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Blood and Serum Biochemical Parameters of Broiler Chickens Fed White Sorghum and Maize Based Diet

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Abstract

Study was conducted to evaluate the blood and serum biochemical indices of broiler chickens fed white sorghum and maize diets, a total of two hundred broiler chickens were used for the study, the chickens were randomly allotted to the five dietry treatment of different white sorghum levels with maize as control. The result shows that all the haematological parameters such as Packed cell volume (PCV), Haemoglobin concentration (Hb),Mean corpular volume (mcv)mean corpuscular haemoglobin (MCH) ,and mean corpular haemoglobin concentration (MCHC) were not significantly affected by the dietary treatments .Also all the serum biochemical indices such as Total protein, Total cholesterols, Albumins and glucose analysed were not significantly affected by the dietary treatmens.It is therefore concluded that sorghum can effectively replace maize in poultry diet upto 100%.It is therefore recommended that poultry farmers should use white sorghum in place of maize when formulating poultry diet, due its lower cost.

Key Words: Blood, Serum, Biochemical, Broiler Chickens, Sorghum, Maize.

Introduction

Feed cost remains the most challenging factor in livestock business world over. Maize is the mainstay source of energy in sub Saharan African countries including Nigeria, in commercial broiler rations, and contributes more than 60% of the ration in diets of monogastric animals (Jama'a, *et al*. 2024). Maize is also a staple feed for most people in Nigeria and its use as animal feed create a competition that inflate price in the market. As a result, commercial and subsistence poultry farmers encounter high feed costs resulting in unprofitable business. Thus, to reduce feed cost and increase profit margin, formulating feed using cheap and locally available ingredients like

sorghum is essential. Tamburawa *et al.* (2012) also suggested that increase in prices of maize necessitates the use of other energy sources such as sorghum and millet in order to reduce the cost of production. Sorghum (*Sorghum bicolor*) is abundant in most parts of Nigeria and is among the main cereal crops because of its tolerance to harsh climatic conditions. Sorghum has a similar energy value to maize therefore it can be used as an energy source in broiler feed (Hidayat *et al.*, 2022). Etuk *et al.* (2012) stated that compared to maize sorghum has a higher protein content, but conversely, the energy and fat contents of maize are relatively higher than sorghum, while the amino acid contents in sorghum are comparable to maize. The lysine digestibility of sorghum has been reported to be similar to that of maize (Da silva *et al.*,2018). Red/brown sorghum, sometimes called bird-resistant often contain anti-nutritional compounds that render their use in monogastrics feeding limited (Myer *et al*., 2007). However, different studies by Osman and Gassem, 2013 and Mohammed *et al*., 2019 have found that body weight decreased significantly in chickens fed sorghum-based diets. The negative effects of sorghum in animal performance are understood to come from anti-nutritional factors (ANFs) such as tannin, karfirn and phytate that affect efficient nutrients utilisation (Hariprasanna *et al*., 2015) and metabolism (Hamid *et al*., 2017). Hancock *et al.*, (2020) proposed that adequate processing improved the nutritive value of sorghum in poultry levels similar to that of maize.

Study Location

The research was conducted at the poultry units of Teaching and Research Farm of the Department of Animal Production, Abubakar Tafawa Balewa University Bauchi, Bauchi State during the months of May and July 2023. Bauchi lies between longitude $10^{0}10^{1}$ to 30^{1}N and latitude 9041 and 10^{0} 31^{1}E at an altitude of 6902 meters above sea level (BSADP, 2015).

Experimental Diets

Five diets were formulated for the feeding trial. White sorghum replaced maize at 0%, 25%, 50%, 75% and 100% levels in the diets and was designated as treatments 1, 2, 3, 4 and 5. Other ingredients used in the formulations were fish meal, bone meal, limestone, salt, broiler starter/finisher premixes, lysine, methionine, wheat offal and soybean.

