U. of K. J. Agric. Sci. 20(3), 329-346, 2012

Effect of Sorghum Tannin on the Performance of Broiler Chicks and their Carcass Characteristics*

Milton Melingasuk[1], Salim Gibril[2] and Abed Elhafiz Eltahir Ahmed[3]

[1, 2, 3] **Department of Animal Production, CNRES, University of Juba, Khartoum, Sudan**
[2] **Currently College of Animal Production, University of Bahri, Khartoum, Sudan**

Abstract: A feeding trial was carried out to study the effects of sorghum tannin on the performance and carcass characteristics of broiler chicks. Seven experimental diets were formulated using zero tannin maize as control and six sorghum grain varieties, each two with low, medium and high tannin level. Diets were fed to 196 unsexed Hubbard commercial broilers chicks for 5 weeks. Low tannin Safra had the best amino acids composition followed by high tannin sorghum varieties. Broilers performance and carcass characteristics showed inconsistent trend as the level of tannin increased, since the birds consuming sorghums with high tannin content gave better performance than their counterparts fed medium tannin. In addition, the results showed that sorghum varieties with the same tannin level gave different effects on broiler performance and carcass characteristics. These results indicate that, tannin level may not be the sole factor affecting nutritional quality of sorghum grains; other factors may be involved.

Key words: Tannin; sorghum; broilers; performance; carcass characteristics

INTRODUCTION

Sorghum is the major cereal grain grown in Sudan for consumption of both humans and poultry. However, due to tannin content, its incorporation in poultry feed may cause certain deleterious effects (NRC1994) such as reduced feed intake (Kumar *et al.* 2005) and reduced

*Part of a Ph.D. thesis by the first author, University of Juba

weight gain and feed conversion efficiency (Reyes Sanchez *et al*. 2000). Other researchers, e.g. Herstad (1980) and Barry and Manley (1984), noticed a decrease in feed consumption in broilers due to high tannin diets. Elkin *et al.* (1978) found that frequent use of high tannin sorghum-based diets decreased growth rate and led to poor feed conversion ratio of broilers. On the other hand, opposing views as regards the effects of tannin on bird's performance were reported by Elkin *et al.* (1995).

There is a need to ascertain whether the nutritional variations in the sorghum grains are attributed solely to tannin levels or whether other nutritional factors are involved. Moreover, there is no clear evidence that tannin levels have an influence on broiler's carcass characteristics. Attempting to answer these questions, an experiment was designed to study the effect of (i) feeding low, medium and high tannin sorghum grains on broiler's performance and carcass characteristics and (ii) feeding pairs of sorghum grains with the same tannin range, each pair with low, medium and high tannin on broiler performance and carcass characteristics.

MATERIALS AND METHODS

Six sorghum varieties were chosen from 23 sorghum varieties brought from the Gezira Agricultural Research Station at Wad Madani, Sudan. The modified vanillin HCl (MV–HCL) method of Price *et al.* (1978) was used for determination of tannin content. The choice of the six varieties was made to have three pairs of varieties, each pair having the same range of tannin content, in accordance with Ahmed (1985). Hence, the varieties Safra and Tabat, Wad Akar and Umbenin, Yarawasha and HSD5709 represent sorghum varieties with low, medium and high tannin contents, respectively.

Six diets were formulated containing the same amounts (weight) of the chosen sorghum grains. Other feed ingredients were groundnut and sesame seed cakes and super concentrate as major sources of protein, amino acids, vitamins and minerals, vegetable oil as energy source and oyster shell as calcium source. Lysine and methionine were added when necessary. Wheat bran was used as filler. In the control diet (tannin-free), sorghum grains were replaced by maize grains.

The analysis of nutrients of the sorghum grains and other feed ingredients used in ration formulation was carried out according to the Association of Official Analytical Chemists (AOAC 1994).

