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PERFORMANCE AND NUTRIENT UTILIZATION OF BROILERS FED MALTED SORGHUM SPROUT (MSP) OR WHEAT-OFFAL BASED DIETS SUPPLEMENTED WITH YEAST CULTURE AND ENZYME

Florence Oluwakemi OKE[1], Adeboye Olusesan FAFIOLU[2], Adebayo Vincent JEGEDE[2], Oluwatosin Oluseye ODUGUWA[2], Samson Adewale ADEOYE[2], Rotimi Adewale OLORUNSOLA[3], Abimbola Oladele OSO[2], Gbolabo Olaitan ONASANYA[1], Ayodeji Oluwatosin ADEDIRE[4], Aliyu Ibrahim MUHAMMED[1]

[1]*Department of Animal Science, Federal University Dutse, Jigawa, Nigeria.*
[2]*Department of Animal Nutrition, Federal University of Agriculture, Abeokuta, Nigeria.*
[3]*Department of Biological Science, State University of Science and Technology, Okitipupa, Nigeria.*
[4]*Department of Agriculture, Wesley University of Science and Technology, Ondo, Nigeria.*

*Email: florenceobadire@gmail.com

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ABSTRACT*:* An experiment was conducted on a total of two hundred and forty day- old, unsexed Marshal Broiler chickens which were randomly allotted to 8 dietary treatment groups of 30birds each. Each treatment group was replicated 3 times with 10 birds per replicate. The experiment was a 2×4 factorial consisting of two test ingredients (MSP and wheat offal) at 4 levels (0 g kg-1 yeast and enzyme, + 0.01 gkg-1 yeast and enzyme, +0.013 gkg-1 yeast, +0.01 gkg-1 enzyme). At the end of the trial, the effect of MSP and wheat offal with 0.01g/kg-1yeast and those on 0.01 g/kg-1 yeast + 0.01 g/kg-1 enzyme inclusion showed a significant effect (P<0.05) for final live weight, weight gain, feed intake and feed conversion ratio and fibre retention. Broiler starter Chickens fed MSP diets had lower (P<0.05) final live weight, weight gain, feed intake and fibre retention than those fed wheat offal based diets irrespective of the additives. However, finishing broilers fed wheat offal diet supplemented with 0.01 g/kg-1 yeast and those on 0.01 g/kg-1 yeast + 0.01 g/kg-1 enzyme recorded a higher (P<0.05) final live weight, weight gain, protein retention and NDF retention than MSP diets. Conclusively, Inclusion of yeast + Enzyme improved protein retention, fat and fibre digestibility. The combination of yeast and Roxazyme enzyme improved the utilization of wheat offal (w/o) and Malted sorghum sprout (MSP) based diets by broiler chickens. It is therefore recommended that MSP supplementation with yeast + enzyme or enzyme singly could be used to improve Livestock rations for better performance.

Keywords: Nutrition, Performance, Broiler, Malted Sorghum Sprout.

INTRODUCTION

In livestock production, modern techniques have enhanced rapid productivity within a very short period of time. This makes the development of poultry industry the fastest means of bridging the protein deficiency gap prevailing in developing countries. Consequently, more problems have arisen in the industries. The major problem so far is how to meet up with the nutritional requirements of the birds. Likewise, increase in cost of conventional feedstuff for basal energy and protein in poultry have encouraged inadequate concentrate feeding and low productivity in poultry production. However, high competitive rate of demand for grains especially maize has made it imperative to supplement with other non- conventional feed ingredients such as malted Sorghum Sprouts (MSP). MSP has prospects as a feed resource (Oke et al., 2012; Fafiolu et al., 2006). Nutritional evaluation of MSP showed that it contained 226, 224, 33 and 522g/kg of crude protein, neutral detergent fibre, ether extract and nitrogen free extract, respectively (Aning et al., 1998; Oduguwa et al., 2007). Oke (2012) reported a crude protein, ether extract, ash, NDF, ADF and ADL values of 163.7, 38.2, 62.70, 147, 217, 103 g/kg, respectively for MSP.

