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# Growth Performance of Broiler Chicken Fed Diets Containing Varying Levels of Molasses-Flavoured Sorghum Distillers' Wastes

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## *Abstract*

This study was conducted to determine the performance of broiler chickens fed diets containing varying levels of molasses-flavoured sorghum distiller wastes. A total of 180 one-old- broiler birds were used. The birds were randomly allotted to four treatments using a completely randomized design model. Each treatment had three replicates with 15 birds per replicate. Treatment 1 served as the control which is 0% of molasses-flavoured sorghum distiller wastes. Treatment 2, 3 and 4, had 10, 20 and 30% inclusion levels of molasses-flavoured sorghum distiller wastes (MFSDW) respectively. The results showed that feeding varying dietary levels of sorghum distillers' wastes flavoured with molasses had positive effect ($P < 0.05$) on all the growth performance parameters measured except the initial body weight and mortality (%). Broiler chickens fed $T_1$, $T_3$ and $T_4$ diets had similar ($P > 0.05$) final body weight (FBW) and total body weight gain (TBWG) which were significantly higher than the values recorded for birds fed the $T_2$ diet (containing 10 % MFSDW). Furthermore, the total feed intake of birds fed the $T_2$, $T_3$ and $T_4$ diets had similar ($P > 0.05$) values which were significantly lower than those recorded for birds fed the control diet The FBW and the TBWG of birds fed diet containing 10 % MFSDW were significantly ($P < 0.05$) lower than the values obtained for birds fed the control diet. However, as the dietary inclusion of MFSDW increased, the FBW and TBWG of the birds increased until they were not significantly different ($P>0.05$) from or even better than those of the control diet. Similarly, TFI of birds fed the control diet were significantly ($P<0.05$) higher than those of the birds fed the 10 %, 20 % and 30 % MFSDW diets. Also, the FCR of birds fed the 10 % MFSDW diet was significantly ($P<0.05$) higher than that of the birds fed the control diet. However, at 20 % and 30 % dietary inclusion of MFSDW, the FCR were not significantly ($P>0.05$) different from that of the control diet. It therefore, can be concluded that the addition of MFSDW at 30% inclusion level in the birds' diets improved their growth performance.

**Keywords:** Broilers Chickens, Molasses, Sorghum Distiller Wastes, Poultry Nutrition, Growth Performance.

## *Introduction*

In Nigeria, broiler chicken has a very high potential for meeting the daily animal protein requirements for the populace, which has for a long time been below standard requirements (Food and Agricultural Organisation, FAO, 2004). Broiler chicken has higher feed conversion efficiency than most other species of domestic animals (Daryll and Harwood, 2013). Considering its high quality protein, readily available fat with low cholesterol, and low fibre content, chicken meat is rated higher than those of other species of domestic animals; and can be conveniently used to substitute for red meat, thereby reducing the dangers associated with the consumption of red meat.

Animal feed is the largest cost item in livestock production, especially poultry, accounting for between 60-70 % of the total cost of production. Due to high cost of conventional feed ingredients, there is the need to identify and use locally available feed resources to compound feeds that are nutritionally balanced, with the aim of reducing the total cost of production and maximize profit (Leeson and Summers, 2005). The rapid expansion of local breweries has stimulated interest in feeding the major by-product of ethanol production process, distillers' wastes (DW), to livestock (Dinneen, 2007). Reports from the International Starch Institute, (ISI) suggested that sorghum is the 5th most important grain in terms of production (ISI, 2008). Utilization of sorghum, in place of maize, for ethanol production has kept increasing over the years. Processing sorghum produce different by-products such as sorghum bran, sorghum brewers' grains, sorghum distillers' dried grains, sorghum wine residue and sorghum gluten feed (National Resource Institute, NRI, 1999; INTSORMIL, 2008; Tokach *et al*., 2010).

The problem associated with feeding distillers' wastes to livestock is the high concentration of sulphur found in it (Pritchard, 2007) which could potentially result in health problems and decrease in performance (Gould, 1998). In order to effectively utilize these by-products for non-ruminants, they have to be subjected to treatments that will improve and facilitate nutrients release as well as enhance their palatability and rate of consumption by broilers. One way of enhancing the palatability of distillers' wastes in broiler diet is through the addition of molasses as a flavouring agent and supplement. The concentration of sulphur in distillers' wastes makes it to have bitter or sour taste, which may eventually reduce its palatability and consumption (Dinneen, 2007). Flavouring distillers' wastes with molasses is an attempt to enhance its consumption by broilers. Utilization of sorghum distillers' wastes to feed broiler chickens is geared towards reducing the cost of production, and thereby maximizing profit. The aim of this research study is to evaluate the growth performance of broiler chicken fed diets containing varying levels of molasses-flavoured sorghum distillers' wastes.

