Effect of Honey Flavoured Sorghum Distillers' Waste on the Performance and Nutrient Digestibility of Broilers

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Abstract:- The research evaluated the performance of broilers fed with sorghum distillers' waste with honey inclusion at 1 % and 2 %. Proximate analysis of the feeds used revealed that the quality of sorghum distillers' waste was improved with the inclusion of honey as well as the palatability which enhanced feed intake of the broilers. However, above 1 % inclusion level, the honey pelletized the distiller waste such that the broilers found it difficult to consume because the feed particles were gummed together to form large granules. The nutrient profile of the treatments revealed that the starter feeds were relatively of highly quality that the finisher feeds. An inconsistent trend in feed intake was recorded, particularly at the starter phase. T_2 was consumed relatively higher than the other treatments but at the finisher phase, T_3 was consumed relatively higher than the other treatment. The trends indicated significant difference ($P \leq 0.05$) for all the weeks apart from week 3. Initial difference on the performance of the birds in terms of weight gain were recorded, however in the long run, comparable weights were attained by the birds fed with the treatments (feeds). Therefore, locally sourced sorghum distillers' grain can be used to replace up to 20 % of conventional feed in order to obtain comparable results as with conventionally compounded feeds. The research also found that the digestibility of distillers' grain by the birds was comparable to that of conventional feed.

Keywords:- *Broiler, Honey, Sorghum, Waste, Digestibility*.

I. INTRODUCTION

It is acknowledged that Nigeria produces sorghum more than any other country in West Africa and this is estimated to be equal to 71 % of the sub-regional's production (Ogbonna, 2011). Also, records show that 35 % of Africa's sorghum production in 2007 was carried out in Nigeria (Gourichon, 2013). As the third in rank after United States and India, Nigeria is ranked first as food grain sorghum producer because the United States and India utilize 90 % of their sorghum in feeding livestock (FAO, 2012). Furthermore, an annual yield of 2.8 million tones is obtained from 5.6 million hectares of land used for its production. Sorghum can be used for different purposes such as the production of sorghum meal, sorghum rice, malt, beer, livestock feed and even beer powder, among others. The whole grain may be ground into flour which is then used in various traditional foods (Mohammed *et al.*, 2011).

Grains (cereals) are used in ethanol production with maize as the most commonly utilized. Gradually, sorghum has been used to replace maize for ethanol production in recent times. Processing sorghum produce different by-products such as sorghum bran, sorghum brewers' grain, sorghum distillers dried grains, sorghum wine residue, sorghum gluten feed (NRI, 1999; Lazard and Favier, 2000; INSORMIL, 2008; Tokach *et al.*, 2010). Local distilleries, particularly in the northern part of Nigeria where sorghum production is prominent (International Starch Institute, 2008; FAO, 2012; Gourichon, 2013) make extensive use of sorghum grains. Processing by fermentation and removal of starch leaves approximately one-third of the original grain in the whole stillage leading to about three times of the concentration in the remaining nutrients: protein, fat, fibre and minerals (Stock *et al.*, 2000; Klopfenstein *et al.*, 2008).

In corn and sorghum dried grain (CDG and SDG respectively), CP increases from approximately 10-30 %, fat from 4-12 % and NDF from 12-36 % (Stock *et al.*, 2000; Klopfenstein, 2008). Although similar in nutrient composition, reviews by Klopfenstein *et al.* (2008) and Owens (2008) suggest that corn WDG (CWDG) is superior to sorghum WDG (SWDG) as a feedstuff. However, several studies have found no significant difference between the two types of DG in terms of animal performance, carcass characteristics and digestibility of nutrients (Al-suwaiegh *et al.*, 2002; Vasconcelos *et al.*, 2007; Depenbusch *et al.*, 2009; May *et al.*, 2010).

Developing effective and efficient means of utilizing by-products (particularly, distillers' wastes) from local distilleries is eminent for environmental sanity, human health sustenance and reducing cost on feeding which is well recognized as the largest cost item in livestock production (especially in poultry), and accounting for 60–70 % of the total cost of production. Efforts should be tailored towards minimizing the nutritional defects associated with by-products from distilleries and improving their consumption by livestock (in this case, poultry; broilers in particular). Babarinde *et al.* (2011) stated that when honey is added to poultry feeds, it can serve as a growth promoter, and as an additive to improve the palatability and digestibility of the feed. Honey also improves feed

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efficiency and acts as feed binder (reduces dust) and improves the aroma of the feed.

In this research, the potentials of honey are explored to boost the use of distillers' wastes for broiler's production. Honey is a sweet food made by bees foraging nectar from flowers. The variety produced by honey bees (the genus *Apis*) is the one most commonly referred to, as it is the type of honey collected by most beekeepers and consumed by people. Honeys are also produced by bumblebees, stingless bees, and other *hymenopteran* insects such as honey wasps, though the quantity is generally lower and they have slightly different properties compared to honey from the genus *Apis*. Honey bees convert nectar into honey by a process of regurgitation and evaporation: they store it as a primary food source in wax honeycombs inside the beehive. It has attractive chemical properties for baking and a distinctive flavor that leads some people to prefer it to sugar and other sweeteners (National Honey Board, 2012).

Most microorganisms do not grow in honey, so, sealed honey does not spoil, even after thousands of years (Prescott *et al*., 1999; Geiling, 2013). However, honey sometimes contains dormant endospores of the bacterium *Clostridium botulinum*, which can be dangerous to babies, as it may result in *botulism* (Shapiro *et al*., 1998). The physical properties of honey vary, depending on water content, the type of flora used to produce it (pasturage), temperature, and the proportion of the specific sugars it contains. Fresh honey is a supersaturated liquid, containing more sugar than the water can typically dissolve at ambient temperatures. At room temperature, honey is a super-cooled liquid, in which the glucose will precipitate into solid granules. This forms a semisolid solution of precipitated glucose crystals in a solution of fructose and other ingredients. Other properties of honey are given in Table 1.