Successful utilization of MSP to a limited extent in rats (Oduguwa et al., 2001), dairy cow (Morrison, 1984) and growing pullets (Fafiolu et al., 2006) has been reported in previous studies. However, the nutritional prospect of MSP as feedstuff for poultry is limited due to its tannin content and non-starch polysaccharides (NSP) (Elkin et al., 1995; Fafiolu, 2003; Oduguwa et al., 2001). Inhibitory effects of dietary tannin and arabinoxylan (Balogun et al., 2005) on intestinal digestive enzymes, nutrient digestibility and growth of poultry have been reported. Recent studies have shown that dietary manipulations such as inclusion of certain feed additives could go a long way to ameliorate the negative effects created in erstwhile denigrated feed ingredients. Enzyme supplementation of cereal based diets improved ileal nitrogen, AME, digestion of dietary starch, fibre, protein and lipid in poultry (Bedford and

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Schulze, 1998; Choct et al., 1999). In a similar manner, yeast and its extracts have been reported in literatures to promote growth, improve nutrient digestibility and stimulate birds' immune systems (Abel and Czop, 1992). These beneficial actions recorded following inclusion of yeast have been linked with the β-1,3 or 1,6 glucans structure present in yeast which stimulate immune modulator substances in animals (Abel and Czop, 1992; Parks et al., 2001). This study therefore seeks to evaluate the effect of yeast and enzyme supplementation on the utilization of malted sorghum sprout or wheat offal based diets by broiler chickens.

MATERIAL AND METHODS

Experimental site

The research work was carried out at the poultry unit of the Teaching and Research Farms, Federal University of Agriculture, Abeokuta, Ogun State Nigeria (Latitude7113′ 49.46″N andLongitude3126′11.98″E).

Experimental birds and housing

Two hundred and forty day –old broiler chickens were obtained from a commercial hatchery and reared intensively on deep litter housing system. The birds were divided into 8 groups of 10 birds replicated 3 times and were allocated to 8 experimental diets .The birds were given the experimental diets from day-old and were fed *ad libitum* until mature weight at 8 weeks of age. The commercial enzyme used contained cellulose (EC.3.2.1.4), beta-glucanase (EC.3.2.1.6) and xylanase EC (3.2.1.8) and was added at the rate of 10g/100kg diet and yeast also at 10g/100kg diet.

Experimental design and Dietary treatment

The experiment was a 2 by 4 factorial design made of 2 factors (MSP and WF) and 4 levels (–Y-E, +Y, +E and +Y+E). MSP was used to replace wheat offal (WF) contained (150g/kg) in broiler finisher diet formulated. Eight diets were formulated such that each MSP and WF was supplemented with yeast (+Y), enzyme (+E) or a combination of yeast and enzyme +Y+E) while unsupplemented diet (-Y-E) stands for control. Two hundred and forty (240) day –old broiler chickens were divided into 8 groups of 10 birds replicated 3 times and were allocated to 8 experimental diets .The birds were given the experimental diets from day-old and were fed ad libitum until mature weight at 8 weeks of age. The commercial enzyme used was added at the rate of 10g/100kg diet and yeast also at 10g/100kg diet.

DATA COLLECTION

Growth performance: Feed intake was computed as the difference between the feed offered and leftovers. Gain in weights and feed intake were measured at weekly intervals. Feed to gain ratio was computed as the ratio of feed consumed to weight gain. A record of mortality was kept as it occurred.

Metabolic trial: Metabolic trial was conducted at the 3rd and 7th week of experiments, 2 birds per replicate were randomly selected and housed separately in appropriate metabolic cages fitted with individual feed troughs and facility for separate excreta collection. A two-day acclimatization period was allowed prior to the commencement of 3 days metabolic trial. Known weight of feed (slightly above the respective daily requirements) was fed to the birds housed in individual metabolic cages. Excreta collected per bird per day (for three days) were oven dried (60oC) and used for subsequent laboratory analyses. Proximate composition (AOAC, 1995) of feed and dried excreta samples were analyzed for Crude protein retention and digestibility of dry matter, crude fibre, ether extract, NFE and ash according to standard procedures.

