ISSN NO: 2770-2936
Date of Publication:04-10-2021

Effect Of Feeding Graded Levels of Whole Sugarcane Waste with Or Without Fishmeal and Grasshopper Meal Supplementation in The Diets of Broilers

Adedeji.M. O*
Habiba.Z.
Duweni.T.
Adeniji. A.A
Department of Animal Science Faculty of Agriculture, University of Abuja. Nigeria
Corresponding author. Email: wddo007@gmail.com

Abstract: A total of two hundred and seventy (270) day old broiler chicks were used to evaluate the effect of feeding graded level of whole sugarcane waste with or without fishmeal and grasshopper meal supplementation in the diet of broiler. The diet formulated had three (3) inclusion levels of Whole sugarcane waste (WSW) at 0, 5, 10 %, with animal protein supplementation (fishmeal and grasshopper meal) at 2.5 % The experimental animals were randomly distributed into nine dietary treatments. There were three replicates per treatment with ten birds per replicates. Feed and water were supplied *ad-libitum* while standard poultry management where strictly followed during the study. Data on different performance parameters such as average daily feed intake, average daily weight gain, feed conversion efficiency and cost of feed where collected. It was a 3×3 factorial experiment in a complete randomized design (CRD). The experiment lasted for a period of (8) weeks. The result showed that the experimental diet had significant effects ($P<0.05$) on final weight, daily feed intake, weight gain and feed to gain ratio. Supplement interaction showed significant difference on final weight, daily feed intake, and feed to gain ratio. This study showed that broilers fed 5% Whole sugar cane waste supplemented with grasshopper meal had better performance as it gave better growth performance When compared to 10% inclusion level.

Introduction

The poultry has become a popular industry for the small holders with tremendous contribution to Nigeria GDP and employment opportunities creation (Adebayo and Adeola, 2005; Okonkwo and Akubo, 2001). Poultry meat is an important source of high-quality proteins, minerals and vitamins to balance the human diet. Specially developed varieties of chicken (broilers) are now available with the traits of quick growth and high feed conversion efficiency. The availability of grain and protein for the formulation of poultry feeds is a major constraint for this development (Daghir *et al.*, 2008). In addition, poultry feed represents over 70% of variable cost of meat production (Oladokun and Johnson 2012). Maize (corn) is the most commonly energy source used in poultry diet, while the main protein sources are fishmeal and legume meal. Almost all developing countries import these ingredients, and poultry feed industries in Africa depends on imports, which are a draining their foreign exchange reserves (Ravindran 2013). Indeed, maize and protein comprise up to 80% farm-made diet (Teguia and Beynen 2005). But alternative raw material can be used to reduce poultry feed cost (Houndonougbo *et al.*, 2012), without compromising laying hen performance (Farrell 2005)

In Nigeria, sorghum or millet is used to replace corn in poultry feeds (Issa *et al.*, 2015, 2016). However, fish meal supply is a main constraint in poultry feeding (FAO 2009).

Insects can be used as a replacement for fish meal and fish oil in animal diets (Van Huis 2012). Locust and grasshopper have a great potential as a more affordable source of protein (Kenis *et al.*, 2014). Grasshopper which is known to have a high capacity for damaging crops, thus causing big economic losses could be used as feed ingredient (Hassan *et al.*, 2009) especially in Niger. Its amino acids composition is an advantage for poultry feed, especially the content in lysine, methionine and cysteine (Wang *et al.*, 2005). In addition, grasshopper contains significant amount of several carotenoids. These carotenoids are sources of vitamin A, and may play important roles in immune response, and reproduction in insectivores (Finke 2015). Grasshopper and locust were used in broiler diets (Hassan *et al.*, 2009, Adeyemo *et al.*, 2008). Their utilisation in broilers diets in Nigeria would contribute to reduce feed cost and improve broiler meat quality.

ISSN NO: 2770-2936
Date of Publication:04-10-2021

Today, insects are receiving great attention as a potential source of poultry feed due to the high costs and limited future availability of conventional feed resources, such as soybean meal and fishmeal, and also because there is a shortage of feedstuffs such as maize and soybean as a result of competition between humans and livestock for these resources. Insects are a natural part of the poultry diet and feeding them to poultry might improve their welfare. Chitin from the insect's exoskeleton has been shown to have a positive effect on poultry immune systems, which could reduce the use of antibiotics. Another reason for the interest in insects is their ability to reduce the great quantities of manure, which is becoming a serious environmental problem. Insects such as grasshoppers have a high protein and calorie content. Grasshoppers, which are known to have a high capacity for destroying farm crops and causing great financial losses, could be turned into feed ingredients, especially in Nigeria. The protein content of grasshopper meal ranges from 43.9-77.1%. In addition, grasshopper has an advantage in amino acid composition for poultry, especially due to its contents of lysine, methionine and cysteine and might constitute a new source of dietary nitrogen for poultry. Harvesting grasshoppers in cropland and grasslands may allow a reduction in the use of harmful pesticides for their control. Grasshopper has a higher protein content compared with the conventional soybean and fishmeal available locally.

