE, 2280kcal/kg metabolisable energy and 6.2% fat (Longe and Adetola, 1983). Researches have shown that brewers grain at 20% dietary level did not depress egg production (Yeong, 1986; Truini, 2001). Similarly, inclusion of brewers' grain up to 20% in the diets did not depress gain or feed conversion during early growth (0-8 weeks) of broilers and up to 30% was not observed to decrease performance in broilers (8-12 weeks) (Deltoro-Lopez, 1981). Pito brewer yeast has been reported to successively replace 50% fishmeal in diets of *Tilapia busumana* in Ghana (Oduro-Boateng and Bart-Plange, 1988). Brewers' yeast is rich in crude protein (42-44%) and is obtained from beer production after fermentation. It is also rich in B-vitamins and phosphorus (Anyaehie, 2006).

Wheat offal: This is the residue collected after crushing of wheat grains and sieving out wheat flour, the materials obtained after sieving of wheat from broken or crushed wheat grain is called wheat offal (Anyaehie, 2006). Chemically, it contains about 17% crude protein, 3.5% fat, 8.5% crude fibre, 0.10% calcium, 0.90% lysine and 1970kcal/kg metabolisable energy (Bello, 1984).

Wheat bran: This is a by-product from wheat grain. It is popular for livestock feed, very palatable but has a mild laxative effect. (McDonald *et al.,* 1998). Wheat bran comprises of the husk with some adhering endosperm, it is the by-product from wheat that remains after the extraction of other industrial active ingredients from wheat grain especially in the brewery industry (Onunwa, 2000). It contains about 19.6% CP, 6.7% EE, 88.66% and gross energy value of 12.90 MJ/kg dry matter. (Anyaehie, 2006). It is rich in phosphorus but low in calcium.

Other agro-industrial by-product used as energy source in poultry production

Palm-oil sludge: This is the effluent that remain after skimming/extraction of palm oil mill (Devendra *et al.,* 1992, Esonu,1996). Processing of palm fruit involves six stages (sterilization, stripping, milling, separation, pressing and clarification). The palm oil sludge is collected at the stage of clarification after the palm oil has been skimmed, remaining what is known as palm oil mill effluent. Hence, Palm oil mill effluent is the final liquid discharge after extracting the oil from the fruit bunch and contains soil particles, residual oil and suspended solid. It represents about 0.5% of the fresh fruit and be a source of pollution to the entire surrounding ecosystem where it is produced. Chemically, it contains crude protein of 9.6% and metabolizable energy of 4245 kcal/kg (Bobadoye *et al.,* 2008). It can be relatively compared to maize with crude protein of between 9-10% and metabolisable energy of 3434 kcal/kg (Dada, 1999). Dada (1999) reported that 5% palm oil sludge inclusion in broiler finisher diets improved the performance characteristics.

Bobadoye *et al.,* (2008) reported that there was no significant difference ($P>0.05$) in weight gain and feed conversion ratio of broiler chicken fed control diet and palm oil sludge based diets up to 40% dietary inclusion, although, there was significant difference ($P<0.05$) in feed intake. However, Hertrampt (1998) reported increase in daily feed intake and daily weight gain of pigs fed palm oil sludge in place of maize at a level of 15% to 30%. This increase in feed intake was attributed to improvement in taste or palatability of the test diets. Dietary inclusion of palm oil sludge in livestock diets especially broiler chicken resulted in feed cost reduction up to N28.07K per kilogram weight gain (Bobadoye *et al.,* 2008).

Utilization of bananas and plantains waste in livestock feed

The utilization of bananas and plantain wastes has been popularized in Cameroun and central Africa to reduce feed costs. Cameroun produces about 2.3 million tons of plantains and bananas annually (World bank, 1984). Approximately half of this is consumed domestically while less than 40% is exported; leaving the remaining quantity to be either discarded as waste product or allow to rot in the field during harvest (Beramgoto, 1989).

Fombad (1984) opined that sundried waste banana meal can replace maize up to 30% dietary level in pig rations without negative effect on the feed intake and daily weight gain; however, feed conversion ratio increased significantly as the level of bananas increased . Research on banana leaves (fresh and sundried) on rabbits at 30% inclusion shows that there was no significant difference (P>0.05) in weight gains of rabbits fed either 30% fresh banana leaves, 30% sundried banana leaves although, feed intake was higher for animals fed fresh leaves (Fomunyam, 1985).

References

Aderolu, A.Z. and Sogbesan, O.A., 2010. Evaluation and potential of cocoyam as carbohydrate source in catfish, (*Clarias gariepinus*) juvenile diets. African J. Agric. Res., 5(6): 453-457.

Agbabiaka, L.A., Odoemenam, S.A and Esonu, B.O., 2006. Preliminary investigation on the potentials of wild variegated cocoyam (*Caladium hortulanum*) as replacement for maize in diets of catfish (*H. bidorsalis*) fingerlings. Int. J. Agric. Rural Dev., 7(1): 138-142.

Agbabiaka, L.A. 2010. Evaluation of some under utilized protein feedstuffs in diets of *Clarias gariepinus* fingerlings. Int. J. Trop. Agric. Food Syst., 4(1): 10-12.

Anyaegbu, B.C. 2001. Comparative Evaluation of fresh and fermented sun-dried cassava tubers as sources of energy in broiler diets. MSc Thesis. Federal University of Technology, Owerri, Nigeria.

