
Minerals Constituents of Crossbred Weaned Pigs Fed Toasted Soybean Hull Based Diets in the Savannah Forest Zone of Nigeria

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ABSTRACT

Minerals Constituents of Crossbred Weaned Pigs Fed Toasted Soybean Hull Based Diets in the Savannah Forest Zone of Nigeria is investigated. The aim is to evaluate the minerals constituents of crossbred weaned pigs fed toasted soybean hull based diets. The experiment is carried out at the piggery unit of the Teaching and Research Farm of the Oyo State College of Agriculture and Technology, Igboora, Nigeria. Sixteen (16) crossbred (Large white x Landrace) weaned pigs in their 8th weeks of age were purchase from a reputable commercial pig farm in Ibadan with the assistance of veterinarian to ascertain their health status. The pigs are dewormed to eliminate endo and ectoparasites. At the end of eight weeks of feeding trial, 5ml of blood from two pigs per treatment is collected through the heart with the use of syringe and needle into plain bottles for the determination of macro and micro minerals. Data are subjected to one way analysis of variance using the completely randomized design model of SAS 2010 and treatment means are separated using Duncan Multiple Range Test at 5% level of probability. Results of the macro minerals composition of crossbred weaned pigs fed graded level of toasted soybean hull indicate that there are significant differences in the mean values for calcium, phosphorus, potassium and magnesium in the pigs fed toasted soybean hull based diet. Calcium and phosphorus play an important role in the development and maintenance of the skeletal system, blood clotting, muscle contraction and many other regulatory functions. Pigs fed 10% inclusion levels of processed soybean hull had the highest of calcium while the lowest value were recorded for pigs maintained on the control diet. Phosphorus was highest in pigs fed 5% of the experimental diets while pigs on 10% inclusion level of toasted soybean hull recorded the least value. Calcium and phosphorus are the two most abundant minerals in the pig.

Keywords: Blood, macro, micro, soybean hull, toasting, weaned pigs,

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INTRODUCTION

The role of minerals in animal production is an area of strong interest for producers, feed manufacturers, veterinarians and scientists. Minerals constitute a small percentage of pig diets, but their importance to growth, health and productivity of the pig cannot be over emphasized. They have a role in digestion, metabolism of protein, fats and carbohydrates and the structure of chromosomes, enzymes, nerves, blood, skeleton, hair and milk (Carlson, Carter, DeRouchey, Meisinger, Reese, Richert, Stalder, Stein, Van Heugten and Whitney 2008). The efficiency of mineral absorption depends on concentration of that mineral in the diet, the mineral source and its availability, mineral to mineral interactions in the diet and the mineral status of the animal (Patience and Zijlstra, 2001).

Most pigs are housed in pens today so they depend solely on their daily feed to supply needed mineral requirements. Overuse of minerals can lead to serious consequences such as antagonistic interactions between minerals leading to potential deficiencies and impaired growth of the pig (Petty, 2006). Macro minerals are the minerals that pig require in larger quantities usually described for inclusion in percent of the diet (Olomu, 1995). Adequate trace mineral intake and absorption is required for a variety of metabolic functions including immune response to pathogenic challenge reproduction and growth. Mineral supplementation strategies quickly become complex because trace mineral status is critical in order to obtain optimum performance in modern animal production system (Pig International, 2004).

As animal trace mineral status declines immunity and enzyme functions are compromised first, followed by a reduction in maximum growth and fertility and finally normal growth and fertility decrease prior to evidence of clinical deficiency (Pig International, 2004). Dietary trace minerals may be added to swine diets as inorganic or organic forms (Pig International, 2004). The objective of the paper was to evaluate the minerals constituents of crossbred weaned pigs fed toasted soybean hull based diets.

MATERIALS AND METHOD

The experiment was carried out at the piggery unit of the Teaching and

Research Farm of the Oyo State College of Agriculture and Technology, Igboora, Nigeria. The experimental areas lie in savannah forest zone on latitude 7° 43N and longitude 3° 28E in an elevation of 140m above sea level (Sanusi, 2011). The average minimum temperature is above 21.5°C and maximum average temperature is about 32.5°C (Sanusi, 2011). The soybean hull was procured from Karma Nigeria Limited Ibadan, Oyo state, Nigeria and was toasted over fire at 70°C for 30 minutes (Sanusi, 2011). The toasting involved adding about 5kg soybean hull in to an open cast iron pan already set over a fire. The soybean hull was stirred to prevent it from sticking to pan and from burning until it turned brownish and produced sweet smelling aromatic flavor.