Sugar cane (*Saccharum officinarum L.*) is a tropical, perennial grass. Sugarcane is widely cultivated in tropical and subtropical countries around the world, with increasing annual production. Nigeria is one of the largest sugarcanes producing country in Africa Sugarcane is grown mainly for sucrose extraction for the production of sugar and ethanol. However, the sugarcane culture is responsible for generating, as a residue, the sugarcane bagasse (140 kg of bagasse are produced for every ton of sugarcane processed), and thus this is the most abundant lignocellulosic residue in Nigeria agriculture. The sugarcane bagasse is readily available and is not in competition by man.Clusters of whole sugarcane waste are usually noticed on the refuse dumps of most supermarket within Abuja thus becoming an environmental problem.

The shortage of good quality feed needed to sustain livestock growth, due to high cost of conventional feed stuffs and scarcity of feed ingredients resulting from competition between animals and man feed constitute the dominant input in animal production ranging from 65-70% of the total cost. it have been reported that conventional feedstuffs are expensive and scarce, the high cost and scarcity derived from cropping realities that are characteristics of third world developing economies (Esonu *et al.*, 2001;2002;2004). They vary in nature from technological to economic, sociological, political and environmental limitations of our system. Conventional feedstuffs are expensive because they suffer from stiff competition with channels in the food chain which commands higher priority and can pay higher prices than the compound feed industry, which have further diminished the already low intake of animal protein intake of the populace (Madubuike, 1992). There is therefore an urgent need for alternative locally available and cheap source of feed ingredients particularly those that do not attract competition in consumption between human and livestock. One possible source of such feedstuff is the whole sugarcane waste (WSW)

Whole sugarcane waste is an end product of sugarcane juice, it is cheap and readily available, there is less competition by human. Sugarcane culture is responsible for generating, as a residue, the sugarcane bagasse (140 kg of bagasse are produced for every ton of sugarcane processed), and thus this is the most abundant lignocellulosic residue in Nigeria agriculture. The basic nutrient that cannot be compromised in the choice of ingredients for feed formulation and preparation is protein (Zeitler *et al.*, 1984), Fish meal is expensive, competitive and scarce. Due to these constraints, effort should be made sourcing cheaper and readily available substitute or replacement for the very expensive fishmeal in livestock feed formulation. Insects can be used as an alternative to fish meal. Grasshopper have a higher protein content compared with the conventional soybean and fishmeal available locally. The protein content of grasshopper meal ranges from 42.9-77.1%. In addition, grasshopper has an advantage in amino acid composition for poultry, especially due to its contents of lysine, methionine and cysteine and might constitute a new source of dietary nitrogen for poultry.

The objective of this study is to evaluate the performance of broilers fed fish meal and grasshopper meal in sugarcane waste feed.

ISSN NO: 2770-2936
Date of Publication:04-10-2021

Materials And Methods

Experimental site

This experiment was conducted at the poultry unit, University of Abuja Teaching and Research farm, Faculty of Agriculture, University of Abuja, Permanent Site, Federal Capital Territory (FCT). It lies between latitude $08^0$51 and $09^0$37N and longitude of $007^0$20 and $007^0$51 E and the land mass cover 65sq km (6500 hectares). Rainfall is moderate with annual total rainfall is approximately between 1100mm to 1650mm.

3.2 Source and processing of test ingredients

Discarded whole sugarcane waste was collected from sugarcane juice outlets at NEXT CASH AND CARRY and other outlets within Abuja. Roasted grasshoppers were purchased from Jos.

Collected whole sugarcane waste was chopped into smaller sizes with a knife, after which was dried for about 3 days to a moisture content of about 10%, which is then milled and incorporated into the experimental diets. The roasted grasshopper collected is sundried properly to avoid spoilage, after which it was grinded into powder. Imported Danish 72% fish meal was purchased.

