Utilization of Sorghum as Energy Source in the Diets of Broilerchickens: A Review

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Abstract: Maize is the conventional source of energy in broilers rations in Nigeria. The ever growing demand for maize for human consumption, livestock feeds and some industrial uses has pushed its market price to an alarming height. The Metabolizable energy value of maize and sorghum are 3432 and 3256 kcal/kg respectively, the crude protein content of maize and sorghum are 9.0 and 11.0 respectively, the crude fat values of maize and sorghum are 3.25 and 4.25% while the crude fibre of maize and sorghum are 2.7 and 2.0 respectively. Sorghum is suitable alternatives to maize considering the cost, availability and their nutritive value. Several research findings revealed that there is no significant (P<0.05) difference in the performance parameters among the three energy sources. Alternative sources of energy will reduce the cost of feeds; improve protein availability and intake, increase efficiency and productivity of broiler chickens as well as the improving the profit margin of the poultry producers.

I. Introduction

Poultry birds especially broilers play a significant role in the provision of animal protein required by man to meet his daily protein intake (Maidala and Istifanus, 2012). They have high growth rate, high feed conversion ratio, short generation interval (5-6 months), short intestinal feed transit of 2-3 hours and traits that respond to feeding and nutritional manipulations within days (Atteh, 2003). The chicken meat is superior to that of other livestock species because it is associated with relatively lower calorie and sodium intake while containing high protein content than other sources of meat (Atteh, 2003). Poultry meat is nutritious, tender, juicy, tasty and generally appealing and accepted when processed (Omole et al., 2006). Feeding is the major constraining factor of poultry production which accounts for 70-85% of recurrent expenditure (Sanni and Ogundipe, 2005). The energy level of the feed is the major factor influencing feed intake as birds will under normal circumstances eat to satisfy their energy needs (Akinola and Sese, 2011). The other dietary nutrients usually vary in relation to dietary energy content of the diet if they are not to become deficient with low feed intake or consumed more with low energy diet. Maize is the major source of energy in poultry feeds and constitutes 50-70% of broilers ration (Ojowola and Olughbemi, 2011). It constitutes 40-60% of the feed of monogastric animals (Ayenor 1985; Ogban, 1991). Maize also serves as staple food for good proportion of Nigerians. The ever growing demand for maize for human consumption, livestock feeds and some industrial uses has pushed its market price to an alarming height (Odukwe, 1994). This is because maize is high in energy and forms the standard (100) against which other cereals grains is compared (Atteh, 2002). Maize has a fat content of about 4% and this fat is high linoleic acid (about 50%) making it excellent source of this essential fatty acid. The increasing competition between man and animals for available grains (Tegbe, et al., 1984; Egbunike and Achihang, 2002), the inadequate production of farm crop to meet the needs of man and his livestock (Babatunde, et al., 1990) and ever increasing cost of maize had made it necessary to critically re-evaluate some other grains like millet and sorghum for alternative energy sources in poultry production. In poultry nutrition energy is used for the provision of body heat, maintenance, growth and production (Inaku et al., 2011). From the foregoing, it is imperative that effort should be made to explore comparative and cheaper alternative to this scarce, expensive and highly needed dietary resource so as to reduce cost of feed ingredients, improve availability, increase both efficiency and productivity of broiler chickens, improve poultry farmers profit margin and above all increase protein intake among the populace.

Sorghum (Sorghum bicolor (L) Moench) which belongs to the family Poacea is known as guinea corn in West Africa and locally called Okababa, Dawa, and Okili in three major languages of Nigeria ( Adegbola, 2013). Sorghum originated from northeastern Africa where it was domesticated about 5,000 years ago (Mann et al, 1983) and it is the fifth most important cereal in the world after corn, rice, wheat, and barley with an annual production of about 57 million tonnes (FAOSTAT, 2012). Nigeria is the largest sorghum producer with an annual production of 6.9 million tonnes (FOASTAT, 2012) and thus the most important cereal grain in the country. Sorghum is another cereal crop that can be used to replace maize to reduce the cost of poultry production. (Etuk et al., 2012). sorghum bicolor (L) Moench is a widely grown in semi arid environment and savanna regions of Nigeria. Mounder (2002) reported that sorghum is a traditional crop of much Africa and Asia and an introduced and hybridized crop in the western hemisphere. It benefit from an ability to tolerate drought,
Utilization Of Sorghum As Energy Source In The Diets Of Broilerchickens: A Review

soil toxicities and temperature extremes effectively than other cereals. Sorghum is next crop to maize in terms of cost, nutritive value and availability as poultry feeds (Subramanian and Metta, 2000).