## MATERIALS AND METHODS

### Experimental Site

This study was carried out at the Poultry Section of the Department of Agricultural Education, Federal College of Education, Kontagora, Niger State. Kontagora is geographically located between latitude $10.40^0$N and longitude $5.47^0$E. The climate is characterized by mono peak rainfall regime with long dry season and short rainfall that lasts for three to four months. The vegetation is typical Southern Guinea Savanna Zone (Ayinde *et al*., 2013).

### Source of Experimental Birds

A total of 180 day old CHI broiler chicks of Arbor Acre strain were obtained from Courage Farm, along Lagos-Ibadan Express way, Ibadan, Oyo State, Nigeria.

### Sources of Feed Ingredients

The sorghum distillers' wastes were obtained from the local brewers (*burkutu* makers) in the Mammy Market at the Army Barracks in Kontagora, Niger State. The molasses was obtained from the Savannah Sugar Company in Numan, Adamawa State. The maize and soya beans (full fat) were obtained from the Kontagora Market while the soya bean cake, limestone, bone meal, lysine, methonine, premix and salt were obtained from Hajia Hauwa Feed Mill, behind the Federal University of Technology, Bosso Campus, Minna.

### Preparation of Molasses-Flavoured Sorghum Distillers' Wastes (MFSDW)

The sorghum distillers' wastes were collected from some local breweries in Kontagora, and sun dried on clean surfaces for three days. Ninety four parts (94%) of the dried sorghum distillers' wastes were mixed with 6 parts (6%) molasses until a homogenous mixture was achieved. This was achieved by first mixing a small quantity of the sorghum distillers waste with the 6 % molasses after gently warming it over a low heat to obtain a homogenous mixture, before finally mixing it with the bulk. This was labeled molasses-flavoured sorghum distillers' waste (MFSDW). It was used in the preparation of the broiler chicken diets at various levels of inclusion.

**Experimental Diets and Experimental Design**

The experimental diets were formulated in accordance with the nutrient requirements of broiler chickens as recommended by Aduku (1993) and Olomu (2011).

The rations contained the following ingredients: molasses-flavoured sorghum distillers' wastes (MFSDW), maize, soybean (full fat), soya bean cake, maize offal, palm oil, bone meal, lysine, methonine, common salt, and vitamins and minerals premix.

The composition of the experimental diets is shown below:

Diet 1 ($T_1$) = 0 % inclusion of MFSDW
Diet 2 ($T_2$) = 10 % inclusion of MFSDW
Diet 3 ($T_3$) = 20 % inclusion of MFSDW
Diet 4 ($T_4$) = 30 % inclusion of MFSDW

**Vaccination and Administration of Medications**

The first dose of Gumboro disease (infectious bursal disease) vaccine was administered orally on the 7$^{th}$ day; on the 14$^{th}$ day first dose of Lasota was administered to the birds. From 16$^{th}$ to 20$^{th}$ day, coccidiostat was administered to the birds. On the 21$^{st}$ day, the second dose of Gumboro vaccine was administered, while on the 28$^{th}$ day, the second dose of Lasota was administered.

**Data Collection**

**Feed intake**

The feed were weighed daily before administering it to the birds. The following morning, the left-over feed that was not consumed by the birds were collected and measured. The difference between the quantity of feed supplied and the quantity of left over feed gives the quantity of feed consumed. This was done per replicate and recorded as the daily feed intake, which when added at the end of each week gives the weekly feed intake. The weekly feed intake was further divided by the number of birds per replicate to obtain the average weekly feed intake per bird in each replicate.

$$\text{Average F.I (g)} = \frac{\text{Amount of feed offered to the animal (g)} - \text{feed left over (g)}}{\text{Number of birds}}$$

**Body weight gain**

The body weight was determined by weighing the birds collectively per replicate. This was carried out by the use of a 50 kg weighing scale.