Ingredients composition of the experimental diets is shown in Table 1, and their determined and calculated compositions are shown in Table 2. The calculations were based on the actual analysis and book values (Ellis 1981; NRC 1994) of composite samples of feed ingredients involved. Metabolizable energy (ME) was calculated according to the modified equation of Lodhi *et al.* (1976). Apart from crude protein, which was induced by the high inclusion rate of sorghums to obtain the required tannin levels, all experimental diets were formulated to meet the requirements of broilers for essential nutrients as outlined by the NRC (1994). Diets were then randomly allocated to 28 pens (4/diet). Amino acids profile in the sorghum grain samples was analyzed by ion exchange chromatography following hydrolysis in 6N HCL for 24 hours at 110º C with two replicates per sample. Derivation with ninhydrin was accomplished (Andrews and Balder 1985), and the quantity of each amino acid was calculated.

Two hundred and fifty, one day old unsexed broiler chicks (Hubbard), were brought from a private commercial hatchery in Khartoum North. On arrival, the chicks were placed in a prepared brooder, where a pre-starter commercial feed was provided *ad-libitum* for the first seven days. Open plate and sacks were used as drinkers and feeders, respectively. Light was provided 24 hours a day.

A completely randomized design was used to lay out the experiment. Diets were randomly allotted to the experimental units. After adaptation of seven days, 196 chicks were randomly selected and distributed to the experimental units in such a way that each dietary treatment was replicated four times, each replicate contained seven chicks. The experimental units were housed in an open sided deep litter poultry house. The experimental pens were $1m^2$ and allotted along the length and the width of the house. Each pen was provided with a drinker and feeder, suspended with a wire from the roof. Saw-dust was used as bedding material. The birds were allowed free access to drinking water and feed during the whole experimental period.

Feed intake and body weight gain of each pen were recorded weekly. At the end of week 5, two birds from each replicate were individually weighed after overnight fasting (except for water) and then slaughtered, handpicked, washed and drained. The heads, feet and shanks were removed. The birds were then eviscerated and the carcasses, pancreas, shanks, total viscera, livers, spleens, bursa of fabricus, gizzards and hearts were individually weighed and expressed as percentages of slaughter weight.

The data were subjected to analysis of variance, and the least significant difference (LSD) was used to separate the means as described by Gomez and Gomez (1984

Table 1. Ingredients composition of experimental diets on percent basis

Ingredient	Sorghum diet	Maize diet
Sorghum	75.0	0.0
Maize	0.0	75.0
Groundnut seed cake	10.0	10.0
Sesame seed cake	7.0	7.0
Super concentrate*	5.0	5.0
Vegetable oil	0.75	0.75
Oyster shell	1.0	1.0
Lysine	0.52	0.52
Methionine	0.13	0.13
Wheat bran	0.10	0.1
Salt	0.25	0.25
Mineral and vitamins	0.25	0.25
Total	100.0	100.0

*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/kg ME plus sufficient amounts of vitamins and minerals

Table 2. Determined and calculated composition of the experimental diets

Parameter	Maize	Sorghum variety					
		Tabat	Safra	Umbenin	Wad Akar	Yarawasha	HSP5907
Determined diet composition							
Crude protein	190.4	194.5	192.3	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 fiber	79.0	76.0	78.0	73.0	72.0	76.0	74.0
Ash	76.0	69.0	71.0	70.0	72.0	3.0	68.0
Calculated diet composition*							
CP(g/kg)	189.4	192.6	191.2	192.8	191.5	190.1	188.9
ME kcal/kg	3200.0	3203.0	3218.0	3199.0	3201.0	3200.0	3195.0
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	12.0	12.0	12.0	12.0	12.0	12.0	12.0
Total phosphorus	5.9	6.5	6.0	6.1	6.4	6.2	6.5

*Calculated according to Ellis (1981) and actual analysis of sorghum samples

Cp= Crude protein

ME= Metabolizable energy

RESULTS

The results of the essential amino acids profile (%) are shown in Table 3. The highest essential amino acid profile was found in Safra (low tannin) followed by HSP5907 (high tannin), Yarawasha (high tannin), Tabat (low tannin). Except for lysine, the lowest values were scored by sorghum grains with medium level of tannin (Umbenin and Wad-Akar). In addition, the essential amino acids profile showed that lysine is the most limiting amino acid followed by threonine and methionine.

