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EFFECTS OF DIFFERENT LEVELS OF AMINO ACIDS INCLUSIONS ON THE GROWTH PERFORMANCE OF BROILER CHICKENS FED SPROUTED OR GERMINATED MASAKWA SORGHUM (*sorghum bicolor (l.) moench*) BASED DIETS

[1*]Niania, S., Adamu, B[2]., Abdullahi, S[3]., Saidu, S. G[4]. and Raymond, C.[5]

[1*]Ministry for Livestock and Production, Yola Adamawa State
[2]Adamawa State Polytechnic, Yola
[3]Post Primary School Management, Board, Yola Adamawa State
[4]Federal College of Education, Yola Adamawa State
[5]Adamawa State Polytechnic, Yola

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ABSTRACT

The research was conducted to determine the Effects of different Levels of Amino Acid Inclusions in Sprouted Masakwa Sorghum (Sorghum bicolor (l.) moench) Based Diet on the Performance of Broiler Chickens. One hundred and fifty day-old (Anak 200) broiler chickens were used for the study, and were randomly allocated to five dietary treatments of thirty broiler chicks per treatment. Each treatment was replicated three times with ten birds per replicate in a completely randomized design (CRD). Five experimental diets were formulated at varying supplementation levels of methionine at 0.20%, 0.25%, 0.30%, 0.35%, and 0.40% of the diets with maize used as a control diet. The growth performance of the birds at the starter phase for the average daily feed intake (ADFI) ranged 93-100.33g, average daily weight gain (ADWG) ranged 33.03 to 42.70g, were significantly (P<0.05) different across the treatment diets, while the feed conversion ratio (FCR range from 2.34-2.38g, total weight gain (TWG) ranged from 991.66 to1173.33g and the final weight (FW) ranged 1221.66 to 1316.66g were significantly (P< 0.05) different among the treatment groups. At the finisher phase, the average daily feed intake (ADFI), average daily weight gain (ADWG), feed conversion ratio (FCR) and the total weight gain (TWG) were all significantly (P <0.05) influenced across the treatment groups. The result of the study indicated that methionine could be a good supplement for a sprouted germinated masakwa in broiler diets and can be included in their diets at 0.30%, 0.35% and 0.40% levels for improved performance of birds. The research was carried out at the Department of Animal Science and Range Management Teaching and Research farm Modibbo Adama University of Technology, Yola, Nigeria.

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INTRODUCTION

In Nigeria, the state of the populace is predominantly marked by inadequate protein intake both in quantity and quality (Taiwo *et al.*, 2005). Food and Agriculture Organization FAO (1993) recommended 27g as an average animal protein daily requirement for human consumption, but an average Nigerian consumes only 3.24g animal protein per day. Maize which has remained the main source of energy in broiler rations is now very expensive and scarce. The problem is further compounded by the recent food policy of the Federal Government which has widened the scope of maize both in brewing and other industries, thereby creating a stiff competition among industrial users, human and livestock requirement for the materials (Esonu, 1990). The increase used

Corresponding author:** ***NiaNia, S.,
Ministry for Livestock and Production, Yola Adamawa State.

of maize in animal feed has resulted in a competition with human feeding (Faquinello *et al*., 2004).

Various processing methods have been employed to detoxify and improve the nutritive value of high tannin sorghum cultivar. The level at which *Masakwa* can replace maize has also been determined in broilers, (Yakubu *et al.,* 2009b). Sprouted or partial germination of *Masakwa* proves superior in terms of replacement value. It increases the protein content, soluble sugar, lysine and also reduces the tannin content of the grain (Fafiolu *et al*., 2006, Talha *et al*., 2008). Sprouted or germinated *Masakwa* sorghum cultivar can be used to replace maize up to 75% in broiler chick diet without any detrimental effect of production and a minimal cost of production (Yakubu *et al*., 2009b), when sprouted or germinated *Masawka* sorghum was fed to broilers and cockerels.

