

Research Application Summary

Effect of feeding tannin cultivars on broiler chicks' performance

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Abstract

A feeding trial was carried out in Kadoru campus, University of Juba. Six sorghum cultivars; Tabat and Safra, Umbenin and Wad Akar, Yarawasha and HSP 5907 with low, medium and high tannin contents respectively were subjected to a feeding trial using one day old chicks of Hubbard broilers strain. High tannin and low tannin sorghum grain based diets were highly consumed ($p < 0.05$) compared to medium tannin sorghum grain-based diet. Sorghum cultivars within the same range of tannin content significantly differed ($p < 0.05$) in their performance. Birds fed on low tannin-Safra sorghum based-diet showed a better body weight gain followed by those fed on Yarawasha, Tabat, Wad Akar and Umbenin sorghum-based diet respectively. Broiler's overall performance showed that sorghum with high tannin content was better ($p < 0.05$) than medium tannin sorghum. However, carcass and non-carcass characteristics showed insignificant ($P > 0.05$) difference between the treatments. This indicates that in some instances, the negative effects of tannins are not correlated with the amount of tannin in the sorghum cultivar. Furthermore, the chemical nature of tannins modifies its final effect as such, and not all high tannin sorghum is harmful to broiler performance.

Key words: Body weight gain , broiler, sorghum grains, Tannin content

Resume

Une expérimentation a été conduite sur l'alimentation des animaux sur le campus Kadoru, Université de Juba. Six cultivars de sorgho Tabat et Safra, Umbenin et Wad Akar, Yarawasha et HSP 5907 ayant respectivement une teneur en tanin faible, moyenne et élevée étaient soumis à une expérimentation d'alimentation animale utilisant des poussins d'un jour de race Hubbard. Les régimes alimentaires à base de grains de sorgho à teneur en tannin faible et élevée étaient hautement consommés ($p < 0.05$) comparativement au régime à base de grain de sorgho à moyenne teneur en tanin. Les cultivars de sorgho se situant dans la même tranche de teneur en tanin diffèrent significativement ($p < 0.05$) par leur performance. Les oiseaux nourris du régime à base de sorgho Safra à faible teneur en tanin ont montré un meilleur gain en masse corporelle suivis de ceux respectivement alimentés par les régimes à base de variétés de sorgho Yarawasha, Tabat, Wad Akar et Umbenin. La performance totale des poulets a montré que le sorgho ayant une teneur en tanin élevée est meilleur ($p < 0.05$) que celui ayant une teneur en tanin moyenne. Néanmoins, les caractéristiques carcasse et non-carcasse ont une différence non-significative ($p > 0.05$) entre les traitements. Ceci indique que dans certains cas, les effets négatifs du tanin ne sont pas corrélés avec la quantité de

tanin dans le cultivar de sorgho. Plus encore, la nature chimique des tannins modifie un tant soit peu son effet final et tous les sorghos à forte teneur en tannins n'ont pas un effet néfaste sur la performance des poulets.

Mots-clés : Gain en masse corporelle, poulet, grain de sorgho, teneur en Tanin

Introduction

Sorghum is the major cereal grown in Sudan for both humans and poultry. Its incorporation in poultry feed has been limited because tannin have potential to cause deleterious effects (NRC, 1994) like reduced feed intake (Douglas *et al.*, 1991; Kumar *et al.*, 2005), reduced weight gain and feed conversion efficiency (Sanchez *et al.*, 2000). In addition tannin level has been reported to cause different effects in birds performance (Elkin *et al.*, 1995). Little research has been conducted to assess tannin levels in feed with aspect to performance of broilers (Badi, 2004). As such there was need to conduct trials to test the effect of feeding broilers with sorghum varieties having the same tannin level. Moreover in most literature there is no indication that different tannin levels influence carcass characteristics. The objective of this study was to determine the effect of feeding low, medium and high tannin sorghum grains on broiler performance and carcass characteristics.

Materials and Methods

Experimental Diets

Six sorghum varieties were used in ration formulation based on their tannin levels. The proximate analysis of ingredients used in ration formulation was carried out according to the official analytical chemist procedures (AOAC,1990). Based on the results of the chemical analysis, different diets were formulated. The diets in the trial consisted of groundnut cake, sesame cake and super concentrate as major sources of proteins; sorghum, maize and vegetable oil as energy sources, oyster shell as calcium source, lysine and methionine were added where necessary. Wheat-bran was used as fillers and maize free of tannin was used as a control.

