Influence of White Sorghum Soaked in Wood Ash Extract on Growth Performance of Pullets and Growers Layers

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Abstract
An experiment was conducted to investigate influenced of feeding varying levels of white sorghum soaked in wood ash extract on performance of chicks and growing pullets. A total of 144 day-old pullets were bought from a reliable hatchery, birds were placed in a deep litter compartment, brooded and reared for eighteen (18) weeks. Thirty six (36) birds each were randomly selected, weighed and allocated to each of the four treatment diets (1, 2, 3 and 4) in a completely randomized designed (CRD). Each treatment group was divided into three duplicates of 12 birds each. All parameters examined (final weight, daily weight gain, daily feed intake, feed conversion ratio (FCR) and protein efficiency ratio (PER) were significantly ($P<0.05$) influenced by the experimental diets at both pullets and growing stages of the experiment except PER that was not significantly ($P>0.05$) affected at growing phase. Conclusively, White sorghum soaked in wood ash extract showed compared favourably with the Maize. Pullet chicks (0-9 weeks) and growing pullets (9-18 weeks) fed up to 75% level of white sorghum soaked in wood ash extract enhanced performance. Therefore, soaked sorghum in wood ash extract up to 75% inclusion levels of growing pullets is recommended in the pullets layers mash.

Keywords: Soaked, white sorghum, wood ash extract, maize, pullets and growth performance

1. Introduction

With continuous growth in poultry production, demand for energy and protein-rich feed ingredients keep rising. Maize is the dominant cereal grain in global poultry feed and remains the most widely used feed grain [1] However, fluctuating maize prices and supply issues, driven partly by its use for ethanol biofuel, have pushed interest toward alternative grains. Sorghum grain is one such crop less common now but gaining traction.

Sorghum (*Sorghum bicolor L. Moench*) ranks as the world's fifth most-produced cereal by volume, after wheat, rice, maize, and barley, and it serves as a key food and feed crop across many regions globally [2]. Its widespread use is driven by strong drought tolerance [3], high yield potential [4] and diverse industrial uses. The crop supports a broad range of food [5], industrial [6], and bioenergy applications [7].

Compared with maize, sorghum survives extended dry periods with minimal crop damage. Modern hybrids have also been bred for low levels of anti-nutritional compounds, particularly tannins [8], allowing higher inclusion rates in broiler diets [9] without reducing performance. In addition, low-tannin

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sorghum varieties benefit poultry health due to bioactive compounds such as phytosterols, anthocyanins, tannins, and phenolic acids [10]. Low tannin levels have also been linked to improved gut health [11] and better digestive efficiency in broilers [12]. Despite these advantages, many poultry producers still avoid sorghum-based diets.

2. Materials and methods

2.1 Experimental site

The feeding trial comprised of the growing and laying phases of birds was carried out in the Livestock Teaching and Research Farm's Poultry Unit, Faculty of Agriculture, Ambrose Alli University Ekpoma, Esan West Local Government Area of Edo State, Nigeria. Located in Nigeria's tropical derived savannah rain forest vegetation area between longitudes 6.440N and 6.080NE, with a mean ambient temperature ranging from 260°C in December to 340°C in February and an average relative humidity of 61 percent in January and 92 percent in August.

2.2 Experimental diets

Four experimental chicks and grower diets were formulated, diet one (1) contained 100 percent maize (control), while diets 2, 3, and 4 substituted the percentage proportion of maize with white sorghum soaked in wood ash extracts meal at levels of 25, 50, and 75 (%) respectively. Diets were iso-nitrogenous (14.5% crude protein) and iso-caloric (2500kcal/kg) as reflected in Tables 1 and 2.