MATERIALS AND METHODS

Experimental Site: The research was carried out at the Poultry Teaching and Research Farm of Animal Science and Range Management Department, Modibbo Adama University of Technology, Yola. located in Girei Local Government Area of Adamawa State. Girei is located in the Guinea Savannah zone of Nigeria and lies between latitude 90 and 11ºN of the equator and longitude 10 and 14ºE of the Greenwich meridian. Adamawa shares boundaries with Taraba State to the south and west, Gombe State to the North-west and Borno State to the North. The state has tropical climate with distinct dry and wet seasons. The rainfall begins in April and ends in late October, while the dry season commence in late October or November and ends in April. It has an average minimum and maximum temperature of 18 & 40ºC and relative humidity of 20 and 80%. Adamawa state has an international boundary with the Cameroon Republic along its eastern boarder (Adebayo 1999).

Procedure for Sprouting or Partial Germination: The procedure of sprouting or partial germination was adopted from the methods described by Yakubu *et al*., (2009b). The sorghum grain was soaked for 12 hours in water after which it was drained and spread on a concrete floor. A polythene material was used to cover the grain to preserve moisture. Germination was then arrested after 12 hours by spreading the grain in the sun to dry. This was then incorporated into the treatment diets after grading.

Animal Management: One hundred and fifty (150) day-old (Anak, 2000) broiler chicks were used and were obtained from Avian Farm in Jos, Plateau State. The chicks were brooded for seven days, during the brooding state the chicks were fed on commercial starter mash, clean drinking water was provided ad-libitum. Light were provided by electric bulb. After the brooding period necessary vaccination was administered and wood shavings were used as a litter material during the period of the experiment. The birds were given experimental diet and water ad libitum.

Experimental Diet and Design: Maize and *Masakwa* sorghum was purchased from Yola town market. Dietary treatment was formulated, Maize based diet was served as the control while the partially sprouted *Masakwa* was supplemented with methionine at 0.25%, 0.30%, 0.35% and 0.40% which were served to treatments 2,3,4 and 5 respectively. The dietary composition of the broiler starter and finisher are presented on tables 1 and 2 respectively. The chicks were removed from the brooder unit after 7 days and allocated into five treatments groups. Each treatment was replicated three times with (10) ten chicks per replicate in a completely randomized design (CRD).

Parameters Measured

Growth performance: Feed consumption (feed intake) was recorded daily. This was done by weighing the feed before feeding and the weight of the feed refused was recorded. The left over feed was subtracted from the feed supplied which gave the feed intake. Thus, feed intake = feed given – feed refused. The chicks were weighed weekly to compute the average daily weight gained. Mortality was recorded as it's occurred. Feed conversion ratio was measured as an index of feed utilization.

Thus feed conversion $= \frac{F \quad i \quad (g)}{W \quad ht\ g \quad (g)}$

Proximate Analysis: All the treatments diets were subjected to proximate analysis as described by AOAC (1991). The proximate analysis of the *Masakwa* was done before the germination.

Quantitative Determination of Tannin: The quantitative determination of Tannin was adopted by the procedure described by Darwa (1988).

Statistical Analysis: Data generated from the experiment was subject to one-way analysis of variance. Steel and Torrie (1988) and means were subjected using Duncan Multiple Range Test.

RESULTS

Proximate Composition of Raw and Sprouted Germinated *Masakwa* Sorghum Cultivar: The result of the proximate composition of raw and sprouted or germinated *Masakwa* sorghum cultivar are presented in Table 3 and 4 respectively. The result for the proximate composition of raw *Masakwa* showed 94%, 11.60%, 7.85%, 2.65%, 73.55% and 4.35% for dry matter (DM) crude protein (CP) crude fibre (CF) ether extract (EE) nitrogen free extract (NFE) and ash respectively while tannin and metabolizable energy were 41 gce/kg and 3227.54 kcal/kg respectively. Similarly, for the Sprouted or germinated *Masakwa*, values were 96%, 11.80%, 7.75%, 2.25%, 73.33% and 4.30% for dry matter (DM) crude protein (CP) crude fibre (CF) either extract (EE), nitrogen free extract (NFE) and ash respectively while the tannin content and metabolizable energy were 19.20 gce/kg and 3235.25 kcal/kg respectively.