Ingredient composition in the different formulated diets are given in Table 1, while the resulting nutritional composition is shown in Table 2. Calculations were based on the actual analysis following the established standards by Ellis (1981) and NRC (1994). In order to determine metabolizable energy (ME), the approach detailed by Lodhi *et al.* (1976) was followed. All experimental diets were formulated in accordance with essential nutrients established by the National Research Council (1994) and were fed to the experimental broiler birds.

Table 1. Ingredient constituent (%) of experimental diets

Ingredients	Maize	Tabat	Safra	Umbenin	Wad-Akra	Yarawasha	HSP5907
Sorghum	75	75	75	75	75	75	75
Groundnut cake	10	10	10	10	10	10	10
Sesame cake	7	7	7	7	7	7	7
Super concentrate	5	5	5	5	5	5	5
Vegetable oil	0.75	0.75	0.75	0.75	0.75	0.75	0.75
Oyster shell	1	1	1	1	1	1	1
Lysine	0.52	0.52	0.52	0.52	0.52	0.52	0.52
Methionine	0.13	0.13	0.13	0.13	0.13	0.13	0.13
Wheat bran	0.10	0.10	0.10	0.10	0.10	0.10	0.10
Salt	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Mineral and vit.	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Total	100	100	100	100	100	100	100

1-Super concentrate: A concentrated source of protein, minerals and amino acids containing 35% CP, 12% Ca, 5.8% P, 5.3% Lysine, 2.8% methionine, 1650 Kcal/R ME plus sufficient amounts of Vitamins and Minerals.

Table 2. Determined and calculated composition of the experimental diets

Ingredient g/kg	Maize	Tabat	Safra	Umbenin	Wad-Akar	Yarawasha	HSP5907
Determined composition							
Crude protein	193.4	194.5	190.3	195.2	192.7	191.3	189.8
Ether extract	83.0	84.4	87.6	81.2	83.3	85.9	87.2
Crude fibre	79	76	78	73	72	76	74
Ash	76	69	71	70	72	73	68
Calculated composition							
CP(g/Kg)	189.4	187.6	186.2	188.8	185.5	190.1	187.9
ME kcal/kg	3200	3203	3218	3199	3201	3200	3195
Lysine	10.8	11.0	10.1	10.7	10.4	10.6	10.3
Methionine	4.8	5.0	4.8	4.8	4.8	4.8	4.8
Calcium	12	12	12	12	12	12	12
Phosphorus	5.9	6.5	6.0	6.1	6.4	6.2	6.5

Experimental birds

The birds used in the experiment were unsexed commercial broiler chicks of Hubbard type. One day old chicks were brought from a private hatchery in Khartoum North about 20 km North of Khartoum city. Chicks were placed in a brooder where a pre-starter (Nester) commercial feed was provided *ad-libitum* for the first seven days. Open plate drinkers elevated by stones and sacks were used as waterers and feeders, respectively. Chicks were provided with light all night round.

Accommodation and management

A completely randomized design was adopted in the experimental setup. Diets were allocated randomly to given experimental units. After seven adaptation days, a given number of chicks were randomly selected and distributed to the experimental units. These chicks were distributed in way that each dietary treatment consisted of three replicates each containing five chicks. The experimental units were in an open sided deep litter poultry house. The experimental pens were one square metre, located along the length and width of the house. Each pen was provided with a waterer and feeder hanged with a wire from the roof. Birds were allowed free access to drinking water, and feed was given *ad-libitum*.

Subsequently Analysis of Variance (ANOVA) was used to detect differences between treatments. Least Significant Difference (LSD) test was used to assess significance of difference between means (Gomaz and Gomaz, 1984).

Results

Performance results showed that the highest feed intake was consumed by birds fed on Yarawasha (high tannin) and Safra (low tannin) sorghum cultivar (Table 3). This was followed by those fed on HSP5907 (high tannin) and Tabat (low tannin) and the lowest feed was consumed by birds fed sorghum cultivars (Wad-Akar and Umbenin) having medium tannin level (Table 3). At the sometime, birds fed on cultivars with similar range of tannins had different intake. This trend was similarly observed in the body weight gain (Table 4).