Sixteen (16) crossbred (Large white x Landrace) weaned pigs in their 8th weeks of age were purchase from a reputable commercial pig farm in Ibadan with the assistance of veterinarian to ascertain their health status. The pigs were dewormed to eliminate endo and ectoparasites. The pig was fed 4% of their body weight as feed per day at the beginning of the experiment and increase as the animals were advancing in age while water was supplied *ad libitum*. At the end of eight weeks of feeding trial, 5ml of blood from two pigs per treatment was collected through the heart with the use of syringe and needle into plain bottles for the determination of macro and micro minerals. Data collected were subjected to one way analysis of variance using the completely randomized design model of SAS 2010 and treatment means were separated using Duncan Multiple Range Test at 5% level of probability (Steel and Torrie, 1980).

RESULTS AND DISCUSSION

Results of the macro minerals composition of crossbred weaned pigs fed graded level of toasted soybean hull was presented in Table 1. There was a significant differences ($P < 0.05$) in the mean values for calcium, phosphorus, potassium and magnesium in the pigs fed toasted soybean hull based diet. Calcium and phosphorus play an important role in the development and maintenance of the skeletal system, blood clotting, muscle contraction and many other regulatory functions (Crenshaw, 2001). Pigs fed 10% inclusion levels of processed soybean hull had the highest (11.40mg/dl) of calcium while the lowest value (10.40mg/dl)

were recorded for pigs maintained on the control diet. Phosphorus was highest (17.54mg/dl) in pigs fed 5% of the experimental diets while pigs on 10% inclusion level of toasted soybean hull recorded the least value (11.98mg/dl). Calcium and phosphorus are the two most abundant minerals in the pig. A reduced extracellular blood calcium increases the irritability of nerve tissue and very low levels may cause spontaneous discharge of nerve impulses leading to tetany and convulsions and since these did not happen such a disease does not occur (Malhorta, 1998). Phosphorus is required in the diet of pigs for proper skeletal growth and mineralization as well as cellular functions (Sharma, Mahotra and Bhattacharyya, 2008). Decrease in serum phosphorus is found in rickets and hyperparathyroidism (Murray, Granner, Mayes and Rodwel) and since phosphorus value is highly significant such disease was not noticed. In the pig approximately 75% of the phosphorus in the body is in the skeleton while 25% is in soft tissues.

Phosphorus is found in every cell in the body serving in the energy system (ATP), cell structural components like phospholipids, phosphorylation sites for enzyme activation and an initiation factor for protein synthesis (Hays and Swenson, 1985). Sodium are involved in nutrient transfer across cell membranes, body pH regulation, water balance and digestion (Murray, Granner, Mayes and Rodwel, 2000). The content of sodium in blood of weaned pigs fed toasted soybean hull based diet was not different from that recorded on the blood of groups receiving the control diet indicating that the toasted soybean hull could meet the sodium requirement of the weaned pigs fed the experimental diet. Sodium regulates plasma volume and acid – base balance, involved in the maintenance of osmotic pressure of the body fluids (Murray, Granner, Mayes and Rodwel, 2000).

Potassium is involved in nerve-muscle function, electrolyte balance, ammonium ion excretion by the kidney (NRC, 1998), regulation of heart rate and preventing tetany in skeletal muscle (Hendriks and Moughan, 1993), the value of potassium obtained increased as the level of inclusion of toasted soya bean hull increased. The value obtained for potassium as level of inclusion of toasted soya bean hull increased indicates hypokalemia. The pigs on test ingredient does not compare favourably with those on control diet this may be as a result of residual

toxins in the processed soybean hull that has ability to inhibit the activity of certain digestive enzyme (Durigan, 1989). The residual effect of toxins in soybean hull might also affect the digestive system and the kidneys of the pigs and so gastrointestinal disorders that impair absorption such as Crohns disease that limit magnesium absorption might have occurred (Merck, 1986). The experimental diet had significance effect ($P < 0.05$) on iron, copper and manganese. Pigs fed diet T3 (10% inclusion levels of toasted soya bean hull) had the highest value (57.50mg/kg) of iron while the lowest value (48.00mg/kg) were recorded on the pigs fed diet T2 (5% inclusion level of toasted soybean hull). Iron value were superior (55.00 and 57.50mg/kg on diets 3 and 4 respectively) at 5% protection limit. Iron is a trace nutrient needed in the body for haemoglobin formation, normal functioning of the central nervous system and in the oxidation of carbohydrates, proteins and fats (Adeyeye and Otokiti, 1999). The level of iron content in the blood of weaned pigs fed toasted soya bean hull is an indication that toasted soya bean hull is a good source of this element suitable to maintain the daily balance.