Chemical and statistical analyses: The proximate composition of the diet was determined by the AOAC (1995). The data collected were subjected to analysis of variance using 2×4 factorial in a complete randomized design. The analysis of variance was done according to the procedure of the statistical Analysis System (SAS, 2001).

RESULTS

Table 2 shows the proximate composition of Malted Sorghum Sprout and wheat offal. The dry matter contents of the experimental diets ranged between 91.46 for birds on wheat offal and 91.67 for birds on MSP. The crude protein, ether extract, ash, crude fibre, NDF, ADF and NFE for MSP and w/o diet ranged from 22.73 to 22.96,

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3.57 to 3.59, 5.32 to 5.26, 3.69 to3.97, 37.29 to36.82, 17.12 to 16.53 and 56.07 to 53.86 for starting broilers while NDF, ADF and NFE values ranged between 38.59, 21.28, 58.19 for finisher broilers on MSP diets respectively. Table 3 present the performance characteristics of experimental birds at the two physiological stages of growth. At the starting phase. Birds fed wheat offal supplemented with enzyme (+E) recorded the highest (P<0.05) final weight of 567.73 g/bird while those fed MSP diets with or without supplementation recorded the least value. MSP diet control and those supplemented with yeast were least utilized. The daily weight gain followed a similar pattern as final weight of birds on wheat offal enzyme diets supplemented recorded the highest (P<0.05) value while those on MSP control diet recorded the least value. The daily feed intake was significantly (P<0.05) influenced by the dietary treatments birds fed w/o based diets supplemented with enzyme recorded the highest amount (P<0.05) of feed consumed with the least value in birds fed MSP diet with or without yeast supplementation. The feed conversion ratio (FCR) were highest (P<0.05) at MSP based diet without supplementation and with Yeast supplementation while the least values were recorded for wheat offal diets with or without additives.

Furthermore, wheat offal supplemented with additives recorded the highest cost of feed per kg diet and cost of feed per kg weight gain while MSP supplemented with additives were cheaper although the means were not significant (P>0.05). There was significant difference (P<0.05) on all the growth parameters measured at the finisher phase. Birds fed w/o diet without and with either yeast or Enzyme had a significantly higher final weight, feed intake and daily weight gain while those fed MSP without additives supplementation recorded the least values for all the parameters measured. The FCR was highest in birds fed wheat offal based diets supplemented with Yeast + Enzyme (+Y+E) and Yeast (+Y), followed closely were birds on MSP diets supplemented without enzyme which were statistically similar with wheat offal control diet, while the least value was recorded for birds on MSP diet supplemented with Yeast + Enzyme (+Y+E). Cost of feed per kg diet showed no significant interactive effect although the cost to produce wheat offal supplemented with additives was costlier than MSP irrespective of the additives. The cost of feed per kg weight gain was highest in birds fed wheat offal supplemented diets with yeast and enzyme and enzyme alone with the least cost in birds fed MSP diet control. Table 4 shows the effect of (MSP) and (W/O) with or without enzyme and yeast on nutrient utilization of broiler chickens at the two physiological stages of growth. At starter phase, supplementation with yeast and enzyme +yeast either with wheat offal or MSP significantly improved the digestibility of ash retention, ADF and NFE digestibility. However, protein digestibility, fat digestibility, fibre digestibility and NDF digestibility were not significant (P>0.05). Ash digestibility recorded for birds fed yeast and enzyme supplemented diets had similar (P>0.05) effects for those with wheat offal or MSP. The NFE digestibility ranged from 48.72 in birds fed MSP diet with yeast (+y) to 60.68 in birds Fed MSP diet control (-Y-E). Digestibility of the finishing broilers revealed that CP, Fibre, NDF and NFE were significantly (P<0.05) influenced. Supplementation of wheat offal diet and MSP diet with enzyme and yeast significantly improved the CP of the birds. The values obtained were however higher than birds fed other diets. The result also revealed that birds fed wheat offal diet with +Y+E and those fed MSP diet with +Y had similar values. The interaction effect recorded a statistically similar values for NDF digestibility of birds fed (+Y) and those fed +E. The interactive (P>0.5) effect for NFE digestibility ranged from 48.72 in birds fed MSP diet with yeast (+y) to 60.68 in birds Fed MSP diet control (-Y-E). Fat retention, ash digestibility and ADF digestibility showed no (P > 0.05) significant interactive effect.