The best weight was recorded for Safra followed by Yarawasha, HSP5907, Tabat, Wad-Akar and Umbenin. On the other hand, the best slaughter weight was found in Yarawasha (high tannin) followed by Safra and tabat (low tannin) and HSP5907 (high tannin). In contrast Wad-Akar and Umbenin (medium tannin) sorghum showed the lowest slaughter weight (Table 4), while Yarawasha had the highest weight followed by Safra, tabat, Wad-Akar, HSP5907 and Umbenin, respectively. Mortality results showed that Yarawasha based diets resulted into high mortality (20%) followed by Safra, Tabat, Umbenin and Wad-Akar. In all these diets, HSP5907 and Maize did not post any mortality.

It was observed that low tannin sorghum based diets (Tabat and Safra) with the same range of tannin resulted into significantly different feed intake and body weight gain. A significant difference in feed intake, body weight gain and FCR was also observed among the high tannin (Yarawasha and HSP5907) sorghum based diets.

Results of feeding low, medium and high tannin sorghum based diets on slaughter weight is shown in Table 4. There was a significant difference in slaughter weight, weight without

Table 3. Performance of Broilers fed on low, medium and high tannins sorghum diets

Parameters	Tabat	Safra	Umbeni	Wad-Akra	Yarawasha	HSP5907	Maize	SE±	L.S
No. of birds.	15	15	15	15	15	15	15		
Feed intake									
gms/bird/Week.	345.47 ^c	420.33 ^b	294.00 ^e	315.60 ^d	423.40 ^b	366.07 ^c	464.53 ^a	21.84	*
Weight gain									
gms/bird/Week	155.40 ^c	221.20 ^b	121.00 ^g	135.67 ^f	190.66 ^c	171.33 ^d	298.66 ^a	21.08	*
F.C.R	2.22 ^d	1.90 ^b	2.43 ^e	2.33 ^e	2.22 ^d	2.14 ^c	1.56 ^a		*
Mortality %	7	7	7	7	20	00	00		

-Means with different superscript in the same row are significantly different at 5% level. Values are means of 15 samples each. SEM= Standard Error of Mean Significant at 5% level

Table 4. Slaughter and Carcass weight of broilers fed on low, medium and high Tannin sorghum and maize

Weight (gms)	Tabat	Safra	Umbenin	Wad-Akra	Yarawasha	HSP5907	Maize	SE±	L.S
Slaughter	980 ^d	1123 ^c	855 ^f	870 ^f	1380 ^b	910 ^e	1594 ^a	99.47	*
without feathers	898 ^d	1011 ^c	770 ^f	800 ^e	1195 ^b	805 ^e	1460 ^a	89.13	*
Carcass	689 ^d	754 ^c	560 ^g	618 ^e	890 ^b	603 ^f	1100 ^a	67.02	*

Means are values of five birds.* Significance Difference

Table 5. Relative weight of non- carcass components of Broilers fed low, medium, high sorghum for five weeks.

Percentages	Tabat	Safra	Umbeinin	Wad-Akra	Yarawasha	HSP5907	Maize	SE±	L.S
Dressing	75.79	74.99	72.74	77.87	74.47	75.26	75.43	0.54	NS
Gizzard	3.03	3.14	3.52	3.75	3.05	3.00	2.90	0.11	NS
Liver	3.16	3.35	3.28	3.79	2.95	3.00	2.45	0.14	NS
Pancreas	0.22	0.25	0.20	0.31	0.26	0.26	0.22	0.01	NS
Heart	0.68	0.62	0.70	0.74	0.57	0.65	0.60	0.01	NS
Bursa Fibricus	0.07	0.10	0.08	0.10	0.08	0.10	0.07	0.01	NS
Spleen	0.10	0.14	0.13	0.15	0.18	0.15	0.13	0.01	NS
Digestive Tract.	6.06	8.42	7.05	8.62	7.24	6.36	5.41	0.42	NS
Legs	5.78	3.17	2.19	5.33	3.03	5.59	3.32	0.51	NS
Heads	5.50	2.54	2.19	4.08	2.71	3.99	3.02	0.40	NS

Means are values of 5 birds.* NS - Non significant Difference

feathers and carcass weight. A non-significant difference on the percentage relative weight of the non-carcass components of the broiler was however observed (Table 5). Overall, the results showed that the best performance was produced by Safra (low tannin) followed by Yarawasha and HSP5907 (high tannins) and Tabat (low tannins). These results also revealed that the negative effect of tannins does not increase as the level of tannin increases.