Table 1. Composition of the Experimental Chicks Mash (0-8 Weeks) as Affected by White Sorghum Soaked in Wood Ash Extract

Inclusion Levels of WSSWAE (%)				
	0	25	50	75
Diets				
Ingredients (%)	1	2	3	4
Maize	58.79	44.09	29.40	14.70
White sorghum	0.00	14.70	29.40	44.09
Soya bean meal	31.00	30.34	30.46	30.60
Fish meal	1.50	1.50	1.50	1.50
Wheat offal	2.65	2.65	2.65	2.65
Bone meal	3.95	4.17	4.04	3.91
Lysine	0.50	0.50	0.50	0.50
Methionine	0.50	0.50	0.50	0.50
Salt	0.30	0.30	0.30	0.30
Biomix (Broiler)	0.25	0.25	0.25	0.25
Total	100.00	100.00	100.00	100.00
Calculated analyses (%)				
Crude protein	20.00	20.11	20.32	20.40
Crude fiber	3.50	3.50	3.53	3.57
Ether extract	3.30	3.21	3.11	3.01
Calcium	1.00	1.05	1.03	1.02
ME (Kcal/kg)	3000.00	3000.00	3000.00	3000.00

Broiler premix Vit. A, 10,000 I.U; Vit D 2000 I.U; Vit E 23mg; Vit K, 2mg; Calcium, Pantothenate, 7.5mg B12, 0.015mg, folic acid, 0.75mg; Choline Chloride, 300mg; Vit B, 1.8mg, Vit. B_2, 3mg; Manganese, 40mg; iron, 20mg; Copper, m3g; Iodine, 1mg; cobalt, 0.2mg; Selenium, 0.2mg' Zinc, 50mg, WSSWAE= White Sorghum Soaked in Wood Ash Extract; ME= Metabolizable Energy

Table 2. Composition of the Experimental Grower Diets (9-18weeks) fed graded level of white Sorghum soaked in wood ash extract

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Inclusion Levels of WSSWAE (%)				
	0	25	50	75
Diets				
Ingredients (%)	1	2	3	4
Maize	45.00	33.75	22.50	11.25
Sorghum	0.00	11.25	22.50	33.75
Soya bean meal	14.00	14.00	14.00	14.00
Groundnut cake	4.45	4.45	4.45	4.45
Wheat offal	30.00	30.00	30.00	30.00
Limestone	3.00	3.00	3.00	3.00
Bone meal	3.00	3.00	3.00	3.00
Salt	0.30	0.30	0.30	0.30
Biomix (grower)	0.25	0.25	0.25	0.25
Total	100.00	100.00	100.00	100.00
Calculated analysis (%)				
Crude protein	14.50	14.50	14.50	14.50
Crude fiber	5.00	5.00	5.00	5.00
Ether extract	4.00	4.00	4.00	4.00
Calcium	1.20	1.20	1.20	1.20
ME (Kcal/kg)	2500.00	2500.00	2500.00	2500.00

Premix grower: Vitamin A, 12,000,000 IU; Vitamin D3 2,000, 000 IU; Vitamin E 7,00 IU; Vitamin B12 10 mg; Nicotinic acid 15,000 mg; Calcium d-pentothenate 8,000 mg; Biotin 40 mg; Vitamin B12 10 mg; Min 20,000 mg; Fe 50,000 mg; Zn 100,000 mg; Cu 10,000 mg; Iodine 750mg; Co 3000 mg; WSSWAE= White Sorghum Soaked in Wood Ash Extract; ME= Metabolizable Energy

3.4 Birds management and experimental design

A total of 144 day-old pullets were bought from a reliable hatchery, birds were fed chicks marsh for seven weeks in a deep litter compartment and brooded for four weeks. Thirty six (36) birds each were randomly selected, weighed and allocated to each of the four treatment diets (1, 2, 3, and 4) in a completely randomized designed (CRD). Each treatment group was divided into three duplicates of 12 birds each. The birds were reared on deep litters system and fed experimental diets (1, 2, 3 and 4) for 18 weeks. All recommended health routine practices was strictly observed.