DISCUSSION

The crude protein, crude fiber, ether extract values of the MSP determined agreed with the values recorded by Fafiolu et al. (2006). However, the values of ash and NFE in this study were relatively lower than values recorded by Fafiolu et al. (2006). The highest (P<0.05) values of daily weight gain and final weight of birds on wheat offal enzyme diets supplemented recorded than those on MSP control diet suggests the superiority of wheat offal in supporting growth than MSP, this agreed with earlier work of Oso et al. (2013) who reported higher final live weight, weight gain and feed intake when fed wheat as sole cereal to turkeys. The poor performance in birds fed MSP can be attributed to the presence of certain anti-nutritional factors (ANFS) in MSP. MSP is known to contain hydrocyanide (Ikediobi, 1989; Taylor, 1993).

Tannin is another ANFS known to be present in MSP (Aning et al., 1998; Oduguwa et al., 2001). The consumption of these ANFS has been reported to depress net protein utilization and hence animal performances (Aletor, 1998). The daily feed intake was significantly (P<0.05) influenced by the dietary treatments. Birds fed w/o based diets supplemented with enzyme recorded the highest amount (P<0.05) of feed consumed with the least value in birds fed MSP diet with or without yeast supplementation. The significantly lower feed intake in birds fed MSP may be due to the stringent taste of MSP which might have affected the palatability of the diets. Jegede (1999) attributed a low intake of MSP fed to rats to bitter taste. The poor performance of birds fed MSP could be attributed to their low intake which resulted in their poor performance.

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Table 1 - The composition of basal experimental diet at starter phase (g/kg)

	Starter				Finisher			
Levels	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**
Ingredient	-Y –E	+Y + E	+Y	+E	-Y –E	+Y +E	+Y	+E
Maize	470	470	470	470	540	540	540	540
Wheat offal	-	-	-	-	150	150	150	150
Fish Meal	30	30	30	30	10	10	10	10
MSP	150	150	150	150	-	-	-	-
Soybean meal	160	160	160	160	120	120	120	120
Groundnut cake	146	146	146	146	130	130	130	130
Bone Meal	18	18	18	18	15	15	15	15
Oyster shell	15	15	15	15	2.5	2.5	2.5	2.5
Premix	3	3	3	3	3	3	3	3
Salt	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
Lysine	2.5	2.5	2.5	2.5	2.0	2.0	2.0	2.0
Methionine	3.0	3.0	3.0	3.0	2.5	2.5	2.5	2.5
TOTAL	1000	1000	1000	1000	1000	1000	1000	1000
Determined Analysis								
ME (MJ/Kg)	11.32	11.32	11.32	11.32	11.25	11.25	11.25	11.25
CP (%)	22.73	23.73	23.62	23.28	19.93	19.86	19.56	19.52
EE (%)	3.86	3.68	3.57	3.68	3.89	3.51	3.59	3.81
CF (%)	3.69	3.60	3.48	3.52	4.83	3.68	3.72	3.61
NDF (%)	37.29	35.92	36.07	36.13	40.12	37.36	38.59	38.62
ADF (%)	17.12	15.29	15.31	15.62	21.74	19.46	19.81	21.01
NFE (%)	56.07	54.57	55.30	55.79	57.55	59.39	59.10	58.01

Table 2 - Proximate composition of the test ingredients.