The initial weight of the birds was recorded at the beginning of the research work and at the end of every week. The body weight of the previous week was subtracted from that of the present week to obtain the weekly weight gain. This was then divided by the number of birds in each replicate in order to obtain the average weight gain per bird per week.

$$\text{Body weight of birds (g)} = \frac{\text{Final weight gain} - \text{initial weight of birds}}{\text{Number of birds per replicate}}$$

**Feed conversion ratio (FCR)**

The feed conversion ratio (FCR) was obtained by dividing the quantity of feed consumed per week by the weekly body weight gain of the birds in each replicate.

$$FCR = \frac{Total\ feed\ intake}{total\ weight\ gain}$$ (Egbewande, 2009)

## RESULTS AND DISCUSSION

### Results

**Proximate composition of the test ingredients**

The proximate composition of the test ingredients (Table 1) show that UFSDW and MFSDW had greater dry matter content of 92.8 % than that of the pure molasses which was 89.61 %. MFSDW had the highest crude protein content of 21.70 % while UFSDW and pure molasses had 19.70 and 1.40 % respectively. MFSDW had the highest crude fibre content of 10.50 % while UFSDW had a crude fibre content of 10.00 %. Molasses had the highest ash content of 10.08 % while MFSDW and UFSDW had 7.40 and 5.50 % respectively. Molasses had the highest NFE of 7.70 % while the UFSDW and molasses had NFE contents of 56.5 and 51.40 % respectively.

**Proximate composition of the experimental diets**

The proximate composition of the experimental diets is presented in Table 2 and it shows that at the starter phase, $T_4$ contains the highest dry matter content of 92.00 %, $T_1$ had 90.80 % dry matter content, while $T_2$ and $T_3$ had the same dry matter content of 90.40 % each. At the finisher phase, there was an increase in the dry matter content of all the treatments.

The crude fibre content of the experimental feeds for $T_1$, $T_2$, $T_3$ and $T_4$ were 4.08, 4.38, 4.19 and 4.38 % respectively while at the finisher phase, the crude fibre contents were 4.00, 3.80, 3.50 and 4.62 % respectively. The crude protein contents of the experimental feeds at the starter phase for $T_1$, $T_2$, $T_3$ and $T_4$ respectively were 21.65, 21.25, 20.85 and 21.94 % while those of the finisher phase were 20.50, 25.25, 19.50 and 19.35 %.

The ash contents of the experimental diets for the various treatments ($T_1$, $T_2$, $T_3$ and $T_4$) at the starter phase were 12.50, 12.50, 16.50 and 18.50 % respectively while those of the finisher phase were 17.50, 17.50, 16.00 and 11.00 % respectively.

The fat content of the experimental diets at the starter phase for the various treatments were 6.32, 6.81, 6.85 and 5.52 % respectively while fat content of the finisher phase were 4.72, 5.32, 5.68 and 5.48 % respectively for $T_1$, $T_2$, $T_3$ and $T_4$.

The NFE content of the experimental diets at the starter phase were 41.25, 40.28, 42.01 and 41.70 % respectively while the NFE content of the finisher phase were 47.28, 46.43, 49.70 and 53.14 % respectively for $T_1$, $T_2$, $T_3$ and $T_4$.

**Table 1: Proximate composition of the test ingredients**

| Parameters (%) | Molasses | MFSDW | UFSDW |
|---|---|---|---|
| **Moisture** | 10.39 | 7.20 | 7.20 |
| **Dry matter** | 89.61 | 92.80 | 92.80 |
| **Crude protein** | 1.40 | 21.70 | 19.15 |
| **Crude fibre** | - | 10.50 | 10.00 |
| **Ash** | 10.00 | 7.40 | 5.50 |
| **Fat** | 1.20 | 1.80 | 1.60 |
| **NFE** | 77.07 | 51.40 | 56.55 |

NFE = Nitrogen free extracts
MFSDW = Molasses flavoured sorghum distillers' wastes
UFSDW = Unflavoured sorghum distillers' wastes