Table 1 Nutritional Value of Honey per 100 g (3.5 oz)

Parameter	Value	
Energy	1,272 kJ (304 kcal)	
Carbohydrates	82.4 g	
Sugars	82.12 g	
Dietary fiber	0.2 g	
FreeFattyAcid(FFA)	0 g	
Protein	0.3 g	
Vitamins		
Riboflavin (B_2)	0.038 mg	(3%)
Niacin (B_3)	0.121 mg	(1%)
Pantothenic acid (B_5)	0.068 mg	(1%)
Vitamin B_6	0.024 mg	(2%)
Folate (B_9)	2 µg	(1%)
Vitamin C	0.5 mg	(1%)
Minerals		
Calcium	6 mg	(1%)
Iron	0.42 mg	(3%)
Magnesium	2 mg	(1%)
Phosphorus	4 mg	(1%)
Potassium	52 mg	(1%)
Sodium	4 mg	(1%)
Zinc	0.22 mg	(2%)
Other constituents		
Water	17.10 g	

Source: USDA National Nutrient Database (2015)

Hence, the general goal of the research is to evaluate and reveal the potency of honey in combination with Sorghum distillers' grain sourced from local distilleries as feedlots for broiler producers who may not be able to afford conventional feeds. The specific objectives of the study are to:

i. Evaluate feed intake and rate of consumption of honey flavoured sorghum distillers' waste by broilers.
ii. Determine the growth performance of broilers fed with honey flavoured distillers' waste.
iii. Determine the nutrient digestibility of broilers fed with honey flavoured sorghum distillers' waste.

II. MATERIALS AND METHODS

2.1 Experimental Site

The research was carried out at the Poultry Unit of the old Teaching and Research Farm (Bosso Campus), Federal University of Technology Minna, Niger State, located in the southern guinea savanna vegetable zone in Nigeria. The temperature ranges between 38 ^{0}C to 42 ^{0}C and the mean annual rainfall is 1200 mm to 1300 mm. It lies on longitude $6^029'$ E and latitude $90^031'$ N and is characterized by wet and dry seasons (Federal University of Technology Minna, 2014).

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2.2 Sources of Feed Ingredients

The sorghum distillers' were obtained from the local breweries (Burukutu Makers) in the mammy market at the army barracks in Bida, Niger State while the maize, maize Offal, Groundnut cake, limestone, bone meal, red oil, lysine, methionine, salt and premix were all bought in Minna, Niger State. The honey was obtained from Zonkwa in Kaduna State, Nigeria.

2.3 Preparation of the Brooding House

A total of 204 day-old broiler chicks of Abo Acre breed were bought from Chi Farm, located at Kilometer 20 of Lagos-Ibadan Expressway, Ajanla Village, Oyo State, Nigeria. The birds were brooded for four weeks in a standard brooder. The research work started at one week old after adaptation. The birds were all fed with conventional feed for the first one week after which they were weighed and randomly allotted to four dietary treatments in three replicates. Each experimental unit was stocked with 17 chicks and was arranged in a completely randomized design (CRD). The four groups of birds were raised in the poultry house using wood shaving as the litter material. Old newspaper was spread on the floor of the brooding house for the first one week after which it was removed and the birds remained on the floor covered with wood shavings.

2.4 Experimental Diets

Four experimental diets were formulated during the starter phase (2-5 weeks) and another four diets were formulated during the finisher phase (6-9 weeks) to meet the nutritional needs of the birds at such ages. Treatment 1 (T_1) was designed to be the control diet with no inclusion of sorghum distillers' waste and no honey (that is, 0 % sorghum distillers' waste and 0 % honey). Treatment 2 (T_2) contained 20 % dietary inclusion of sorghum distillers' waste and 0 % honey, treatment 3 (T_3) contained 20 % sorghum distillers' waste and 1 % honey while treatment 4 (T_4) contained 20 % sorghum distillers' waste and 2 % honey. The compositions of the experimental diets during the starter and finisher phases are contained in Tables 2 and 3 respectively.

Table 2 Composition (Calculated) of Experimental Diets (kg/100kg) during Starter Phase

Ingredients	Diet 1	Diet 2	Diet 3	Diet 4
Maize	49.80	38.80	38.00	37.15
GNC	40.20	34.65	34.95	35.00
Maize Offal	4.45	1.00	0.50	0.30
SDW	0.00	20.00	20.00	20.00
Honey	0	0	1.00	2.00
Salt	0.30	0.30	0.30	0.30
Premix	0.25	0.25	0.25	0.25
Methionine	0.50	0.50	0.50	0.50
Lysine	0.50	0.50	0.50	0.50
Bone meal	3.50	3.50	3.50	3.50
Lime Stone	0.50	0.50	0.50	0.50

Table 3 Composition (Calculated) of Experimental Diets (kg/100kg) during Finisher Phase

Ingredients	Diet 1	Diet 2	Diet 3	Diet 4
Maize	57.00	42.95	41.95	40.80
GNC	33.45	27.50	27.50	27.65
Maize Offal	1.00	1.00	1.00	1.00
SDW	0.00	20.00	20.00	20.00
Honey	0	0	1.00	2.00
Palm Oil	3	3	3	3
Salt	0.30	0.30	0.30	0.30
Premix	0.25	0.25	0.25	0.25
Methionine	0.25	0.25	0.25	0.25
Lysine	0.50	0.50	0.50	0.50
Bone meal	3.50	3.50	3.50	3.50
Lime Stone	0.50	0.50	0.50	0.50