Ingredients	CP	CF	EE	Ash	NDF	ADF	NFE	DM
MSP	22.73	3.69	3.86	5.32	37.20	17.12	56.07	91.67
W/O	22.96	3.97	3.59	5.26	36.87	16.53	53.86	91.46

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Table 3 - Effect of (MSP) and (W/O) with or without enzyme and yeast on performance characteristics of broiler chickens

	Starter								
	MSP				W/O				
Measurements	**-Y-E**	**+Y+E**	**+Y**	**+E**	**-Y-E**	**+Y+E**	**+Y**	**+E**	**SEM**
Initial weight (g)	48.37	48.47	48.43	48.21	48.37	48.36	48.23	48.17	0.06
Final weight(g)	338.57^{e}	380.49^{d}	343.09^{e}	399.17^{c}	554.03^{b}	560.17^{b}	556.28^{b}	567.73^{a}	20.70
Daily weight gain (g)	10.36^{e}	11.86^{d}	10.52^{e}	12.53^{c}	18.06^{b}	18.28^{b}	18.14^{b}	18.56^{a}	0.74
Daily feed intake(g)	31.20^{g}	32.28^{e}	31.73^{f}	33.24^{d}	37.93^{c}	39.18^{b}	39.18^{b}	39.90^{a}	0.74
Cost of feed/kg diet (₦)	58.00	58.48	58.08	56.40	67.00	67.48	67.08	67.40	0.74
Cost of feed/kg weight gain (₦)	137.08	131.64	147.34	142.69	135.09	134.49	140.83	128.64	0.95
FCR	3.01^{a}	2.72^{b}	3/02^{a}	2/65^{c}	2/10^{e}	2.16^{d}	2.16^{d}	2.15^{de}	0.08
FINISHER PHASE									
Parameters	+Y	+E	+Y+E	-Y-E	+Y	+E	+Y+E	-Y-E	SEM
Initial weight(g)	462.43	463.43	463.43	463.43	463.43	463.43	463.43	463.43	20.70
Final weight(g)	1076.45^{c}	1141.41^{b}	1128.45^{b}	1016.06^{d}	1252.02^{ab}	1263.44^{ab}	1278.37^{a}	1287.16^{a}	31.80
Daily weight(g)	21.93^{d}	24.25^{c}	23.79^{c}	19.77^{e}	28.16^{b}	28.61^{a}	29.14^{a}	29.45^{a}	0.44
Average feed(g)	49.30^{de}	55.97^{d}	51.24^{e}	44.53^{f}	67.23^{a}	65.55^{b}	59.88^{c}	58.05^{c}	1.17
Cost of feed /kg diet (₦)	52.08	52.40	52.48	52.00	61.08	61.40	61.48	61.00	2.10
Cost of feed /kg weight gain (₦)	131.50^{c}	136.89^{c}	120.19^{d}	120.34^{d}	169.33^{a}	159.62^{b}	168.9^{a}	159.78^{b}	3.17
FCR	2.26^{c}	2.31^{b}	2.17^{d}	2.26^{c}	2.39^{a}	2.29^{bc}	2.28^{bc}	2.30^{b}	0.02

Table 4 - Effect of (MSP) and (W/O) with or without enzyme and yeast on nutrient utilization of broiler chickens