Growth Performance

Growth Performance at starter phase: The average daily feed intake (ADFI), average daily weight gain (ADWG) and the feed conversion ratio (FCR) for the broiler chicken's starter is presented in Table 5. At the starter phase, the average daily feed intake (ADFI) was significantly ($P < 0.05$) different across all the dietary treatments. The highest average daily feed intake (100.33g/bird) was recorded on birds fed 0.20% methionine in T_1 (control/diet) which was maize, whereas birds fed 0.25% in T_2 had the least value (79g/bird). However,

the value of the average daily feed intake (ADFI) obtained for T_1, T_2, T_3, T_4 and T_5 during the phase were 100.33g, 79g, 98g, 94g and 93g/bird respectively. The performance of the birds fed different supplementation levels of methionine indicated that the average daily weight gain (ADWG) was significantly ($P < 0.05$) different across the treatment groups and with T_1 (0.20%) having the highest ADWG (42.70g/bird), while T_2 (0.25%) recording the lowest ADWG (33.03g/bird). In all, the values of 42.70g, 33.03g, 42.06g, 40.00g and 39.46g/bird were recorded for T_1, T_2, T_3, T_4 and T_5 respectively as the average weight gain (ADWG) for the birds in the treatment groups. The results of the fed conversion ratio (FCR) were also significantly ($P < 0.05$) influenced across the treatment groups. Birds fed T_3 (0.30% diet had superior FCR of 2.23 compared to other treatment diets, whereas T_2 (0.25%) and T_4 (0.35%) had the inferior FCR of 2.34. the values 2.34, 2.38, 2.33, 2.34 and 2.35 were recorded for T_1, T_2, T_3, T_4 and T_5 respectively.

Effect of different levels of amino acids inclusions on broiler chickens fed sprouted or germinated *masakwa* sorghum (*sorghum bicolor (l.) moench)* based diets on the average feed intake: The average feed intake of the broiler birds at the starter phase was significantly ($P < 0.05$) influenced by the dietary treatments across all the groups. Jamaa *et al.,* (2014) also found a significant ($P <0.05$) difference across the treatment diets when birds were fed sorghum variety as a replacement for maize in broiler diets. The values reported by Jamaa *et al.,* (2014) were numerically lower which was as a result of methionine supplementation. Birds fed T_1 (control maize based diet) had the highest feed intake of 100.33g/bird compared to other treatment diets. The low feed intake observed in the processed diets compared to those on the control diets could probably be due to the residual effect of tannin as it is known to reduce feed intake (Mohammed and Ali, 1988) cited by Yakubu *et al.,* (2009). Similarly, at the finisher phase, the highest average daily feed intake (147.33g/bird) was obtained in T_1 (control diet) and was significantly ($P <0.05$) across all the treatment diets with T_2 (79g/bird) being the lowest. Also numerically, the values obtained were higher than values reported by (Yakubu *et al.,* 2009).

Effect of different levels of amino acids inclusions on birds fed sprouted or germinated *masakwa* sorghum (*sorghum bicolor (l.) moench)* based diets on feed conversions ration of broiler chickens: In this study, a significant ($P < 0.05$) difference was observed for the feed conversion ratio for both the starter and the finisher phases of broiler bird's growth. At the starter phase, the values for the FCR which ranged between 2.33 (T_3) and 2.37 (T_2) confirms the values of FCR as 2.26 and 2.38 obtained by Jamaa *et al.,* (2014) when birds were fed sorghum variety as a replacement for maize in broiler diets. Similarly, at the finisher phase FCR ranged between 3.34 and 3.40. The value was superior to 3.50 and 5.07 as reported by (Jamaa *et al.,* 2014). This mean that the increase levels of methionine was adequate to reduce the residual effect of tannin thereby resulting into growth rate similar to that of maize (Luis and Sollivian, 1982)