2.4 Data collections

2.4.1 Growth performance at chicks and growing stages of the experiment

During the feeding trial, the pullet chicks and growers birds were weighed at the start of each stage of the experiment and then weekly and feed consumption were recorded appropriate. To evaluate the birds' growth performance, weight increase, feed intake, feed conversion ratio (FCR), and protein efficiency ratio (PER) were calculated. Weight increase was measured by subtracting the final weight from the initial weight FCR and PER was calculated using the formulae:

$$\text{FCR} = \frac{\textit{Feed intake (g)}}{\textit{Weight gain (g)}}$$

$$\text{PER} = \frac{\textit{Weight gain/week}\,(g)}{\text{Pr}\textit{otein}\ \text{intake/}\textit{week}\,(g)}$$

2.5 Statistical analysis

The results obtained were subjected to a one-way analysis of variance (ANOVA). All statistical procedures were according to [13]. Differences between mean were separated using [14] Duncan's Multiple Range Test (DMRT) at 5% level of probability.

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3.6 Results and discussion

3.6.1 Results

The performance of pullet chicks (1-8 weeks) fed graded levels of sorghum soaked in wood ash extract is presented in Table 4. All the parameters examined were affected significantly (P<0.05) by the experimental diets. Pullets fed T1 had the highest (P<0.05) final weight (547.74 g/bird) which was comparable to those fed T3 (541.40 g/bird), followed by T2 (510.00 g/bird) while those fed T4 had the least (473.07 g/bird) final weight. The daily weight gain followed the same pattern with that of the final body weight with the highest (P<0.05) value (6.91g/bird) obtained in birds fed T1. The feed intake was significantly (P<0.05) increased in birds fed T1 (34.1), which compared favorably with that of T3 (6.83g/bird) followed by T2 (6.38g/bird) and lowest in T4(5.86g/bird) which is similar to those fed T3 (33.08), followed by T2 (31.73) but the lowest daily feed intake was obtained in birds fed T4 (27.75 g/bird). The FCR was significantly higher (P<0.05) in birds fed on T2 (4.97) but comparable to those fed T1 (4.94), which was followed by comparable values of 3.84 and 4.74 in birds fed T3 and T4 respectively. Birds that consumed T4 significantly (P<0.05) had the highest (1.46). PER followed by 1.42, 1.40 and 1.39 respectively obtained in T3, T1 and T2 but were statistically the same.

Table 4: Performance of Pullet Chicks (1-8 weeks) Fed Graded Level of White Sorghum Soaked in Wood Ash Extract

	Inclusion levels of WSSWAE (%)				
Parameters	**0**	**25**	**50**	**75**	
	1	**Diets 2**	**3**	**4**	**SEM±**
Initial weight(g/bird)	63.90	63.25	63.56	63.44	0.93
Finial weight (g/bird)	547.74[a]	510.00[b]	541.40[a]	473.40[c]	4.15
Weight gain (g/bird/day)	6.91[a]	6.38[b]	6.83[a]	5.86[c]	0.12
Feed intake(g/bird/day)	34.10[a]	31.73[b]	33.08[a]	27.75[c]	0.55
FCR PER	4.94[a] 1.40[b]	4.97[a] 1.39[b]	4.84[b] 1.42[b]	4.74[b] 1.46[a]	0.07 0.01

[abc]: Means in the same row with varying superscripts differ significantly (P<0.05); SEM= Standard error of mean; PCR= Protein Conversion Ratio; PER= Protein Efficiency Ratio

WSSWAE= White Sorghum Soaked in Wood Ash Extract

The results of pullet grower stage, experimental diet is presented in Table 5. Among all parameters examined, dietary treatments had a significant (P<0.05) influence on final weight, daily weight gain, daily feed intake and FCR but not on PER. The birds fed T1 basal diet had highest (P<0.05) final weight (890.60g/bird) followed by those on T3 (881.80g/bird) which was comparable to T4 (879.60g/bird) while those on T2 had the least (865.80g/bird) final weight. Also, the daily weight gain was highest (P<0.05) in birds maintained on T4 (6.45g/bird) compared to 5.64,5.43 and 5.40g/bird in birds that that had T2,T1,and T3 respectively which were not statistically different from one another. In terms of daily feed intake, the pullets maintained on T1 had the most significant (P<0.05) value (34.31g/bird) followed by

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T3(33.08g/bird), T4(31.04g/bird) while T2 had the least value of (27.75g/bird)). The greatest feed conversion ratio (P<0.05) was found in T1 (6.31), which has comparable to those fed T3 (6.12), followed by those fed T2 (4.92) while the least FCR was obtained from birds fed T4 (4.81). PER of birds were not significantly (P<0.05) varied by the dietary treatments values of 1.43, 1.40, 1.13 and 1.09 were obtained in birds fed T4, T2, T3 and T1 respectively.