Table 4 Proximate Composition of Experimental Diets during the Starter Phase

Ingredients	Diet 1	Diet 2	Diet 3	Diet 4
Crude Protein (%)	23.05	23.01	23.05	23.02
ME (kcal/kg)	2809	2801	2802	2800.11
Calcium (%)	1.54	1.58	1.46	1.53
Phosphorus (%)	0.98	0.91	0.9	0.82
Lysine (%)	1.32	1.20	1.20	1.20
Methionine (%)	0.80	0.74	0.73	0.73
Crude Fibre (%)	3.33	3.80	3.80	3.73
Ether Extract (%)	5.75	5.24	6.06	5.21

Table 5 Proximate Composition of Experimental Diets during the Finisher Phase

Ingredients	Diet 1	Diet 2	Diet 3	Diet 4
Crude Protein (%)	20.25	20.17	20.11	20.11
ME (kcal/kg)	3070	3012	3008	3001
Calcium (%)	1.53	1.52	1.52	1.52
Phosphorus (%)	0.96	0.90	0.90	0.80
Lysine (%)	1.24	1.10	1.10	1.10
Methionine (%)	0.80	0.70	0.70	0.71
Crude Fibre (%)	2.92	3.64	3.61	3.58
Ether Extract (%)	5.36	4.80	4.80	4.90

2.5 Feeding and Routine Management

During the first four weeks, the birds were inspected early in the morning and late evening for any abnormality. Due to the cold weather condition, warmth was provided to the birds with 200 watts electric bobs hung at 1 m above the ground. Five of the 200 watts bobs were used in each experimental unit to ensure that enough warmth are provided. The feeders and drinkers were cleaned and washed two times in a day and the birds were served with fresh feeds on daily basis.

2.6 Vaccination and Medication

On the day of arrival, the birds were given glucose, vitalyte and antibiotics in drinking water. From the 3rd to the 8th day, coccidiostat was given to them. The first dose of Gumboro disease vaccine was administered orally on the 10th day, on the 17th day, the first dose of lasota was administered to the birds, form the 19th to the 23rd day, Coccidiostat was given to the birds. On the 24th day 2nd dose of Gumboro vaccine was administered and on the 31st day, the second dose of lasota vaccine was administered.

2.7 Data Collection

2.7.1 Mean Feed Intake

The initial body weights of the birds were taken at one week old. Weighing was subsequently done weekly throughout the period of experimentation. Mean weekly body weight was obtained by dividing the total weight of the birds within a replicate by the number of birds within the replicate.

$$\text{Mean Weekly Weight} = \frac{\text{Total Weight of Birds in a Replicate}}{\text{Number of birds in the Replicate}}$$

2.7.2 Weekly Body Weight Gain

The mean weekly body weight gain is determined by finding the difference between the current week's body weight and the weight of the previous week.

2.7.3 Feed Conversion Ratio

From the weight gain and the quantity of feed consumed by each replicate, feed conversion rations (FCR) were determined as follows:

$$\text{FCR} = \frac{\text{Average Feed Intake(g)}}{\text{Average Weight Gained (g)}}$$

2.7.4 Digestibility Studies

Digestibility is described as the quantity of nutrients in the feed that are not excreted in the faeces; therefore they are assumed to be absorbed by the animal. At the end of the third and seventh week of the experiment respectively, four birds per replicate and twelve birds per treatment making a total of 48 birds were used for the digestibility study. The birds were removed from the flock and placed in metabolic cages for three days in order to adjust to the conditions of the cage. After the three days adjustment period, weighed quantities of experimental feeds were given to the birds and faecal samples collected from them after 24 hours. The oven dried faecal samples were packaged and stored in plastic containers in a deep freezer until used for proximate analysis. Digestibility was calculated using the formula below:

$$\text{FCR} = \frac{\text{Nutrient in Feed Consumed} - \text{Nutrient in Faecal Droppings}}{\text{Nutrient in Feed Consumed}} \text{ x } 100\ \%$$

2.7.5 Total Digestible Nutrient (TDN)

TDN = Digestible Crude Protein + Digestible N_2 Free Extract + Digestible Ether Extract x 2.25

2.8 Chemical Analysis

The proximate composition of sorghum distiller's waste, honey, experimental diets and the faecal droppings were analyzed based on the procedures of AOAC (2000).

2.9 Statistical Analysis

Data obtained on various parameters were analyzed using SSPS (2007) by means of analysis of variance (ANOVA). The least significant difference (LSD) was used to separate the means where there were statistical significant differences.

III. RESULTS AND DISCUSSION

3.1 Proximate Analysis of Poultry Feeds

The feeds given to the birds were classified into starter and finisher feeds. The starter feeds were fed to the birds from the second to fifth week after the week of stabilization. The proximate analysis of starter feeds revealed that they had moisture content of range between 6.80-8.00 %; ash content was 8.50–9.50 %; crude protein range was 23.00–24.11 %; crude fibre was at the range of 4.00–8.00 %; fat content was between 3.00–4.50 %; NFE content range was 49.18–53.70 %; and the energy content was at the range of 321.88–342.80 kcal.