	MSP				W/O				
Measurements	**+Y**	**+E**	**+Y+E**	**-Y-E**	**+Y**	**+E**	**+Y+E**	**-Y-E**	**SEM**
Protein Retention (%)	73.68	72.21	75.10	75.28	.73.96	73.92	75.10	74.66	0.268
Fat	69.93	71.07	76.05	74.80	75.59	76.43	75.56	72.57	0.555
Ash	80.83^{b}	7 8.72^{d}	81.59^{a}	80.54^{b}	80.38^{bc}	79.86^{c}	81.56^{a}	78.08^{e}	0.287
Fibre	72.15	71.16	73.14	74.05	74.47	74.41	75.06	72.55	0.340
NDF	52.05	53.42	57.09	61.84	53.94	60.86	56.07	61.47	1.01
ADF	33.83^{d}	39.03^{d}	45.62^{c}	53.13^{a}	46.26^{bc}	48 .46^{b}	44.00^{c}	45.55	1.18
NFE	48.72^{e}	51.71^{cd}	52.71^{b}	60.68^{a}	54.34^{b}	49.88^{de}	51.77^{cd}	53.31^{bc}	0.940
Finisher phase									
Protein retention (%)	75.73^{a}	74.30^{bc}	74.21^{c}	71.18^{d}	75.15^{ab}	74.58^{bc}	76.03^{a}	69.29^{e}	0.515
Fat	77.54	77.23	77.43	76.82	77.29	76.77	77.21	74.74	0.310
Ash	81.78	81.75	80.38	81.56	82.37	81.37	81.89	89.56	0.224
Fibre	77.97^{ab}	76.52^{cd}	77.23^{bc}	75.78^{d}	78.83^{a}	76.92^{c}	78.84^{a}	68.18^{e}	0.711
NDF	62.91^{a}	61.51^{ab}	58.57^{c}	55.08^{d}	59.41^{bc}	58.72^{c}	60.40^{abc}	52.46^{e}	0.954
ADF	56.49	58.96	58.85	59.55	57.37	62.99	54.49	55.44	0.778
NFE	64.76^{a}	63.27^{ab}	60.25^{cd}	59.39^{d}	60.84^{bcd}	60.45^{cd}	62.40^{abc}	53.62^{e}	0.942

^{abc} Means on the same row having different superscripts are significantly different ($P<0.05$)

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The values of feed conversion ratio recorded for birds on wheat offal diets with or without additives showed that the diets were better utilized, it agreed with the work of Park et al. (2001). Though birds fed MSP diet with or without Yeast supplementation recorded the worst value.

Furthermore, wheat offal supplemented with additives recorded the highest cost of feed per kg diet and cost of feed per kg weight gain while MSP supplemented with additives were cheaper although the means were not significant (P>0.05). Jegede et al. (2008) confirmed that MSP is a cheap and locally available agro-industrial by product from dried roots and shoots left after extraction of malt from germinated sorghum. Ikediobi (1989) also reported that MSP has prospects as feedstuff in Nigerian livestock industry. Furthermore, supplementation with yeast and enzyme +yeast either with wheat offal or MSP significantly improved the digestibility of ash retention, ADF and NFE digestibility. The increased Ash digestibility recorded suggests that more minerals are available and retained by the birds. The trend observed with MSP diet control could be a reflection of anti- nutritional factors present in MSP whereas the better performance noticed in Yeast based diet is an indication that Yeast is able to breakdown the Acid Detergent fibre whereby making more nutrient available for birds. It agreed with the earlier work of Gurbuz et al. (2011). Saccharomyces cerevisiae yeast cell wall (YCW) components have been used in animal feeding to improve nutrient digestibility (Hooge, 2003; Rosen, 2007). Major structural components of yeast are glucans with -1-3 glycosidic linkages (Griggs and Jacob, 2005). The -1-3 glucans serves as immune modulators and improved poultry immune system (Abel and Czop, 1992), body weight gain and feed conversion (Parks et al., 2001).

However, the increment noticed for the digestibility indices of birds placed on +E and +Y+E is an indication that enzymes supplementation improved the digestibility of the proximate constituents. The findings of Fafiolu (2007) earlier indicated this fact that addition of enzyme led to significant improvement in nutrient, utilization of crude protein, crude fiber, and ash digestibility. Digestibility of the finishing broilers revealed that CP, Fiber, NDF and NFE were significantly (P<0.05) influenced. Supplementation of wheat offal diet and MSP diet with enzyme and yeast significantly improved the CP of finishing broilers. This confirmed the earlier report of Zanella et al. (1999) and also agreed with the findings of Patridge and Wyatt, (1995) who reported that enzyme supplementation improved protein digestibility in broilers. They also stated that the digestibility of amino acids was found to increase by 10% with added enzymes in broilers.

CONCLUSION

It can be concluded that Malted Sorghum Sprouts cannot replaced wheat offal without appropriate supplementation with additives for better performance. However, Malted Sorghum Sprouts supplemented with yeast +enzyme and enzyme singly improved performance characteristics and nutrient digestibility.

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