**Table 2: Proximate composition of the experimental diets**

| Parameters (%) | $T_1$ | $T_2$ | $T_3$ | $T_4$ |
|---|---|---|---|---|
| ***Starter phase*** | | | | |
| **Moisture** | 9.20 | 9.60 | 9.60 | 8.00 |
| **Dry matter** | 90.80 | 90.40 | 90.40 | 92.00 |
| **Crude fibre** | 4.08 | 4.36 | 4.19 | 4.38 |
| **Crude protein** | 21.65 | 21.25 | 20.85 | 21.94 |
| **Ash** | 12.50 | 12.50 | 16.50 | 18.50 |
| **Fat** | 6.32 | 6.81 | 6.85 | 5.52 |
| **NFE** | 46.25 | 45.48 | 42.01 | 41.66 |
| ***Finisher phase*** | | | | |
| **Moisture** | 6.00 | 6.70 | 6.70 | 6.90 |
| **Dry matter** | 94.00 | 93.30 | 93.30 | 93.10 |
| **Crude fibre** | 4.00 | 3.80 | 3.50 | 4.62 |
| **Crude protein** | 20.50 | 20.25 | 19.50 | 19.35 |
| **Ash** | 17.50 | 17.50 | 16.00 | 11.00 |

| | | | | |
|---|---|---|---|---|
| **Fat** | 4.72 | 5.32 | 5.60 | 5.48 |
| **NFE** | 47.28 | 46.43 | 48.70 | 52.65 |

NFE = Nitrogen free extracts

**Growth performance of broiler chicken fed diets containing varying levels of molasses-flavoured sorghum distillers' wastes**

The results of the effects of feeding varying levels of sorghum distillers' wastes flavoured with molasses on the growth performance of broiler chickens is presented in Table 3. The results showed that feeding varying dietary levels of sorghum distillers' wastes flavoured with molasses had positive effect ($P < 0.05$) on all the growth performance parameters measured except the initial body weight and mortality (%).

Broiler chickens fed $T_1$, $T_3$ and $T_4$ diets had similar ($P > 0.05$) final body weight (FBW) and total body weight gain (TBWG) which were significantly higher than the values recorded for birds fed the $T_2$ diet (containing 10 % MFSDW). Furthermore, the total feed intake of birds fed the $T_2$, $T_3$ and $T_4$ diets had similar ($P > 0.05$) values which were significantly lower than those recorded for birds fed the control diet.

The FBW and the TBWG of birds fed diet containing 10 % MFSDW were significantly ($P < 0.05$) lower than the values obtained for birds fed the control diet. However, as the dietary inclusion of MFSDW increased, the FBW and TBWG of the birds increased until they were not significantly different ($P>0.05$) from or even better than those of the control diet.

Similarly, TFI of birds fed the control diet were significantly ($P<0.05$) higher than those of the birds fed the 10 %, 20 % and 30 % MFSDW diets. Also, the FCR of birds fed the 10 % MFSDW diet was significantly ($P<0.05$) higher than that of the birds fed the control diet. However, at 20 % and 30 % dietary inclusion of MFSDW, the FCR were not significantly ($P>0.05$) different from that of the control diet.

**Table 3: Growth performance of broiler chicken fed diets containing varying levels of molasses-flavoured sorghum distillers' wastes**

| Parameters | $T_1$ | $T_2$ | $T_3$ | $T_4$ | SEM | P - value |
|---|---|---|---|---|---|---|
| **Initial BW (g)** | 121.88 | 122.44 | 123.81 | 124.88 | 0.419 | 0.116 |
| **FBW (g)** | 1765.00 $^{a}$ | 1666.67 $^{b}$ | 1818.33 $^{a}$ | 1858.33 $^{a}$ | 25.162 | 0.010 |
| **Total BWG (g)** | 1643.12 $^{a}$ | 1544.53 $^{b}$ | 1694.52 $^{a}$ | 1734.22 $^{a}$ | 24.870 | 0.010 |
| **Total FI (g)** | 7602.19 $^{a}$ | 7578.00 $^{b}$ | 7588.13 $^{b}$ | 7579.41 $^{b}$ | 33.83 | 0.011 |
| **FCR** | 4.63 $^{a}$ | 4.91 $^{b}$ | 4.48 $^{a}$ | 4.37 $^{a}$ | 0.071 | 0.009 |
| **Mortality (%)** | 2.00 | 2.33 | 2.33 | 2.00 | 2.170 | 0.916 |

$^{a,b}$Means on the same row with different superscripts were significantly different ($P < 0.05$).