Anyaehie, A.A. 2006. Studies on exogenous enzyme supplementation on high fiber (maize-cob) soyabean based poultry diets. PhD. Thesis. Imo State University, Nigeria.

Aregheore, E.M. and Abdul-razak S.A., 2005. Estimation of organic matter digestibility and metabolisable energy contents of agro-industrial wastes using in-vitro gas production. Nigerian J. Anim. Prod., 32(1): 79-89.

Belewu, M.A., Orisameyiti, B.R. and Ajibola K.A., 2007. Effect of feeding graded levels of Tigernut (*C. esculentus*) seed meal on the performance characteristics of west African Dwarf Goat. Pakistan J. Nutr. 6(6): 526-529.

Bello, A.O., 1984. The use of Agro-industrial by products in livestock feeding. Nigerian J. Anim. Prod., 11(1): 22-31.

Beramgoto, T., 1989. The feeding value of some Agro-industrial by products for beef cattle at Bambui centre: In overcoming constraints to the efficient utilization of agricultural by products as animal feed. Proc. of 4th workshop of the African Research Network for Agriculture by products (ARNAB), Said and Dxowela ed., ILCA, Addis-Ababa, Ethopia.

Bobadoye, A.O., Onibi G.E. and Fajemisin A.N., Olasupo O.O., Bobadoye B.O., 2008. Replacing maize with palm oil sludge in broiler chicken diets: effect on carcass characteristics, organ weight and muscle development. Int. J. Sustain. Crop Prod., 3(6): 1-5

Bradbury, J.H., 2006. Simple wetting method to reduce cyanogen content of cassava flour. J. Food Comp. Analysis, 19 : 388-393

Cresswell, D. and Zainuddin D., 1980. Corn bran as a feedstuff for broiler and laying hens. Nutr. Abstr. Rev., 229-233

Cullison, E.A., 1987. Air-dry energy feeds. Feeds and feeding. 2nd ed., Reston publishing company incorporated. 161-163.

Dada, A., 1999. Effect of palm oil sludge inclusion in broiler finisher ration. Proc. 24th Annual Conference. Nigerian Soc. Amin. Prod., (NSAP) held at Ilorin. 23rd-29th March.

Deltoro-Lopez, 1981. Dried brewer's grain in young and older birds. *Http://www.fao.org/dg/agap/frg/afris/data/468.htm*

Devendra, C., Yeong S.W. and Ong H.K., 1992. The potential value of palm oil mill effluent (POME) as feed resource for manilas in Malaysia. Proc. of National workshop on oil palm product utilization. December 14th-15th 1992.

Edache, J.A., Musa U., Haruna E.S., Esilonu J.O., Jibrin I., Okpala E.J. and Dogo I.G., 2005. Replacement value of guinea corn for maize in practical diet fed to quail (*Coturnix coturnix Japonica*) chicks. Anim. Res. Int., 2(2): 311-313.

Enyenihi, G.E., 2008. Effect of 5 hour wetting of sun - dried cassava tuber meal on cyanide

content and performance of laying hens. MSc. Thesis. Dept. Anim. Sci. University of Uyo, Nigeria.

Esonu, B.O., 1996. Nutritive Value of Sun-dried Palm-oil Sludge as energy Suppliment for Broilers. Indian J. Anim. Sci., 66(4); 389-392.

Esonu, B.O., 2000. Animal Nutrition and feeding: A functional Approach. Rukzed and Rucksons Associates, Owerri, Nigeria.

Fadugba, A.B., 1989. Evaluation of the nutritive value of industrial maize offal in poultry diets Thesis. Ahmadu Bello University. Department of Animal Science, Zaria, Nigeria.

Fagbenro, O.A. and Adebayo O.T., 2002. An overview of the animal feed industry in Nigeria. In livestock and fish feeds in sub-Sahara Africa. FAO Fisheries Technical paper: FAO, Rome.

FAO, 2005. Food and Agricultural organizatior United Nations Statistics (FAOSTAT database F 267).

Fombad, R.B., 1984. Annual Report of Restitute of Animal Research. Mankon, Cameroon.

Fomunyam, R.T., 1985. Cabbage and banana/plantain leaf in rabbit diets. Sci. Technol. Rev., 1(2): 13-19.

Hertrampt, J., 1988. Unconventional feedstuff for livestock. Muhle. mishfulter. chinik., 125(9): 103-109.

Lee, W., 1999. Taro (*Colocasia esculenta*). South Illinois University Carondale/ethnotaniel leaflets. http://www.siu.edu.ebl

Longe, P.G. and Adetola J.A. 1983. Metabolisable energy values of some agricultural wastes and industrial by-products for layers and effects of these ingredients on gut dimension. J. Anim. Prod. Res., 3(1): 2-13.

Madubuike, F.N., 1988. Effect of inclusion of graded levels of brewers' dried grain in the diet of early weaned pigs on their performance up to 10 weeks of age. Nigerian J. Anim. Prod. 15: 37-42.

McDonald, P., Edwards R.A and Greenhalgh, 1998. Animal nutrition. 5th ed., Longman, Malaysia.

Obidinma, V.N., 2009. Brewer's spent grain as energy source in finisher broiler birds and laying hen production. PhD. Thesis, Imo State University, Owerri, Nigeria.

Odukwe, C.A., 1994. The feeding value of composite cassava root meal for broiler chicks. PhD. Thesis, Department of Animal Science; University of Nigeria, Nsukka, Nigeria.