3.4 Experimental animal and design

One-hundred-and-Eighty-day old unsexed day-old broiler chicks were used, this was purchased from a reputable hatchery. All the chicks were randomly allocated to the treatments, using a Completely Randomized Design (CRD). The chickens were kept in battery cage housing which was constructed in such a way that there are 6 dietary treatments and each diet had 3 replicates of 10 birds each. The cage was covered up with tarpaulin. The chickens were fed the experimental diets at 0, 5.0 and 10 percentage inclusion levels of the test ingredients for a period of 8 weeks (56 days). The cage was electrically heated using 200-watt bulbs per pen. The brooder temperature was maintained at about 32-35 °C for the first 7 days of age and monitored frequently for about 3 times per day (in the morning, during the day, and at night). Feed and clean water was provided *ad-libitum*. The cage was cleaned everyday and water trough was also washed daily to ensure proper cleaning.

Experimental Diets

Nine (9) experimental diets will be formulated in which WSW is fed at graded levels of 0, 5 and 10% with and without grasshopper meal and fishmeal. 9 diets with 3 replicates and 10 birds per replicate in a 3*3 factorial experiment is adopted such that there are 3 levels of sugarcane waste inclusion (0, 5 ,10) and three protein supplements (No supplement, fish meal and grasshopper)

Table 3.3: EXPERIMENTAL DIET (kg /100kg)

Ingredients	**Levels of WSW (%)**								
	0			**5**			**10**		
	T1	T2	T3	T4	T5	T6	T7	T8	T9
WSW	0	0	0	5	5	5	10	10	10
Fm	0	2.5	0	0	2.5	0	0	2.5	0
Gm	0	0	2.5	0	0	2.5	0	0	2.5
Maize	40	43	43	40	41.5	41.5	38	38.5	38
GNC	35	32	32	40	34.5	34.5	40.5	36.5	36.5
Wheat offal	19	16.5	16.5	6.5	8	8	0.5	1.5	2
Bone meal	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
Lime stone	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
Salt	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35
Vit premix	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Methionine	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15
Lysine	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15
Anti toxin	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Total	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**
Analyzed values									
Moisture	10.98	10.95	10.94	11.00	10.91	10.99	11.12	11.23	10.98

ISSN NO: 2770-2936
Date of Publication:04-10-2021

CP (%)	23.03	23.29	23.02	23.03	23.28	23.02	23.06	23.29	23.06
CF (%)	4.46	4.16	4.43	4.76	4.76	5.03	5.55	5.53	5.84
EE (%)	4.96	4.99	5.04	5.15	5.02	5.08	5.07	5.03	5.08
Ash	6.56	6.67	6.54	6.69	6.53	6.47	6.56	6.68	6.70
M. E (kcal/kg)	2652	2675	2680	2551	2715	2694	2698	2700	2672

*****Premix used contained the following per Kg: Vit. A, 7200 mg; Vit. D , 1600mg; Vit. E, 14400mg; Menadion, 800 mg; Thiamine, 720 mg; Riboflavin, 2640 mg; 2 3 Niacin, 12000 mg; Pyridoxin, 1200 mg; Vit B12, 6 mg; D-Pantothenic acid ,4000 mg; Folic acid, 400 mg; Biotin ,40 mg; Choline chloride, 100000mg; Antioxidant, 40000 mg. Supplied per Kg: Manganese, 40000 mg; Zinc ,33880 mg; Iron, 20000 mg; Copper, 4000 mg; Iodine, 400 mg; Choline chloride, 3 100000 mg.

Data collection and analysis

The initial live weight of the chicken was recorded at the commencement of the experiment. The weight gain was measured on weekly basis with the use of weighing balance likewise daily feed intake was measured throughout the experiment.

$$\text{Feed to gain} = \frac{average\ feed\ intake}{average\ weight\ gain}$$

$$\text{Percentage retention} = \frac{Nutrient\ intake - nutrient\ in\ excreta}{Nutrient\ intake} \times 100$$

Proximate analysis of nine dietary treatments was carried out, using the method described by Association of Official and Analytical Chemists (AOAC, 1990). Data collected were subjected to analysis of variance according to the method of Steel and Torrie (1980). Differences were considered to be significant at $P<0.05$ and the significant differences between means were separated using Duncan's new multiple range test.