Growth performance at finisher phase: The performance of broiler chickens fed Sprouted or germinated *Masakwa* sorghum cultivar supplemented with different levels of methionine for the average daily feed intake (ADFI), average daily weight gain (ADWG) and the feed conversion ratio is presented in Table 6. It was evident from the result that supplementation levels of methionine had significantly ($P < 0.05$) influenced the average daily feed intake (ADFI) across all the treatment groups. The highest average daily feed intake of 147.33g/bird was recorded in T_1 (0.20%), while the least average daily feed intake of 129g/bird was recorded in T_2 (0.25%) and tended to increase from T_3 (133.33g/bird), T_4 (136.33g/bird) and T_5 (140.66g/bird) with the increasing levels of supplementation of methionine.

The average daily weight gain (ADWG) was significantly ($P < 0.05$) different across all the treatment groups, with the highest value (44.00g/bird) obtained on birds fed T_1 (control diet). Birds fed T_2 (0.25%) had the least ADWG (37.93g/bird) and which again tended to increase with increasing levels of supplementation of methionine from T_3 (39.53g/bird), T_4 (40.56g/bird) to T_5 (41.80g/bird). In terms of the feed conversion ratio (FCR), birds fed T_1 (control diet) has a superior FCR of 3.34 and T_2 (0.25%) having the inferior FCR of 3.40. however, the FCR tended to improve with the increasing levels of supplementation of methionine in T_3 (2.37), T_4 (3.36) and T_5 (3.36) respectively. In all, the FCR was significantly ($P < 0.05$), in the treatment means.

Effect of different levels of amino acids inclusions on broiler chickens fed sprouted or germinated *masakwa* sorghum (*sorghum bicolor (l.) moench)* based diets on the average daily weight gain (ADWG): Result of the average daily weight gain (ADWG) indicated significant ($P < 0.05$) differences across the treatment diets for both the starter and finisher phases of broiler growth. This is not in conformity with the findings reported by Kwari *et al.,* (2011) who found that there were no significant ($P > 0.05$) difference among the sorghum based diets. Also the values obtained were higher than values obtained by Kwari *et al.,* (2011). These could be as a result of methionine supplementation. But their values were significantly ($P < 0.05$) lower than the control diet when birds were fed different cultivars of sorghum as replacement for maize. The difference ($P < 0.05$) observed among the treatment diets could probably be due to the different levels of methionine supplementation.

The ADWG for the starter and finisher phases are in conformity with the result obtained by Kwari *et al.,* (2011). Birds fed T_1 (maize based control diet) had higher ADWG than birds fed sorghum treatment diets; this could be due to the astringent effect of tannin residue. According to Nyachoti *et al.,* (1996) tannins have high affinity for proteins, with which they interact by hydrogen bonding Longstaff *et al.,* (1991) and Nelson *et al.,* (1975) added that tannin may also reduce the utilization of energy and specific amino acids, thereby, birds are able to meet only their maintenance requirements but not their needs for tissue accretion, which in turn result in poor growth.

Though T_1 (maize based control diet) had the highest value for the ADWG, there was however an improvement in the values for the ADWG in the sorghum treatment diets as the levels of supplementation of methionine increased. This is possible because the increase in the levels of methionine was adequate to ameliorate any tannin effect. Potter and Fuller (1968) reported that in the gastro-intestinal tract, tannins are hydrolyzed to Gallic acid and Sprouted extracted in the form of 4-0-methyl-galic acid utilizing the methionine and choline of the feed as sources of o-methyl groups for the o-methylation.