The results of performance, carcass yield and relative weight of non carcass components of broilers fed low (Tabat and Safra), medium (Umbenin and Wad-Akar) and high (Yarawasha and HSP5907) tannin sorghum grains are shown in Tables 4, 5 and 6, respectively. The highest feed intake was consumed by birds fed on Yarawasha (high tannin) and Safra (low tannin) sorghum varieties, followed by HSP5907 (high tannin) and Tabat (low tannin), and the lowest feed was consumed by birds fed Wad-Akar and Umbenin having medium tannin levels (Table 4). This means that feed intake is not related to tannin content, likewise gain in body weight and carcass characteristics. The heaviest weight was exhibited by birds fed Safra (low tannin), followed by Yarawasha (high tannin), HSP5907 (high tannin level), Tabat (low tannin level), Wad-Akar (medium tannin) and Umbenin (medium tannin).

On the other hand, there were significant ($P<0.05$) differences in slaughter weight and carcass weight between treatments (Table 5). The best slaughter weight was achieved by birds fed on Yarawasha (high tannin), followed by Safra (low tannin) and then Tabat (low tannin) and HSP5907 (high tannin), and the least was Wad-Akar and Umbenin (medium tannin). Yarawasha gave the best carcass weight followed by Safra, Tabat, Wad-Akar, HSP5907 and Umbenin.

The results further showed that low tannin sorghum-based diets (Tabat and Safra) with the same content of tannin produced different effects on the parameters examined. A similar trend was observed in the case of high tannin (Yarawasha and HSP5907). On the other hand, the medium

tannin sorghum-based diets with the same content of tannin resulted in different effects on feed intake and body weight gain. No difference between treatments was found in the relative weights of non- carcass components (Table 6).

Overall, the results indicated that the best performance was obtained by chicks fed Safra (low tannin), followed by Yarawasha and HSP5907 (high tannin) and then Tabat (low tannin), and the least performance was shown by birds fed on medium tannin sorghum grains. However, birds fed Wad-Akar gave better performance than those fed Umbenin. Moreover, catechin equivalent (CE) intake and crude protein intake tends to increase as the level of tannin increases (Table 7).

Table 3. Essential amino acids profile (%) of the tested sorghum varieties

Level of tannin	Variety	Isoleu	Leu	Lys	Thre	Val	Meth	Phe
Low	Tabat	11.08±0.82^{c}	21.08±0.82^{c}	0.21±0.01^{d}	0.83±0.02^{d}	9.42±0.01^{c}	3.99±0.03^{d}	4.89±0.02^{c}
(0.14-0.15)	Safra	16.60±0.01^{a}	35.38±0.92^{a}	0.78±0.01^{a}	2.73±0.02^{a}	15.1±0.02^{a}	6.01±0.01^{a}	9.28±0.07^{a}
Medium	Umbenin	4.97±0.01^{e}	6.77±0.02^{e}	0.24±0.02^{c}	0.26±0.01^{f}	5.00±0.01^{e}	2.77±0.02^{f}	1.00±0.01^{e}
(0.67-0.81)	Wad-Akara	8.18±0.01^{d}	13.92±0.02^{d}	0.24±0.02^{c}	0.66±0.02^{e}	7.27±0.08^{d}	3.42±0.02^{e}	3.01±0.01^{d}
High	Yarawasha	13.72±0.02^{b}	28.22±0.83^{b}	0.35±O.O3^{b}	1.32±0.02^{c}	12.15±0.02^{b}	4.68±0.01^{b}	8.06±0.02^{b}
(0.94-1.12)	HSP5907	15.56±0.02^{a}	34.88±0.02^{a}	0.38±0.02^{b}	1.83±0.01^{b}	12.68±0.07^{b}	4.43±0.02^{c}	8.14±0.03^{b}
Level of significance		*	*	*	*	*	*	*

Values are means of three determinations ±standard deviation.
Means in a row, with the same superscript letters are not significantly different.
*Significant at P = 0.05

Table 4. Performance of broilers fed low, medium and high tannin sorghum diets

Parameter	Tabat	Safra	Umbenin	Wad-Akar	Yarawasha	HSP5907	Maize	SE±
Tannin level	0.150	0.145	0.675	0.812	0.943	1.121	0.0	
Feed intake (g/bird/week)	345.4^{c}	420.3^{b}	294.0^{e}	315.6^{d}	423.4^{b}	366.0^{c}	464.5^{a}	21.8
Weight gain (g/bird/week)	155.4^{e}	221.2^{b}	121.0^{g}	135.6^{f}	190.6^{c}	171.3^{d}	298.6^{a}	21.0
F.C.R.	2.22^{d}	1.90^{b}	2.43^{e}	2.33^{e}	2.22^{d}	2.14^{c}	1.56^{a}	

F.C.R. = Feed conversion ratio

Values are means of 15 samples each.