Experimental birds and their management

Two hundred (200) day-old broiler chicks were used for the research. Before their arrival, brooding room was adequately prepared. Heat was provided using charcoal and kerosene stove. Anti – stress was given in their drinking water the first day and there after feed and fresh water were supplied *ad-libitum*. After seven days brooding, the birds were randomly allotted to the five (5) diets. Each treatment was replicated four times with ten (10) chicks per replicate in a completely randomised design totalling to forty chicks per treatment. The feeding trial lasted for eight (8) weeks with four weeks each of starter and finisher phases. Fresh drinking water and feeds were given *ad-libtum*. All vaccinations and other routine activities were carried out at their appropriate times.

DATA COLLECTION

Blood samples was collected from 25 randomly selected birds (one per replicate) and analyse haematological and biochemical parameters. The blood sample was collected through the wing veins before slaughtering. Five (5) millimetre (ml) of blood was collected from each bird into sample bottle containing ethylene diametetra acetic acid (EDTA) as anticoagulant. The haematological parameters determined were Red blood cell (RBC),packed cell volume (PCV), mean corpuscular volume(MCV)

mean corpuscular haemoglobin concentration (MCHC),and mean corpuscular haemoglobin (MCH). serumbiochemicalpaametersrTotalproteins,glucose,Bloodurea,alkalinephosphate,iron, calcium,phosphorus,phosphate,magnesium and cholesterols

DATA ANALYSIS

Data generated were subjected to analysis of variance using MINITAB 17 VERSION and where significant differences exist among the means, Duncan Multiple Range Test was used to separate them.

Table 1: Percentage and Proximate Compositions of Experimental Diets at Stater phase

Ingredients	D1(0%)	D2(25%)	D3(50%)	D4(75%)	D5(100%)
White maize	50.64	37.98	25.32	12.66	0.00
Local white sorghum	0.00	12.60	25.32	37.98	50.64
Soybean meal	30.66	30.66	30.66	30.66	30.66
Wheat offal	10.00	10.00	10.00	10.00	10.00
Fish meal	5.00	5.00	5.00	5.00	5.00
Bone meal	2.00	2.00	2.00	2.00	2.00
Lime stone	1.00	1.00	1.00	1.00	1.00
Lysine	0.10	0.10	0.10	0.10	0.10
Methionine	0.10	0.10	0.10	0.10	0.10
Salt	0.25	0.25	0.25	0.25	0.25
Premix	0.25	0.25	0.25	0.25	0.25
Total	100	100	100	100	100
Calculated Analysis (%)					
Crud Protein (%)	23.00	2.00	23.00	23.00	23.00
ME (Kcal/kg)	2808.48	2791.77	2775.06	2758.35	2743.29
Crude Fiber (%)	3.91	3.91	3.91	3.91	3.91
Calcium (%)	0.31	0.39	0.39	0.39	0.39
Phosphorus (%)	0.41	0.44	0.47	0.49	0.53
Lysine (%)	1.30	1.31	1.33	1.34	1.35
Methionine (%)	0.39	0.38	0.37	0.36	0.35

Table 2: Percentage and Proximate Compositions of Experimental Diets at Finisher

Ingredients	D1 (0%)	D2(25%)	D3(50%)	D4(75%)	D5(100%)
White maize	54.95	41.21	27.47	13.74	0.00
Local white sorghum	0.00	13.74	27.47	41.21	54.95
Soybean meal	25.15	25.15	25.15	25.15	25.15
Wheat offal	12.00	12.00	12.00	12.00	12.00
Fish meal	3.00	3.00	3.00	3.00	3.00
Bone meal	2.50	2.50	2.50	2.50	2.50
Lime stone	1.50	1.50	1.50	1.50	1.50
Salt	0.25	0.25	0.25	0.25	0.25
Premix	0.25	0.25	0.25	0.25	0.25
Lysine	0.20	0.20	0.20	0.20	0.20
Premix	0.25	0.25	0.25	0.25	0.25
Total	100	100	100	100	100
Calculated Analysis					
ME (Kcal/kg)	2804.71	2786.58	2768.11	2750.32	2732.18