The finisher feeds which were fed the birds from the sixth to ninth week of age indicated by proximate analysis that moisture content range was 7.2–8.00 %; ash content was within 8.00–9.00 %; crude protein content was 19.69–20.19 %; crude fibre was within the range of 4.00–6.00 %; fat content was 4.80–7.50 %; NFE content showed a range of 52.64–54.13 %; and Energy content was within the range of 337.00–360.42 kcal. It is obvious from the proximate analysis that the starter feeds were of relatively higher quality than the finisher feeds because of the relatively higher protein contents in the starter feeds than the finisher feeds. The results of the proximate analysis of the feeds are contained in Table 4.

Table 4 Proximate Analysis of Experimental Feeds

Parameter	Starter Phase				Finisher Phase			
	T_1	T_2	T_3	T_4	T_1	T_2	T_3	T_4
Moisture (%)	7.40	7.80	6.80	8.00	7.50	8.00	8.00	7.20
Ash (%)	8.00	9.00	8.50	9.50	8.00	8.50	8.50	9.00
Crude protein (%)	23.42	24.11	23.00	23.14	20.19	19.69	20.17	20.16
Crude Fibre (%)	8.00	4.67	4.00	6.00	4.00	6.00	4.67	6.00
Fat (%)	4.00	4.50	4.00	3.00	7.50	5.00	4.80	5.00
NFE (%)	49.18	49.92	53.70	50.58	53.04	53.31	54.13	52.64
Energy (kcal)	326.40	33.62	342.80	321.88	360.42	337.00	337.70	336.20`

3.2 Feed Intake of Broiler Chicks at the Starter Phase

At the starter Phase, the birds exhibited an inconsistent trend in feed intake. There was a decreasing tendency in the intake of treatment 1(Conventional feed) after an initial increase with the decrease intake of the feed reducing as the experiment progresses. Similar trend was observed for treatment 2 (Sole DG) but the feed intake increased after decreasing in the third week of the starter phase. The birds showed similar response to treatment3 (DG+1 % honey) as treatment 2 although there was relatively lower intake of treatment 3. The response of the birds to treatment 4 (DG +2 % honey inclusion) was similar to that for treatment2 but the intake of treatment4 was relatively higher than the intake of treatment2.The mean weekly feed intake of broiler chicks is summarized in Table 5.

Table 5 Mean Weekly Feed Intake of Broiler Chicks during Starter Phase

Week	Feeds (Treatments), g			
	T_1	T_2	T_3	T_4
1.	1683.3	1616.7	1683.3	1783.3
2.	3050.0	3000.0	3183.3	3316.7
3.	2750.0	2816.7	2816.7	2783.3
4.	2566.7	3100.0	2883.3	2583.3

3.3 Feed Intake of Birds during Finisher Phase

At the finisher phase of the experiment, there was gradual increase in feed intake by birds for all the treatments. Treatment 3 (DG +1 % honey inclusion) was consumed more than all the other treatments; followed by treatment 2 (Sole DG), then treatment 4 (DG+2 % honey inclusion) and finally, treatment1 (conventional feed). Table 6 summarizes the results of feed intake of broilers during the finisher phase of the experiment.

Table 6 Mean Weekly Feed Intake of Broiler Chicks during Finisher Phase

Week	Feeds (Treatments), g			
	T_1	T_2	T_3	T_4
5.	3500.0	4033.3	4466.7	3916.7
6.	4366.7	5016.7	5333.3	4400.0
7.	4916.7	6200.0	6450.0	5400.0
8.	5366.7	6966.7	6800.0	6383.3

Generally, apart from in week 3 during the starter phase, significant differences were established between feed intakes of the treatments (feeds) at 95 % confidence interval (that is $P \leq 0.05$). This was achieved by the multiple comparisons of data on feed intake using the SPSS package of data analysis (Bryman and Cramer, 2005). The weekly feed intakes are shown in Figures 1 to 7.