Result

Growth performance of broilers fed Whole sugarcane waste with or without fishmeal and grasshopper supplementation is presented in Table 1 below. There was no significant effect of treatment on the initial body weight of birds. All the birds had comparable initial body weight which ranged between 43.78 and 44g. The treatment had significant effect ($P<0.05$) on the final body weight of the broilers. Birds fed 5% WSW had the highest ($P<0.05$) final body weight of 1521.67g while broilers on the 10% WSW had the lowest final body weight which was comparable to broilers fed 0% WSW. Broilers fed GHM supplemented diets gave the best final body weight which was higher than broilers on the FM diets; the final weights of birds fed with FM supplementation and No supplementation were comparable and showed no significant difference ($P<0.05$) It's obvious that birds on the supplementation diets of GHM had a better, higher final body weight than those on the FM supplemented and un supplemented diets. The control diets had the lowest ($P<0.05$) feed intake value. broilers fed 5% WSW had the highest feed intake value, while the birds fed 10% WSW had a feed intake value which was not significantly different ($P<0.05$) from broilers fed 0% and 5% WSW. The broilers on the GHM based diets had the highest ($P<0.05$) feed intake value of 67.78g/b/d, while the birds fed FM diet had significantly lower ($P<0.05$) feed intake value of 62.22g/b/d, birds fed no supplementation had the lowest feed intake value which was not significantly different from broilers fed FM supplementation. The broilers on the 5% WSW diets had highest ($P<0.05$) weight gain; birds on 10% WSW diet had the lowest weight gain value, birds on the control diets similarly had a rate of weight gain which was comparable ($P<0.05$) to the weight gain at 10% WSW inclusion. There were no significant effects of supplementation on the obtained rate of weight gain. GHM supplemented diet, FM supplemented diet and No supplementation diet weight gain values obtained were comparable.

ISSN NO: 2770-2936
Date of Publication:04-10-2021

The boilers on the 5% WSW diets had the best (P<0.05) feed to gain ratio of 2.58. This is comparable to 2.65 obtained on the birds fed the control diets but were significantly different (P<0.05) from birds on the 10 % WSW diets which had the poorest feed to gain ratio of 2.94. On supplement interaction, birds of the FM supplemented diets gave a better feed to gain ratio 2.66, which was highly comparable (P<0.05) to birds fed GHM with a feed to gain ratio of 2.68, while No supplement diet had the poorest feed to gain ratio of 2.70.

Table 1 GROWTH PERFORMANCE CHARACTERISTICS OF BROILERS FED WHOLESUGARCANE WASTE MEAL WITH OR WITHOUT FISH MEAL AND GRASSHOPPER SUPPLEMENTATION

	Initial weight	Final weight	Daily feed Intake	Weight gain	Feed to gain
0	44	1308.89^{b}	60.22^{b}	22.60^{b}	2.66^{b}
5	44	1521.67^{a}	67.44^{a}	26.40^{a}	2.55^{b}
15	44	1267.22^{b}	64.00^{ab}	21.84^{b}	2.93^{a}
SEM	0.000	46.43	1.20	0.82	0.60
SIG	NS	*	*	*	*
SUPPLEMENT					
NO SUPP	43.89	1300^{b}	61.67^{b}	22.43	2.75^{a}
FM	43.89	1340.55^{b}	62.22^{b}	23.15	2.69^{b}
GHM	43.78	1458.88^{a}	67.78^{a}	25.27	2.68^{b}
SEM	0.08	31.06	1.16	0.55	0.12
WSW*Supp interaction	NS	*	*	NS	*

Treatment means with different subscript along the same column are significantly different (p<0.05). WSCWM –Whole Sugar Cane waste meal FH –Fish Meal GHM – Grasshopper Meal SUPP –Supplement NS – not significantly different SEM- Standard error of mean SIG – Significance

Discussion

Utilization of WSW in livestock feed will go a long way in the improvement of the environmental and sanitary conditions of our cities; and particularly sugar cane producing and selling areas. This waste is just deposited on the floor, not packed and difficult to burn.

Feed intake significantly increased with the inclusion of WSW increased in the diet from 0 to 10%, this finding supports the report of Adeniji and oyeleke (2008) who also observed increased feed intake on all rumen content diets despite grit supplementation Adeniji, (2009) also made similar observation when PKC and grit were fed to pullet chicks WSW is high in fiber (19.77%) and fibers have been reported to increase feed intake. Birds fed 5% WSW had the highest (P <0.05) final body weight while broilers on the 10% WSW had the lowest final body weight which was comparable to broilers fed 0% WSW with final weight of 1308. 89g.The drop in final weight as WSW increased in the diet is due to the increased fiber level of the diets increased fiber level of the diet implies that less nutrients are available to the broilers at 10% WSW inclusion level; less nutrients for the broilers to convert to flesh. This is in agreement with the report of Oyawoye and Nelson (1998) that reduced digestibility of nutrient is due to high fiber levels in diets and this will result in reduced final weight. The birds were able to tolerate WSW at 5% inclusion level with the highest weight gain of 26.42g/b/d; the poorest weight gain of 21.85 g/b/d was recorded on birds fed 10% WSW, Similar to final weight, low weight gain at 10% inclusion is due to high fiber level of the diet implies that less nutrients are available to the broilers at 10% WSW inclusion level; less nutrients for the broilers to convert to flesh. This is in agreement with the report of Oyawoye and Nelson (1998) that reduced digestibility of nutrient is due to high fiber levels in diets and this will result in reduced weight gain. The highest Feed to gain ratio was obtained on the 5% WSW diets and this increased as the as the level of WSW increased in the diet. This shows that the broilers did not tolerate the higher 10% WSW. Owudike (1986) reported that increased fiber content of a diet reduces feed efficiency. Similarly, Oyawoye and Nelson

ISSN NO: 2770-2936
Date of Publication:04-10-2021

(1998) also observed reduced growth rate and efficiency due to poor utilization of nutrients as the fiber level in the diet increased.