BW = Body weight, FI = Feed intake, FBW= Final Body Weight, BWG= Body Weight Gain, FCR= Feed Conversion Ratio
$T_1$ = 0 % inclusion of MFSDW
$T_2$ = 10 % inclusion of MFSDW
$T_3$ = 20 % inclusion of MFSDW
$T_4$ = 30 % inclusion of MFSDW
SEM = Standard error of the means
P-value = Probability value

**Discussion**

There were significant ($P < 0.05$) improvement in both the FBW and TBWG of broiler chickens fed diets containing 20 and 30 % sorghum distillers' wastes flavoured with molasses. As the level of sorghum distillers' wastes increased, it was observed that these parameters also increased. This could be due to the reduced negative impact of undigested residues on digesta viscosity as reported by Khose *et al*. (2017) who studied the effect of feeding sorghum distiller dried grains with solubles and enzyme supplementation on performance of Vencobb broiler chickens. The result of the present study is at variance with that reported by Hassan and Al Aqil (2015) and Khose *et al*. (2017) who had observed no significant differences in the FBW and TBWG of broiler chickens fed sorghum distiller dried grains. The reason for the differences could be as a result of differences in the breeds of broiler chickens used as *CHI* chicks were used for the present study while Vencobb 400 was used by Khose *et al*. (2017).

The feed intake was significantly different upon feeding broiler chickens varying levels of sorghum distillers' wastes flavoured with molasses when compared to those chickens fed the basal diet. This reduction in feed intake however led to an increase in weight gain of the broiler birds, when compared to birds fed the control diet. This may be due to the palatability of the feed being reduced as the quantity of the distillers' wastes increased in the diet. This is contrary to the results of Min *et al*. (2012) and Khose *et al*. (2017) who reported that feeding sorghum distiller wastes had no effect on the feed intake of broiler chickens.

Supplementing 10 % sorghum distillers' wastes flavoured with molasses diet to broiler chickens significantly influenced their feed conversion ratio (FCR) at the end of the feeding trial when compared to birds fed 0, 20 and 30 % diets. This could imply that at higher levels of sorghum distillers' wastes, there is improved feed utilization when compared to the lower levels. Although, the differences is not significant compared to those obtained from birds fed the control diet, but broiler birds fed higher levels (30 % MFSDW) had better FCR values. This is in agreement with the result reported by Barekatain *et al*. (2013) and Khose *et al*. (2017) who also recorded a significant difference in the FCR of broiler chickens fed sorghum distiller dried grains.

On the other hand, studies carried out by Damasceno *et al*. (2020) showed that feeding sorghum distillers' wastes to broiler chickens did not influence their FCR. This could be as a result of differences in the breeds of broiler chickens used for the study.

While there are recorded studies on the relationship between feeding DDGS diet to laying hens (Shalash *et al*., 2010; Ghazalah *et al*., 2011), there is limited information on the effect of feeding dietary molasses flavoured sorghum distillers' wastes on the apparent nutrient digestibility of broiler chickens. In the present study, varying the inclusion levels of MFSDW diet had influence on the nutrient digestibility of broiler chickens both at the starter and finisher levels of the experiment.

At the starter phase, chickens fed 30 % MFSDW diet had a low fat digestibility which was significantly lower than those chickens fed 0, 10 and 20 % MFSDW diets. This could be as a result of the inclusion of molasses to the sorghum distillers' wastes which enhanced the palatability of the feed, absorption of fat soluble vitamins and regulates the passage rate of the digesta in the gastrointestinal tract (Fouad and El-Senousey, 2014). This is in agreement with the result reported by Ashour *et al* (2019) who observed a significant difference in the ether extract digestibility of broiler chickens fed varying levels of dietary DDGS. Conversely, Shalash *et al*. (2010) and Ghazalah *et al*. (2011) recorded no significant difference in the ether extract digestibility of chickens fed dietary DDGS. The reason for the difference could be due to the differences in class of chickens used as broiler chickens were used for the current study while laying hens were used by the reported authors.

## CONCLUSION AND RECOMMENDATIONS

The following conclusions are made: The addition of MFSDW at 30 % level in the diet of broiler chickens positively influenced their growth performance. The economy of feed conversion was significantly influenced by the addition of MFSDW at 30 % inclusion level compared to the basal diet.

The following recommendations are made: Diets for broiler birds should be formulated using MFSDW at 30 % inclusion level in order to boost their growth performance, to achieve reduced cost of production and optimum economy of feed conversion, 30 % inclusion level of MFSDW is recommended for broiler chicken. Further research studies should be carried out on the use of MFSDW in the feeding of other categories of farm animals.

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