Field observation in Nigeria revealed the inclusion of sorghum as poultry and rabbits (Abubakar et al., 2006). Other workers (Hancock, 2000; Dowling et al. 2002; Travis et al., 2006) have shown that sorghum could be a suitable feedstuff in the poultry industry. Parthasarathy, (2003) and Issa et al. (2007) reported that sorghum grains can play an important role in poultry feeds. Several verities of sorghum have been developed and introduced in Nigeria (IAR, 1999). However the diversity of chemical composition and antinutritritional factors, mainly tannin resulting in variability and digestibility of sorghum from 35-60% or more has been reported (Becker, 1992). Varieties of sorghum, climatic conditions and soil conditions, fertilizers types are listed among the factors responsible for the variation in chemical composition of sorghum (Aduku, 1993; Tacon, 1995; Ngoka, 1997; Etuk and Ukejofo, 2007; Etuk 2008). Several improve varieties have been developed and released in Nigeria since 1970s mainly by institute of agricultural research (IAR) Ahmadu Bello University Zaria.

The high cost of maize in Nigerian markets has affected profitability of poultry production negatively and thus, resulted in inadequate protein intake among Nigerians (Nkwocha et al., 2014). The cost of feed in poultry production constitute of about 70 to 85 percent of total production cost and out of these about 95 percent is meant for meeting the energy and protein requirement of the diet (Sanni and Ogundipe, 2005; Ravindran, 2014). Therefore, these necessitate the need for cheaper and always available cereal ingredient that can meet the energy requirement of the birds which constitute over 50-70% of broilers ration (Ojowola and Olugbemi, 2011). Sorghum was identified as the major crop that can easily replace maize because of its similarity in composition with maize (Subramanian and Metta, 2000; Ravindran, 2014). These made many scientist to evaluate the performance of birds fed with sorghum based diet and compared it with the performance of birds fed with maize based diet in order to produce a formulation that can be used to completely replace maize in poultry feed production.

II. Results And Discussion

Various observations revealed that sorghum has a nutritive value similar to maize (Subramanian and Metta, 2000). Ahmed et al., 2013 reported that Metabolizable Energy (ME) of sorghum was 14.40 MJ/kg while yellow maize has 14.17 MJ/kg. Therefore, the similarities in composition between maize and sorghum have made Sorghum a potential crop to replace maize. The amino acid composition of the two cereal revealed that the amino acids is fairly distributed. Sorghum contain low level of lysine but high tryptophan content relative to maize (Purseglove, 1972; Olomu, 1995) Macdonald et al., 2000 reported that both maize, millet and sorghum have the main limiting indispensable amino acids argenine, lysine, methionine, Cystein and tryptophan. Xanthophylls and linoleic acids are much lower in sorghum than in maize and yellow endosperm with carotene and xanthophylls increases the nutritive value of sorghum. However, Sorghum grain contains some antinutritional factors that makes it less digestible than maize ( Etuk et al., 2012). These anti-nutritional factors include the presence of tannin and phytic acids (Mohammad et al., 2011) which lowers the palatability, protein utilization and activity of digestive enzymes by non-ruminants (Medugu et al., 2010a). Tannins also affect carbohydrate utilization by forming complex compound which are difficult to digest (Akande et al., 2010; Maidala et al., 2013).