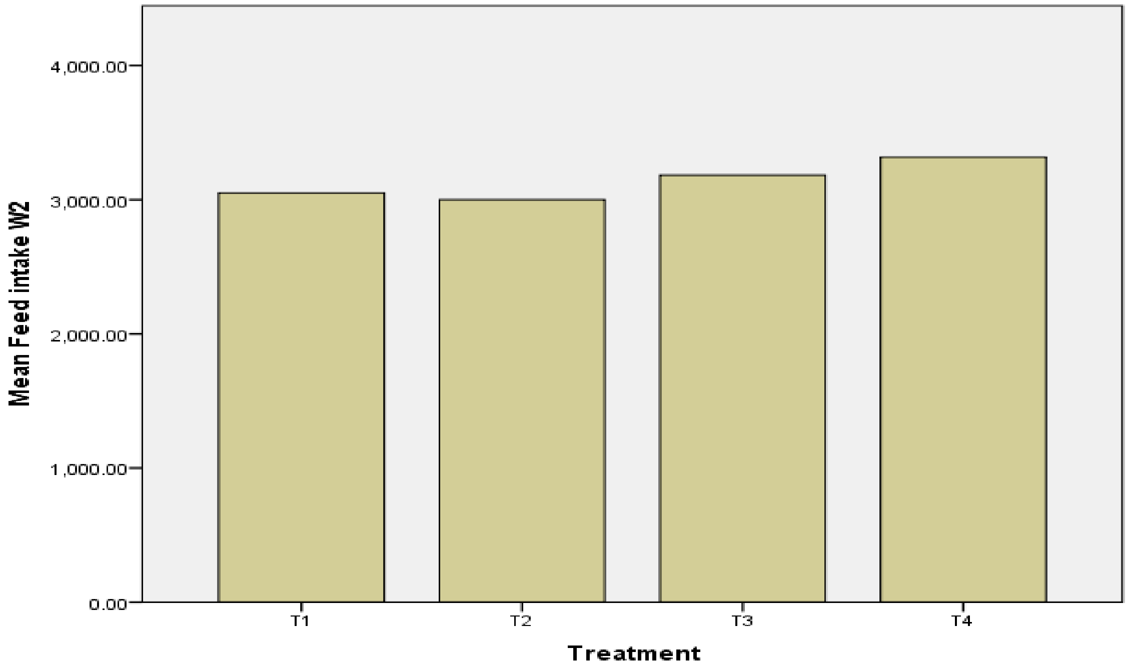

Fig 1 Mean Feed Intake for Week 2

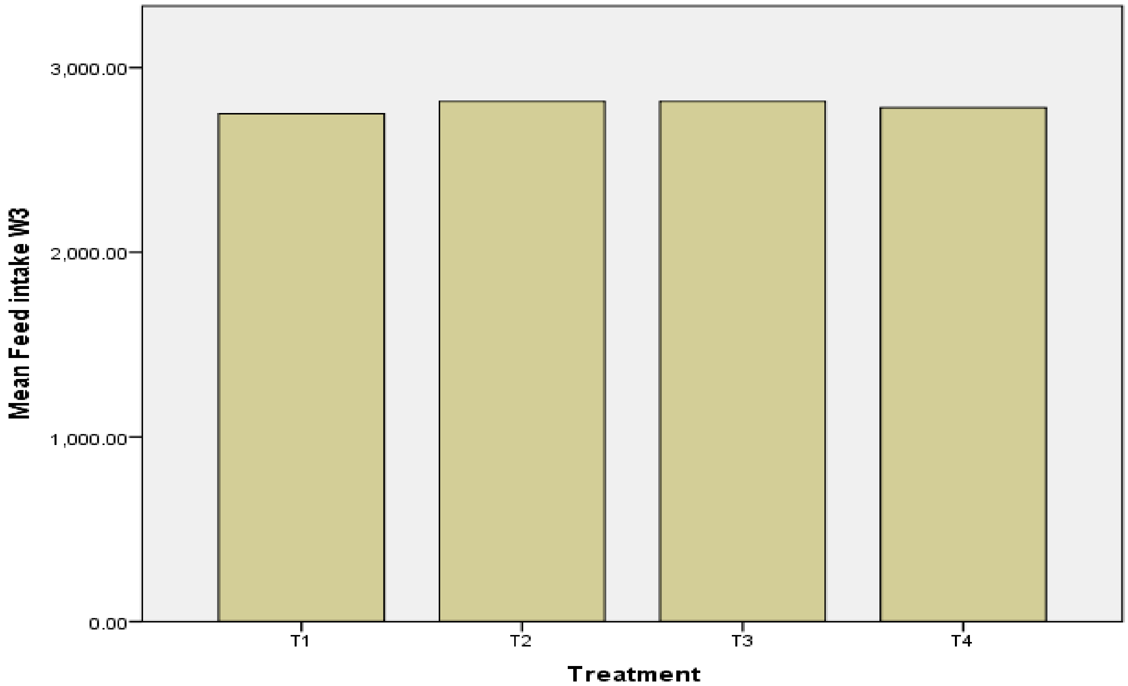

Fig 2 Mean Feed Intake for Week 3

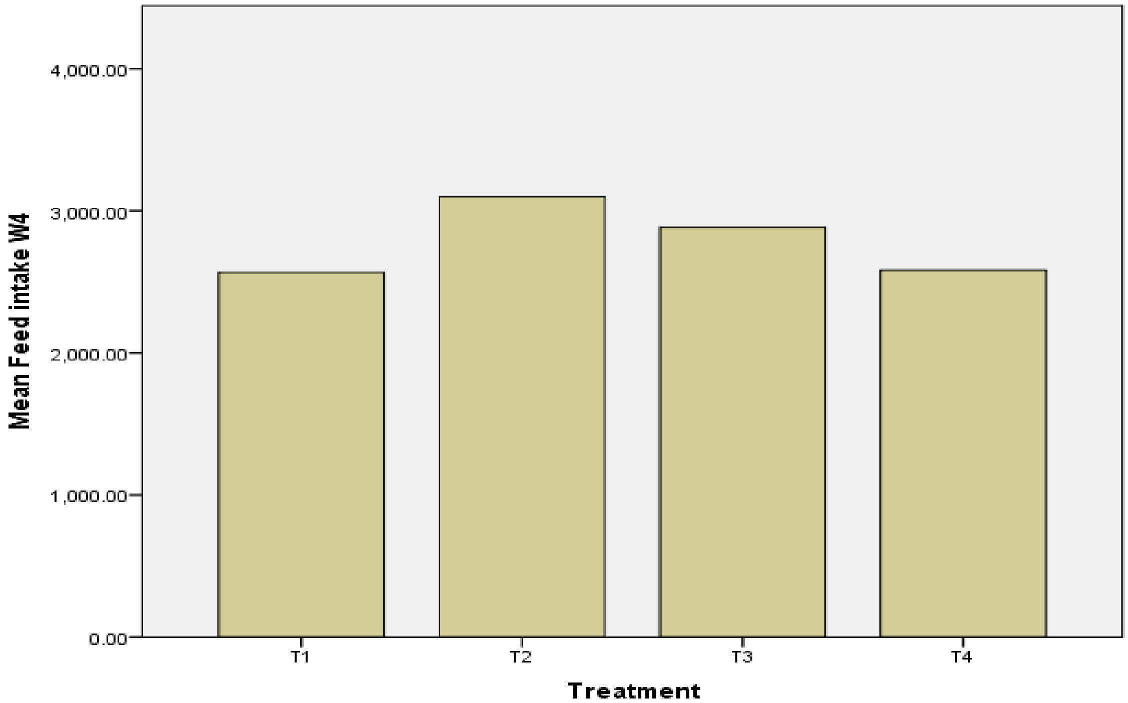