Table 1: Broiler Starter containing methionine Supplementation Levels in Sprouted Masakwa based Diet

	Supplementation levels of methionine (%)				
Ingredients %	T_1	T_2	T_3	T_4	T_5
Maize	48.39	0.00	0.00	0.00	0.00
PGMSC	0.00	48.32	48.25	48.19	48.11
Maize offal	10.00	10.00	10.00	10.00	10.00
G/nut cake	36.31	36.32	36.35	36.36	36.38
Bone meal	2.50	2.50	2.50	2.50	2.50
*premix	0.25	0.25	0.25	0.25	0.25
Methionine	0.20	0.25	0.30	0.35	0.40
Lysine	0.10	0.10	0.10	0.10	0.10
Salt	0.25	0.25	0.25	0.25	0.25
Fish meal	2.00	2.00	2.00	2.00	2.00
Total	100	100	100	100	100
Calculated Analysis					
Crude Protein	23.00	23.95	23.95	23.94	23.93
Crude fibre	4.69	4.58	4.31	3.95	3.56
Calcium	1.13	1.11	1.09	1.10	1.07
Phosphorus	0.78	0.81	0.79	0.80	0.82
Methionine	0.43	0.45	0.48	0.53	0.57
Lysine	1.12	1.10	1.10	1.10	1.10
ME (Kcal/kg)	3018.49	2965.44	2908.16	2892.10	2867.23

* Vitamin-mineral premix providesper kg. The following: Vit A, 1500 IU; vit D_3 3000 IU, vit E; 30 IU; vit K 2.5mg; Thiamine B_1 3mg; Riboflavin B_2 6MG; Pyridoxine B_6 4mg; Niacin 40kg; vit B_{12} 0.02mg; panthothenic acid 10mg; Folic acid 1mg; Biotin 0.08g; Chloride 0.125g; M_n 0.096g; Antioxidant 0.125g; Cu 0.006g; I 0.0014g; Se 24g; Co 0. 240g.SMSC – Sprouted *Masakwa* Sorghum Cultivar. PGMSC - Partially Germinated *Masakwa* Sorghum Cultivar

Table 2: Composition of Broiler Finisher Containing Different Methionine Supplementation Levels in Sprouted Masakwa based Diet

	Supplementation levels of methionine (%)				
Ingredients %	T_1	T_2	T_3	T_4	T_5
Maize	56.70	0.00	0.00	0.00	0.00
PGMSC	0.00	56.64	56.59	56.53	56.50
Maize offal	10.00	10.00	10.00	10.00	10.00
G/nut cake	28.00	28.01	28.01	28.02	28.02
Bone meal	2.50	2.50	2.50	2.50	2.50
*premix	0.25	0.25	0.25	0.25	0.25
Methionine	0.20	0.25	0.30	0.35	0.40
Lysine	0.10	0.10	0.10	0.10	0.10
Salt	0.25	0.25	0.25	0.25	0.25
Fish meal	2.00	2.00	2.00	2.00	2.00
Total	100	100	100	100	100
Calculated Analysis					
Crude Protein	20.67	20.62	20.61	20.61	20.59
Crude fibre	4.54	4.48	4.48	4.47	4.46
Calcium	1.10	1.12	1.12	1.11	1.11
Phosphorus	0.78	0.77	0.77	0.76	0.78
Methionine	0.42	0.46	0.49	0.52	0.54
Lysine	1.21	1.11	1.11	1.10	1.12
ME (Kcal/kg)	3189.62	3188.78	3032.56	3048.44	3121.45

* Vitamin-mineral premix provides per kg. vit A, 1500 IU; vit D_3 3000 IU, vit E; 30 IU; vit K 2.5mg; Thiamine B_1 3mg; Riboflavin B_2 6mg; Pyridoxine B_6 4mg; Niacin 40kg; vit B_{12} 0.02mg; panthothenic acid 10mg; Chloride 0.125g; M_n 0.096g; Antioxidant 0.125g; Cu 0.006g; I 0.0014g; Se 24g; Co 0. 240g.SMSC = Sprouted *Masakwa* Sorghum Cultivar. PGMSC = Partially Germinated *Masakwa* Sorghum Cultivar

Table 3. Proximate Composition of Raw *Masakwa*Sorghum Cultivar

Nutrient	Percentage (%) composition
Dry matter (DM)	94
Crude protein (CP)	11.60
Crude fibre (CF)	7.85
Ether Extract (EE)	2.65
Ash	4.35
Nitrogen free extract (NFE)	73.55
**Tannins	41.00
MECKcal/kg	3227.54