Field trials have shown the two cereals have no significant differences in daily feed intake (94.00-100.17g), daily weight gain (34.44-43.17g) and feed conversion ratio (2.24-2.94)(Medugu et al., 2010a). Aladeen et al., 2013 fed maize millet and sorghum to finishing broiler birds as an energy sources and reported no significant differences in growth performance and mortality of the birds. Ibitoye et al. (2012) fed white and red millet varieties and white and red sorghum varieties with maize as a control diet in broilers and reported mean final weight gain (111.62-170.58), mean feed intake (466.88-535.62) and feed conversion ratio (3.09-4.18) and the values are statistically similar (P>0.05). Bashar et al. (2012) fed maize, millet and sorghum to broilers and reported significant difference (P<0.05) in feed intake (45.26-47.49g), body weight gain (484.08-587.76g), body weight gain (427.53-531.76g) and feed conversion ratio (2.49-2.98) in the starter phase but the values in the finisher phase were feed intake(132.80-135.72g), final body weight (1826.52-1967.52) and feed conversion ratio (2.94-2.97) and the values are statistically similar (P>0.05). In contrast Abubakar et al. (2011) reported a significant difference in feed intake (50.48-63.88g), final weight gain (880.56-1092.94) and cost of feed consumed (24.71-30.94). (Table 8). Similarly Ojowola and Olugbemi, (2011) reported a significant differences in mean final feed intake (2600-3524.29), mean daily feed intake (53.08-71.92g) final weight gain (870-1130g).

The complementary nature of the cereals fed to broilers revealed no significant difference in live weight(2000.00-2250.00g), slaughter weight(1933.33-2188.33g), pluck weight(1874.82-2112.11g), dressed weight(1470.43-1708.17g) and dressing percentage(73.52-75.92) (P>0.05) (Medugu et al 2010b). The cuts of parts revealed no significant difference in head (2.36-2.38%), shanks (3.00-4.15%), neck (4.94-5.12%), wings (8.76-9.45%), thigh (13.00-13.16%), drumstick (9.31-10.25%) and thorax (9.90-10.14%) (Medugu et
Utilization Of Sorghum As Energy Source In The Diets Of Broiler Chickens: A Review

Ala., 2010). Similarly the organs weight (%) has no dietary effect on the three energy sources in the heart (1.10-1.18%), full gizzard (10.02-10.85%), and liver (7.03-7.74%) (P>0.05) (Medugu et al. 2010). However Ibityo et al. (2012) fed different energy sources and reported no significant differences in final body weight, and significant difference of organs weight of broilers fed the three cereal sources in the proventriculus (0.05-0.10%), lungs (0.04-0.07%), small intestine (0.23-0.27%), large intestine (0.32-0.61%) and liver (0.22-0.30%) (P<0.05). Adamu et al. (2012) reported broilers fed yellow sorghum to broilers as replacement for maize and reported live weight (1925.0-2200.0g), pluck weight (1750.0-2025.0g), eviscerated weight (1600.0-1712.5g) and carcass weight (1550.0-1612.5g) and the values are statistically similar (P>0.05).

Mohammed et al., 2013 fed graded levels of sorghum at 0%, 25%, 75%, and 100% and reported no significant differences in feed conversion ratio, weight of most internal organs and most of the blood parameters (P<0.05). The complementary nature of the cereals revealed the differences in the hematological parameters as it affected RBC (1.82-3.10), PCV (20.00-31.67%), Hemoglobin (4.07-6.83) and mean corpuscular value (97.13-119.20) (P<0.05) (Medugu et al. 2010b). Similarly mean corpuscular hemoglobin (18.06-22.76), white blood cells (4.28-5.13), monocytes (6.67-13.67), lymphocytes (41.67-48.00), basophiles (0.00-2.00), Neutrophiles (33.00-43.00) and eosinophils (6.33-8.67) were statistically significant (P<0.05) (Medugu et al. 2010b). Serum biochemical indices of broilers fed maize, millet and sorghum affected total protein (16.00-34.00), globulin (2.00-20.00), sodium (147.50-160.00), potassium (4.40-5.60), alkaline phosphatase (137.50-187.00) and bicarbonates (16.50-19.50) (P<0.05) Medugu et al. 2010b).

Economics of production revealed a significant reduction of cost of production when sorghum replace partially or all maize in broilers ration (Ibityo et al., 2012; Etuk et al. 2012; Adamu et al., 2013; Aladeen et al., 2013) The complementary nature of maize for sorghum as energy sources in feeding broilers in Nigeria can be encouraged as it does not affect most of the growth and carcass characteristics, this will reduce the cost and diversify the feed ingredients used as energy feedstuff.

References


DOI: 10.9790/2380-1006021316 www.iosrjournals.org 15 | Page
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DOI: 10.9790/2380-1006021316 www.iosrjournals.org 16 | Page