Discussions

The results of broilers performance fed on sorghum with different levels of tannins showed a decreased feed intake in medium and low tannin sorghums. Although it is generally believed that high tannins have adverse effect on feed intake, birds fed Yarawasha (high tannins) ate more feed as birds fed on Safra compared to Tabat with low tannin and Umbeinin and Wad-Akar (medium tannins). These findings disagree with those of Hassan *et al.* (2003) who reported that high tannin sorghum reduces feed intake in broiler chicks compared to low tannin sorghum. Similarly, Herstad (1980), Mitaru *et al.* (1983), Barry and Manley (1984) and Ibrahim *et al.* (1988) found a significant decrease in feed intake of broilers fed diets containing tannin. They indicated that this decrease may be due to astringent taste of tannin. In this work the high feed intake may be due to ingredients found in this newly bred sorghum cultivars (Yarawasha and HSP 5907).

In terms of body weight gain Safra (low tannin) performed best, followed by Yarawasha and HSP5907 then Tabat and lastly the medium tannin sorghum (Wad-Akar and Umbeinin). The good performance of Safra may be due to its high content of essential amino acids (Isoleucine, leucine, lysine and threonine). Our findings agree with the work of Musharaf and Latshow, (1991) who reported no effect on weight gain, feed intake and FCR of chicks fed low tannin sorghum.

Conclusion

There was no consistent decrease in broiler performance as the level of tannin increased, which indicates that the negative effect of tannins are not always correlated with the amount of tannins contained in feed. There is therefore need to investigate the introduction of tannins with other feed ingredients that may reduce or eliminate the negative effects of tannins that have for long been reported.

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References

- Badi, W.H.I 2004. Effect of processing on anti-nutritional factors and mineral bioavailability of sorghum, Ph.D. Thesis, University of Khartoum, Sudan.
- Barry, T.N. and Manley, T.R. 1984. The role of condensed tannins in the nutritional value of *Lotus pedunculatus* for sheep. I. Voluntary intake. *Br.J. Nutr.* 51: 485 – 491.
- Douglas, J.H., Sullivan, T.W., Abdal-Kadir, R. and Ruprow, J. H. 1991b. Influence of infrared (Micron, Zation) treatment on the nutritional value of corn and low and high tannin Sorghum. *Poultry Science* 70: 1534 – 1539.
- Elkin, R.G., Featherston, W.R. and Rogler, J.C. 1995. Condensed tannins are only partially responsible for variations in nutrient digestibility of sorghum grain cultivars. *Poultry Science* 74 (supplement 1) 125 (Abstract).
- Gomes, A.K. and Gomes, A.A. 1984. Statistical procedures for agricultural research. An International Rice Research Institute book. 2nd Eds. John Wiley and Sons, New York 657pp.
- Hassan, I. A., El-Zubeir, E. A. and El-Tinay, A.H. 2003. Growth and apparent absorption of minerals in broiler chicks fed diets with low or high tannin contents. *Trop. Anim. Health Prod.* 35: 189 – 196.
- Herstad, O. 1980. Effect of different tannin content in sorghum grains on the feed value of chickens. *Chemical Abstract* 92: 507.
- Hulse, J. H., Laing, E. M. and Pearson, D. E. 1980. Sorghum and millets: Their composition and nutritive value. *London J. Food Sci. and Agric.* 80: 2216 – 2222.
- Ibrahim, S., Fisher, C., Elalaily, H., Soliman, H. and Anwar, A. 1988. Improvement of the nutritional quality of Egyptian and Sudanese sorghum grams by the addition of phosphates. *British Poultry Science* 29: 721 – 728.
- Mitaru, B. N., Reichert, D. and Blair, R. 1983. Improvement of the nutritive value of high tannin sorghums for broiler chickens by high moisture storage (Reconstitution). *Poultry Science* 62: 2065 – 2072.
- Gassem, M. A.A. and Osman, M.A. 2003. Proximate composition and the content of sugars, amino acids and anti-nutritional factors of three sorghum varieties. Res. Bult, No. (125). Agric. Res. Cent. g. Saud University. 5-19 pp.
- National Research Council, 1994. Nutrient Requirements of Poultry. 9th edition revised

National, Academic Press, Washington, D.C.

- Kumar, V., Ecangovan, A.V. and Mandal, A. B. 2005. utilization of reconstituted high tannin sorghum in the diet of broiler chickens. *Asian Australasian Journal of Animal Science* 18: 538 – 544.
- Sanchez, R. E., Cuevas, C. A., Barrera, M. E. and Gonzalez, A. E. 2000. DL – Methionine addition in high tannin sorghum grains diets for broilers. *TecnicaPecuararia on Mexico* 38: 1 – 8.