Means with different superscripts in the same row are significantly different at P=0.05.

SE±= Standard error

Table 5. Carcass characteristics of broilers fed sorghums with low, medium and high tannin

Parameter	Sorghum variety						Maize	SE±	L.S
	Tabat	Safra	Umbenin	Wad-Akar	Yarawasha	HSP5907			
Tannin level (g)	0.150	0.145	0.675	0.812	0.943	1.121	0.0		
Slaughter wt.(g)	980^{d}	1123^{c}	855^{f}	870^{f}	1380^{b}	910^{e}	1594^{a}	99.47	*
Carcass wt. (g)	689^{d}	754^{c}	560^{g}	618^{e}	890^{b}	603^{f}	1100^{a}	67.02	*
Dressing (%)	70.3	67.14	65.5	71.03	64.5	66.26	69	0.54	NS

Means are values of 8 birds.
Means with different superscripts in the same row are significantly different at P=0.05.
SE±= Standard error
*Significant at P = 0.05
NS= Not- significant

Table 6. Relative weight of non- carcass components of broilers fed low, medium and high tannin diets

Parameter	Sorghum variety						Maize	SE±
	Tabat	Safra	Umbenin	Wad-Akar	Yarawasha	HSP5907		
Tannin content %CE	0.150	0.145	0.675	0.812	0.943	1.121	-	
Dressing (%)	70.3	67.14	65.5	71.03	64.5	66.26	69	0.54
Gizzard	3.03	3.14	3.52	3.75	3.05	3.00	2.90	0.11
Liver	3.16	3.35	3.28	3.79	2.95	3.00	2.45	0.14
Pancreas	0.22	0.25	0.20	0.31	0.26	0.26	0.22	0.01
Heart	0.68	0.62	0.70	0.74	0.57	0.65	0.60	0.01
Bursa of fabricus	0.07	0.10	0.08	0.10	0.08	0.10	0.07	0.01
Spleen	0.10	0.14	0.13	0.15	0.18	0.15	0.13	0.01
Digestive tract	6.06	8.42	7.05	8.62	7.24	6.36	5.41	0.42
Shanks	5.78	3.17	2.19	5.33	3.03	5.59	3.32	0.51
Heads	5.50	2.54	2.19	4.08	2.71	3.99	3.02	0.40

Means are values of 8 birds.
CE = Catechin equivalent
SE±= Standard error

Table 7.Tannin intake and crude protein intake of broilers fed diets with different tannin

Parameter	Sorghum variety					
	Tabat	Safra	Umbenin	Wad-Akar	Yarawasha	HSD5907
Tannin content (g)	0.150	0.145	0.675	0.812	0.943	1.121
Tannin intake(CE)	0.52	0.6	1.98	2.56	3.99	4.10
Ranking	1	2	3	4	5	6
CPi (g)	64.8	78.26	55.5	58.4	80.45	68.78
Ranking	3	5	1	2	6	4

CPi = Crude protein intake
CE= Catechin equivalent

DISCUSSION

Birds fed on the maize-based diet had a greater growth performance compared with those fed the sorghum-based diets. The same trend was observed by Issa (2009), who recorded 532 and 505 g gain/g feed intake at the 6th week of age for broilers fed maize and sorghum grains, respectively. Sorghum grains have several nutritional merits over maize grains. Proteins, essential amino acids and trace minerals contents are higher than those of maize grains (NRC 1994). Furthermore, the non-starch polysaccharides (known as digestion and absorption depressants) are more concentrated in maize (8.1%) than in sorghum (4.8%) (Cocht 2006). This indicates that the tannin content of sorghum grains has a profound anti-nutritional effect to the extent that it adulterates its nutritional qualities.