Ingredients	D1 (0%)	D2(25%)	D3(50%)	D4(75%)	D5(100%)
Crude protein (%)	20.00	20.00	20.00	20.00	20.00
Crude fiber (%)	3.78	3.78	3.78	3.78	3.78
Calcium (%)	0.25	0.25	0.25	0.26	0.27
phosphorus (%)	0.33	0.36	0.39	0.42	0.45
lysine (%)	1.08	1.09	1.11	1.13	1.12
Methionine	0.33	0.32	0.31	0.29	0.29

Table 3: Laboratory Analysis of the Experimental Diets (starter)

Sample Description	D_1	D_2	D_3	D_4	D_5
DM%	88.90	89.23	89.24	89.48	88.48
Ash%	9.83	10.64	10.69	10.92	10.92
Cp%	22.54	23.02	23.16	23.11	22.63
EE%	8.54	8.69	8.89	8.98	8.59
CF%	6.49	6.23	6.19	6.13	6.32

Table 4: Laboratory Analysis of the Experimental Diets (finisher)

Sample Description	D_1	D_2	D_3	D_4	D_5
DM%	89.56	90.16	89.11	88.66	88.61
Ash%	7..29	7.16	6.63	6.58	6.89
CP%	19.49	19.51	18.84	20.13	19.52
EE%	7.53	6.89	7.11	7.29	7.23
CF%	5.41	5.40	5.49	5.30	5.35

Table: 5 Laboratory Determined Proximate Compositions of White Sorghum

DM	Ash	CP	EE	CF
89.74	1.72	11.39	1.83	2.34

RESULTS

Table 6: Serum Biochemical Parameters of Broiler Chickens Fed White Sorghum and Maize Based Diets

Parameters	Diets					
	1	**2**	**3**	**4**	**5**	**SEM**
Total protein (g/dl)	7.18	7.33	7.50	6.63	7.30	0.37^{NS}
Total cholesterol (mmol/L)	4.86	4.99	5.28	5.32	5.08	0.21^{NS}
Albumin (g/dl)	3.16	3.38	3.05	3.40	3.23	0.31^{NS}
Glucose (mmol/l)	4.30	4.58	5.83	5.51	5.73	0.67^{NS}

Ns= Not significant, SEM= Standard error of the mean.

Table 7: Serum Haematology of Broiler Chickens Fed White Sorghum and Maize Based Diets

Parameters	Diets					
	1	**2**	**3**	**4**	**5**	**SEM**
PCV (%)	31.30	33.15	29.83	32.70	32.38	2.14^{NS}
Hb (g/dl)	10.42	11.05	9.93	10.90	10.78	0.71^{NS}
MCV(FL)	148.98	146.25	144.15	141.32	146.13	3.57^{NS}
MCHC(g/dl)	42.75	41.45	43.65	40.08	137.05	41.28^{NS}
MCH (pg)	67.78	60.95	64.85	65.78	63.73	3.52^{NS}

Ns= Not significant, PCV= packed cells volume, Hb= Hemoglobin, mean corpuscular volume, MCHC= Mean corpuscular hemoglobin concentration MCH=Mean corpuscular hemoglobin.

DISCUSSION

The result of the haematological and serum biochemical parameters shows that there is no significant difference in the parameters observed .This result shows that sorghum can effectively replace maize in broiler feed production without any adverse effects on the haematology and serum biochemistry of the birds ,this finding agrees with the findings of Jama,a ,et al (2023) who reported sorghum can replace maize up to 75% in the poultry diet, also Ibitoye ,et al (2012) reported that yellow sorghum can effectively replace maize up 80% without any adverse effects on the haematology and serum biochemistry of the births. Also the findings agrees with the result obtained by Issa, et al (2012)l and Doma (2013).

CONCLUSION/RECOMMENDATION

It is therefore concluded that sorghum can effectively used in the broiler diet production as a replacement to maize, without compromising lives of the broiler chickens. It therefore recommended that sorghum be used in formulating diets for poultry in place of maize because it less expensive.

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