*Metabolizable energy (Kcal/kg) of practically germinated sorghum cultivar was estimated using the methods of Pausenga (1985) as follows: ME = 37 x CP% + 81.8 x EE% + 35.5% x NFE% **Tannin was expressed in gce/Kg

Table 4: Proximate Composition of Sprouted *Masakwa*Sorghum Cultivar

Nutrient	Percentage (%) composition
Dry matter (DM)	96
Crude protein (CP)	11.80
Crude fibre (CF)	7.75
Ether Extract (EE)	2.85
Ash	4.30
Nitrogen free extract (NFE)	73.30
**Tannins	19.20
MECKcal/kg	3235.23

*Metabolizable energy (Kcal/kg) of practically germinated sorghum cultivar were estimated using the methods of Pausenga (1985) as follows: ME = 37 x CP% + 81.8 x EE% + 35.5% x NFE%**Tannin was expressed in gce/Kg

Performance of broiler chicks when pooled: The pooled growth performance of the broiler chicks fed Sprouted or germinated *Masakwa* sorghum cultivar with different supplementation levels of methionine is presented in table 7. There was significant ($P < 0.05$) difference across the treatment groups in terms of the average daily feed intake (ADFI). The highest ADFI of 123.83g/bird was recorded for birds fed T_1 (control diet), while the least ADFI of 104.00g/bird was obtained in T_2 (0.25%). Consequently, the birds fed T_3, T_4 and T_5 had similar ADFI of 115.50g, 115.16g and 116.83g/bird respectively. The performance of the birds pooled was on Table 7 for the average daily weight gain (ADWG) showed there was a significant ($P < 0.05$) difference observed across the treatment groups. T_1 (control diet) recorded the highest value of 43.70g/bird for the ADWG, while the lowest value of 35.80g/bird was obtained for T_2 (0.25%). T_3, T_4 and T_5 were however similar for the ADWG of 41.36g and 40.73g/bird respectively. There was also significantly ($P < 0.05$) difference for the feed conversion ratio (FCR). When the performance of the birds was pooled, birds fed maize based control diet T_1 (0.20%) has a superior FCR of 2.84. Among the other treatments diets with Sprouted germinated Masakwa sorghum cultivar, birds fed T_3 and T_4 had a better FCR of 2.85 each and followed closely with birds on T_5 diets, while T_2 recorded a poorer feed conversion (FCR) of 2.89.

Effect of different levels of amino acids inclusions on broiler chickens fed sprouted or germinated *masakwa* sorghum (*sorghum bicolor (l.) moench)* based diets on average daily feed intake: The pooled performance of the birds in terms of average daily feed intake showed variation ($P < 0.05$) across the treatment groups. Similarly, there was variation ($P < 0.05$) across all the treatment groups for average daily weight gain. The feed conversion ratio, also had significant ($P < 0.05$) difference among the treatment means. However, the values obtained were higher for the average daily feed intake and the average daily weight gain as reported by Yakubu *et al.,* (2009). These could be attributed to the increase levels of methionine in the diets as reported by Luis and Sullivan (1982). For the feed conversion ratio, the values were within the value range reported by Jama'a *et al.,* (2014).

CONCLUSION

From the result of this study, it was an evident that, fortifications with methionine of Sprouted Masakwa sorghum cultivar have been established to improve the performance of broiler chickens. Methionine can be included in the diet of broiler chickens at 0.30% for optimum performance and without adverse effect on the growth performance, it is also evident from final weight (2535.009) T_1 (maize based control diet) and T_3 (0.30%) with final weight 2423.33) that sprouted or germinated *Masakwa* can replace maize by 95%.

Recommendations

According to the result of this study, it was clearly shown that fortification of methionine on Sprouted germinated *Masakwa* Sorghum Cultivar can be included in broiler diets at 0.30%.

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