Table 5: Performance of Growing Pullet (9-18 Weeks) Fed Graded Level of Sorghum Soaked in Wood Ash Extract

	Inclusion level of WSSWAE (%)				
Parameters	**0**	**25**	**50**	**75**	
	Diets				
	1	**2**	**3**	**4**	**SEM±**
Initial weight(g/bird)	**547.74**	**510.00**	**541.40**	**473.40**	**0.22**
Finial live weight (g/bird)	**890.60^{a}**	**865.80^{c}**	**881.80^{ab}**	**879.60^{b}**	**38.42**
Daily weight gain(g/bird)	**5.43^{b}**	**5.64^{b}**	**5.40^{b}**	**6.45^{a}**	**10.92**
Daily feed intake (g/bird/day)	**34.31^{a}**	**27.75^{d}**	**33.08^{b}**	**31.04^{c}**	**0.05**
FCR	**6.31^{a}**	**4.92^{b}**	**6.12^{a}**	**4.81^{b}**	**0.03**
PER	**1.09**	**1.40**	**1.13**	**1.43**	**0.02**

^{abc}: Means in the same row with varying superscripts differ significantly (P<0.05); SEM= Standard error of mean; PCR= Protein Conversion Ratio; PER= Protein Efficiency Ratio

WSSWAE= White Sorghum Soaked in Wood Ash Extract

3.7 Discussion

The performance characteristics of pullet chicks fed diets containing white sorghum soaked in wood ash extract revealed that final live weight, weight gain, feed intake, FCR and PER were significantly affected by dietary treatments. During the pullet chick phase, the average live weight and weight gain were highest in T_1 and comparable to T3. Birds fed the control diet and T_3 had feed intake than those on the other treatments. Feed utilization was improved in birds consuming T_3 and T_4 compared to those fed T_1 and T_2. The inclusion of graded levels of white sorghum soaked in wood ash extract at 75% significantly improved protein utilization relative to the other treatment groups. The significantly dietary effect on feed intake in T1 and T3 may indicate the birds' greater capacity to tolerate low or negligible levels of anti-nutrient substances in the diet, leading to improved nutrient utilization and higher weight gain. Lower body weight and better FCR in chicks fed T_4 correspond with [15], who reported that low tannin content in sorghum-based diets had efficiency similar to corn-based diets.

These results indicate significant differences in final body weight gain, especially in T_1 and T_3 compared to other treatments, which may contribute to earlier onset of lay and greater egg production. This could be attributed to improved energy availability, increase feed intake and enhanced nutrient digestibility which agree with the report of [16], who reported that low-tannin sorghum did not depress growth performance. The similar values recorded in T_1 and T_3 are also consistent with [17] who found no significant difference in body weight of chicks, fed low-tannin sorghum diets. The feed conversion ratio (FCR) and protein efficiency ratio (PER) were best in pullets fed the control diet but were comparable to those in T3, which agrees with [18], who reported that replacing yellow corn with low-tannin sorghum at a 50% inclusion level did not affect FCR in broiler diets. The improved performance on T_3 may

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also be attributed to the high nutritive value of soaked sorghum in wood ash extract, suggesting that pullets tolerated this inclusion level without adverse effects. Therefore, white sorghum soaked in wood ash extracts reduced tannins content and improving the nutritional quality and bioavailability to the grain [19].

3.8 Conclusion

Soaking Sorghum in wood ash showed no inferiority with the Maize. Pullet chicks (0-9 weeks) and growing pullets (9-18 weeks) fed up to 75% level of white sorghum soaked in wood ash extract enhanced performance. Therefore, soaked sorghum in wood ash extract up to 75% inclusion levels of growing pullets is recommended in the pullets layers mash.

3.9 References

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