Fig 3 Mean Feed Intake for Week 4

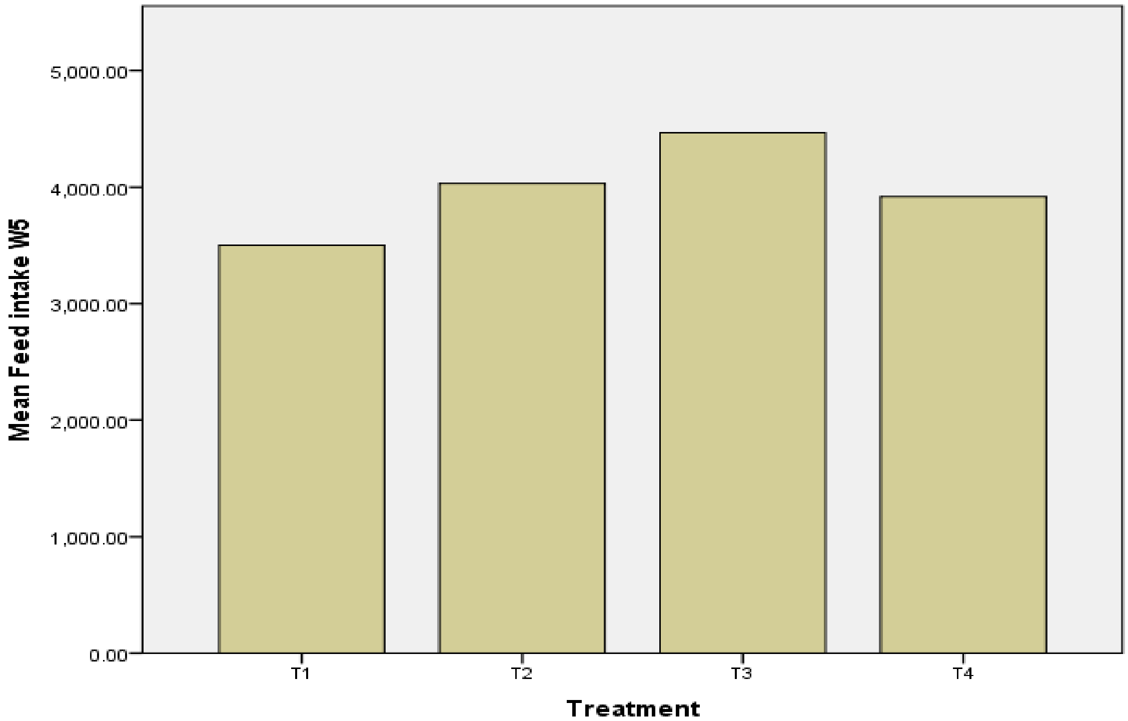

Fig 4 Mean Feed Intake for Week 5

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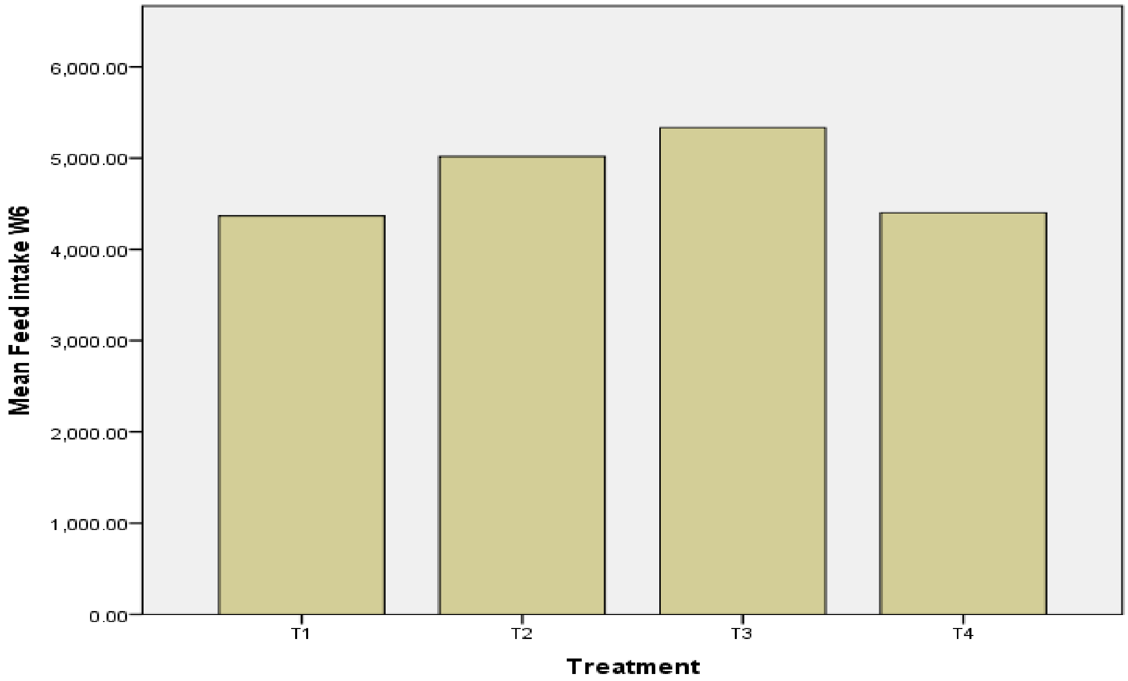