Pigs fed on diet T4 (10% inclusion level of processed soybean hull) recorded the highest value (1.30mg/kg) of zinc while the lowest value (1.04mg/kg) were obtained in pigs on diet T3 (10% inclusion level of toasted soybean hull). The pigs on the control diet compare favourably with those animals on the test ingredient. Elemental zinc prevents and cures parakeratosis in swine (Gordon, 1977) and since the experimental diet did not influenced the zinc content of the blood, parakeratosis were not noticed. Poor growth, loss of appetite and a bad feed conversion ratio associated with zinc deficiency were not observed as the quantity of zinc available in the test ingredient were able to meet the nutrient requirement of pigs. The values obtained for copper were significantly ($P < 0.05$) difference across the treatment. Copper is an essential trace nutrient necessary for the haematologic and neurologic system (Tan, Burns and Jones, 2006). Copper is necessary for the growth and formation of bone, it helps in the incorporation of iron in haemoglobin, assists in the absorption of iron from the gastrointestinal tract and in the transfer of iron from tissues to the plasma (Murray, Granner, Mayes and Rodwel, 2000). Through the promotion of superoxide dismutase, which deactivates free oxygen radicals, copper is also involved in cell protection and thereby

in a healthy immune system (Gardea-Torresday, Becker-Hapak, Hosea and Darnall, 1990). There were significant ($P < 0.05$) difference in the values obtained for manganese in the blood of weaned pigs fed graded level of toasted soybean hull based diets. Although the values obtained for weaned pigs maintained on processed soybean hull were inferior to that of the control diets, manganese deficiency in pigs such as lameness, enlarged hock joints and shortened legs were not noticed; this might be as a result of the toasting employ to detoxify the toxins present in the soy bean hull.

CONCLUSION

The experiment was carried out to evaluate the minerals constituents of crossbred weaned pigs fed toasted soybean hull based diets in the savannah forest zone of Nigeria. It was conducted at the piggery unit of the Teaching and Research Farm of the Oyo State College of Agriculture and Technology, Igboora, Nigeria. Data were subjected to one way analysis of variance using the completely randomized design model of SAS 2010, while the treatment means were separated, according to Steel and Torrie (1980), using Duncan Multiple Range Test at 5% level of probability. From the results of this experiment, it can be concluded that toasted soybean hull is a good feed resources and very rich in minerals. Processing soybean hull had no adverse effects on the pig mineral balance except on sodium and zinc. Therefore, it may be useful as unconventional protein feedstuff in nutrition of monogastric animals.

Table 1.0 The effect of toasted soybean hull on macro and micro minerals

	T1	T2	T3	T4
Calcium (mg/dl)	10.40 ^c	11.05 ^b	11.40 ^a	11.05 ^b
Phosphorus (mg/dl)	13.20 ^c	17.54 ^a	11.98 ^d	14.98 ^b
Sodium (mg/dl)	142.50 ^a	142.00 ^a	137.50 ^a	143.50 ^a
Potassium (mg/dl)	4.65 ^b	5.50 ^a	5.00 ^b	5.65 ^a
Magnesium (mg/dl)	4.80 ^a	4.09 ^b	3.98 ^b	4.24 ^b
Iron (mg/kg)	49.50 ^c	48.00 ^d	57.50 ^a	55.00 ^b
Zinc (mg/kg)	1.12 ^a	1.22 ^a	1.04 ^a	1.30 ^a
Copper (mg/kg)	31.87 ^d	39.21 ^b	42.34 ^a	37.13 ^c
Manganese (mg/kg)	10.95 ^a	8.85 ^d	9.84 ^b	9.44 ^c

a,b,c,d Means on the same row with different superscripts differ significantly

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