FM supplemented diet gave the best feed to gain ratio which was highly comparable to GHM. This result agrees with Ravinder *et al*., (1996) who recorded no statistical difference in feed to gain ratio of fish meal and grasshopper meal in broiler diet, indicating that 100% of fishmeal can be replaced by grasshopper meal in broiler diet.

Conclusion

WSW is a promising feedstuff that is readily available and is a waste. It is not competed for by man, it is safe to use and can support the growth and production of broilers.

Whole sugar cane waste inclusion at 5% showed significantly higher weight gain due to higher feed intake, but increased inclusion of whole sugar cane waste at 10% did not translate into weight gain due to the high fiber content and poor utilization by the birds, this is in agreement with Suresh et al (2012) who reported that the inclusion of sugar cane press residue beyond 5% in broiler diet is not feasible. This research concludes that grasshopper meal can replace significant quantity of fish meal in broiler ration without compromising the economics of production. Grasshoppers which are known to have a high capacity for destroying farm crops and causing great financial losses to the farmers especially in the northern parts of Nigeria could be turned into a money-spinning livestock feed ingredient.

References

1. Adebayo, O.O. and R.G. Adeola, (2005). Socio- Economic Factors Affecting Poultry Farmers in Ejigbo Local Government Area of Osun State. *J. Hum. Ecol.*, 18(1): 39-41
2. Adeniji, A.A and jimoh, A. (2007). Effects of replacing maize with enzyme- Bovine Rumen content in the diets of pullet chicks. *International Journal of Poultry Science*. 6(11): 814-817.
3. Adeniji, A.A. and Oyeleke, M.M. (2008). Effects of dietary grit fed on the utilization of rumen content by pullet chicks. *Journal of Applied Sciences Research*, 4: 1257-1260
4. Adeyemo G O, Longe O G and Lawal H A. (2008). Effects of feeding desert locust meal (Schistocerca gregaria) onperformance and hematology of broilers (Abstract). Tropentag, Hohenheim. Retrieved February 18, 2017. www. tropentag.de/2008/abstracts/full/623.pdf.
5. Daghir N J. (2008). Poultry Production in Hot Climates. 2nd edn. CAB International Press, Wallingford, UK. 402 p.
6. Esonu, B.O., Azubuike, J.C., Udedibie, A.B.I., Emenalom, O.O., Iwuji, T.C. and Odoemenam, V., (2006): Evaluation of the nutritive value of mixture of fermented bovine blood and rumen digesta for broiler finisher. *Journal of Natural Sciences Research*, 4(1), 1–8. 2011.
7. FAO (2009). Revue du secteur avicole du Niger. 69 p. Organisation des Nations Unies pourl 'Alimentation et l'Agriculture, Rome, Italie.
8. Farrell D J. (2005). Matching poultry production with available feed resources: issues and constraints. *World's Poultry Science Journal* 61: 298–307.
9. Hassan AA, Sani I, Maiangwa MW, Rahman SA. (2009). The effect of replacing graded levels of fishmeal with grasshopper meal in broiler starter diet. PAT. 5(1):30–38.
10. Oladokun,V.O and Johnson, A. (2012)DIET formulation problem in Nigeria poultry farms; a mathematical programming approach. *Am. J. Sci. Ind. Res*, 2012, 3(1): 14–20.
11. Onu, P. N.; Okongwu,S. N.(2006). Performance characteristics and nutrient utilization of starter broilers fed raw and processed pigeon pea (Cajanus cajan) seed meal. Int. J. Poult. Sci., 5 (7): 693-697.
12. Van Huis A. (2013). Potential of insects as food in assuring food security Annu. Rev. Entomol. 58, pp. 563-583.
13. Wang D, Zhai S-W, Zhang CX, Zhang Q, Chena H. (2007). Nutrition value of the Chinese grasshopper *Acrida cinerea* (Thunberg) for broilers. *Anim Feed Sci Technol*. 135:66–74. doi: 10.1016/j.anifeedsci.2006.05.013