Fig 5 Mean Feed Intake for Week 6

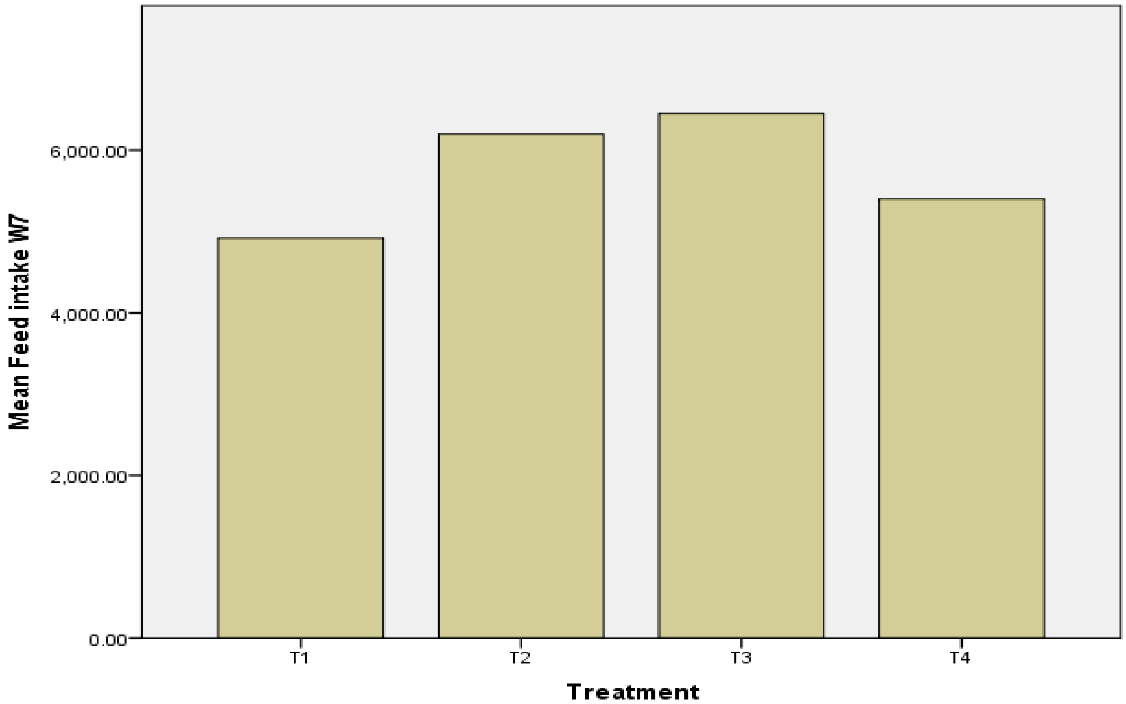

Fig 6 Mean Feed Intake for Week 7

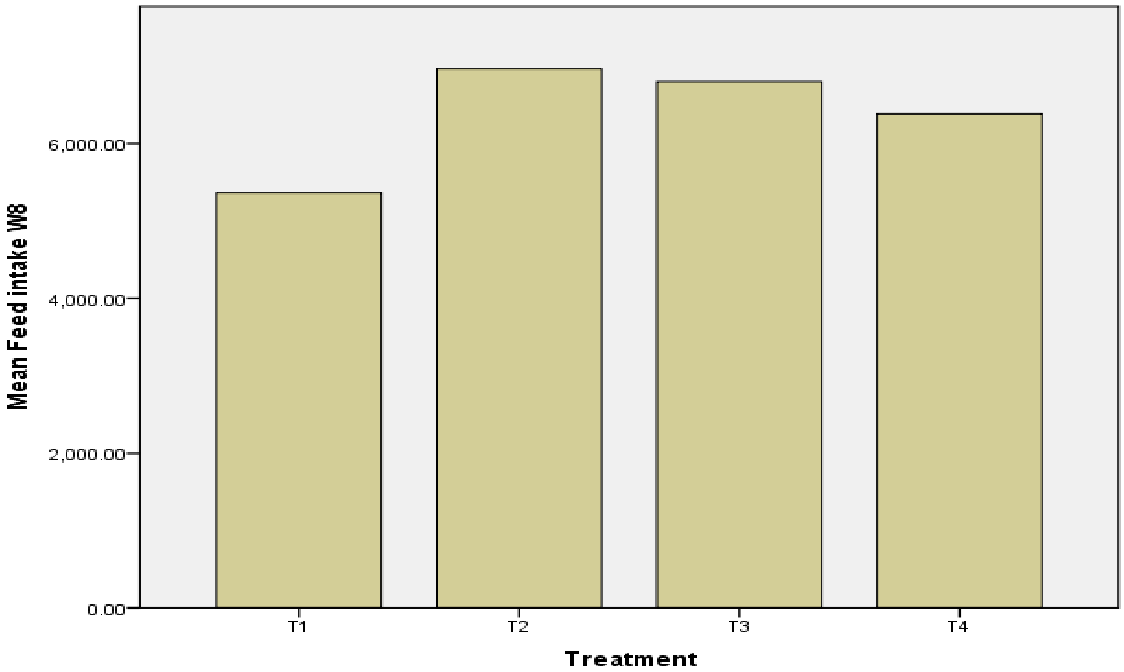

Fig 7 Mean Feed Intake for Week 8

3.4 Weight Gain of Broilers

Results on weight gain show that feeding broilers with the feeds led to increase in weight of the birds over the period of the experiment. At the beginning of the experiment, there were noticeable differences on the performance of the birds with respect to the feeds they were subjected to, with the conventional feed (treatment 1) performing relatively better than the other feeds. However, in the long run (that is, at the termination of the experiment), no significant difference was recognized between the feeds in terms of weight gain of birds grown with them. The results are summarized in Table 7.

Table 7 Mean Weekly Weight Gain of Broilers under Different Feeding Plans

Week	Feeds (Treatments), g			
	T_1	T_2	T_3	T_4
1.	1191.7	1083.3	1150.3	1139.6
2.	1833.3	1683.3	1683.3	1633.3
3.	2283.3	1933.3	2050.0	2166.7
4.	2466.7	2266.7	2300.0	2133.3
5.	3233.3	3366.7	3133.3	3166.7
6.	5250.0	5366.7	5466.7	5166.7
7.	6750.0	6700.0	7033.3	6683.3
8.	7366.6	7266.7	7200.0	7379.2

3.5 Feed Digestibility and Utilization

The fecal analysis revealed that moisture contents for the faeces at the starter and finisher phases were 7.33 – 10.21 % and 7.22 - 9.42 % respectively. For the other parameters, ash content was 17.39 - 19.48 % and 18.24-20.63 %; crude fibre was 18.33 - 20.63 % and 15.33 - 20 %; fat content, 4.98 - 7 % and 1.50 – 2.34 %; NFE, 13.56 - 19.09 % and 28.62 - 38.87 %; and energy content was 237.43 - 253.08 kcal and 213.04 – 249.50 kcal respectively for the starter and finisher phases. Apart from the contents of ash and NFE which were increased at the finisher phase; moisture, crude protein, crude fibre, fat and energy contents were relatively decreased at the finisher phase; energy contents were relatively decreased at the end of the finisher phase when compared to the end of the starter phase.

With respect to the feeds, moisture, crude fibre and ash contents were increased at end of both the starter and finisher phases whereas energy and NFE contents were decreased at the end of both the starter and finisher phases. For fat and crude protein contents, they were increased and decreased at the end of the starter phase and finisher phase respectively when compared to their contents in the feeds. The trends indicated that the feeds were relatively better digested and utilized at the finisher phase than at the starter phase by the birds. The mean values of the fecal analyses for both the starter and finisher phases are shown in Table 8.

Table 8 Fecal Analyses at the End of Each Phase

Parameter		Starter					Finisher			
		T_1	T_2	T_3	T_4		T_1	T_2	T_3	T_4
Moisture, %		8.16	9.89	7.93	9.80		7.81	8.38	7.71	8.63
Ash, %		18.23	18.37	18.91	17.85		19.18	19.38	20.35	20.54
Crude protein, %	30.33	30.62	30.66	29.51		18.53	20.19	19.68	20.08	
Crude Fibre, %	20.14	18.92	19.85	19.72		19.20	18.99	16.03	19.19	
Fat, %		5.26	6.80	6.53	5.98		2.22	1.81	1.83	2.01
NFE, %	17.87	15.40	16.12	17.30		35.03	31.22	34.41	29.55	
Energy, kcal		240.12	245.60	245.55	240.35	234.71	223.67	232.79	216.61	

3.6 Discussion

The use of sorghum grains in the local distilleries was associated with nutrients accumulation in the distiller waste. This has been reported by several authors such as Stock *et al.* (2000), Lardy *et al.* (2003) and Klopfenstein (2008). However, they were able to record up to 30 % CP by DM of distiller wastes but the highest value of 24.11 % CP was recorded for the sorghum distiller waste used for this research. This can be attributed to difference in the distillery process which was more or less locally undertaken and did not utilized additives that could have helped improved the nutrient contents in the distiller's waste used in this experiment.

The trend on feed intake noticed at the starter phase is attributable to the age of the birds and the nature of the feeds. The inclusion of honey to the DG enhanced feed intake of the birds but above 1 % inclusion level, the honey which is sticky, pelletized the feed and thereby, making it large for the chicks to pick up. Relatively, treatment 3 (DG + 1 % honey inclusion) was preferable by the chicks because of its nature and palatability as a result of the honey inclusion. Similar trend was recorded at the finisher phase but more feeds were consumed by the birds which is a function of the age of the birds. Differences established in the feed intake of the treatments are associated with their palatability.

The use of DG in livestock feeding is widely reported but sparsely reported with respect to poultry feeding (Min *et al.*, 2009). Weight gain of the broilers, although were different at the earlier stage of the experiment; in the long run, such differences were compensated for and thereby, leading to production of birds of comparable body weight. This could be due to the enhanced digestibility of the DG which has nutrient accumulation after it has been used for distillery. Improved performance of broilers fed with DG has been reported by researchers such Spiehs *et al.* (2002), Jung *et al.* (2008) and Loar *et al.* (2010).

IV. CONCLUSION

The findings of the research have shown that locally sourced sorghum distillers' grain can be honeyed and used as feeds for broilers to substitute for conventional feeds up to 20 %. However, the honey inclusion should not exceed 1 % to avoid pelletizing of the distillers' grain into granule sizes that may pose difficulty for young broilers' consumption. It is therefore pertinent to recommend that:

1. Locally sourced Sorghum distillers' grain can be used successfully to feed broilers as substitute for conventional feeds and thereby, reducing cost of production. This could lead to increased profit margin for broilers' producers.
2. Honey can be added to locally sourced sorghum distillers' grain to enhance its palatability but the inclusion level should be left at about 1 % to avoid sticking together of feed particles to produce feed granules too large to impede feed intake of young broiler chicks.

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