Previous research found no clear relationship between the concentration of tannin in the diet and the magnitude of reduction in feed intake. Ibrahim *et al.* (1988), Musharaf and Latshow (1991) and Hassan *et al*. (2003) noted a decrease in feed intake with increasing level of dietary tannin in growing broilers. Abbas and Musharaf (2008) reported that the removal of tannin from sorghum grains increased the total feed intake from 3004 to 3175 g during the growing period of broilers. The current results are in agreement

with the above observations as feed intake was not consistently affected by the tannin level. These results are in accord with what was found by Damrun *et al.* (1968) who compared the feeding value of several sorghum varieties and obtained significantly higher feed intake for birds eating two high-tannin sorghums. On the other hand, the present results disagree with the findings of Ibrahim *et al.* (1988) and Hassan *et al.* (2003) who reported that high tannin sorghum reduces feed intake in broiler chicks compared with low tannin sorghum. This controversy is more likely attributed to type of tannin and adaptive features that are not related to tannin concentration.

The acceptable explanation for the best feed intake of birds fed on high tannin pairs (Yarawasha and HSP5907) compared with those fed medium tannin is that Yarawasha and HSP5907, as newly developed varieties by crossing, might have contained substances that enhance feed intake. It is known that selection for bird resistant varieties is likely to increase tannin content of the grain (Nyachoti *et al.* 1997). Other possible explanations are the high level of the essential amino acids profile and that tannin may create special situation in the gut that cause deficiency of nutrients as a result of formation of complexes with tannin, and hence birds eat more to compensate.

Body weight gain showed inconsistent trend as the level of tannin increased, where sorghum grains having high tannin content produced heavier body weight in broilers than that obtained by low tannin Tabat and those having medium tannin content. The heavy body weight gain exhibited by birds given the high tannin sorghum (Yarawasha and HSP5907) do not conform to the results of Luis and Sullivan (1982) who found that the frequent use of sorghum with high tannin decreases growth rate of birds. This heavy body weight gain can be attributed to the high values of the essential amino acid profile (Table 3) and high crude protein intake (Table 7) of these two sorghum grains. High crude protein intake reduces the harmful effects of tannin on the ground that tannin will not be able to bind with all proteins. This result contradicts the findings of Trevino (1992) and Elkin *et al.* (1995) who attributed the reduction in growth rate of birds fed on diets containing high sorghum tannin to decrease in utilization of energy, proteins and specific amino acids. On the other hand, the present results of

feeding Yarawasha and HSP5907 (high sorghum tannin) agree with the findings of other workers (Teeter *et al.*1986; Musharaf and Latshow, 1991) who reported that some high tannin sorghums have no negative effect on weight gain of chicks.

The results of feed conversion ratio also showed similar inconsistent trend as feed intake and body weight gain where birds fed on Yarawasha sorghum variety with high tannin level showed similar feed conversion ratio as those fed on Tabat having the lowest tannin level. Other factors, beside the type of tannin, may also be responsible for the observed inconsistency in feed utilization efficiency.

The results of performance infer that sorghum varieties with the same range of tannin produce different effects on broiler performance. This may be due to amino acids content of different varieties. The low performance recorded for the birds fed on sorghum varieties having medium tannin level could be attributed to many factors, the most important of which is the chemical nature of the tannin contained, that might have negatively affected feed intake, feed conversion efficiency and amino acids utilization (Elkin *et al.* 1995). Other reasons are low essential amino acids profile (Table 3), low feed conversion ratio (Table 4) and low protein intake (Table 7). The good performance showed by birds fed on Wad Akar compared with those fed on Umbenin can be attributed to its high amino acids profile and feed intake. The best performance of birds fed on Safra (low tannin pair) in almost all parameters examined is possibly due to its high essential amino acids profile (Table 3), high feed utilization efficiency (Table 4) and high crude protein intake (Table 7).

According to Reyes Sanchez *et al.* (2000), slaughter weight and carcass weight are expected to be negatively affected by increased tannin concentration. The present results do not agree with this statement since birds fed Yarawasha (high tannin) had higher slaughter weight and carcass weight than those fed low tannin sorghum varieties. This contradiction could be attributed to the inconsistencies seen in the performance parameters. However, the similarity in the dressing percentages of birds fed different tannin levels infers that slaughter weights and carcass weights of the experimental birds' changes with similar rate.

Tannin level had no effect on non-carcass characteristics of broilers (Table 6). However, available literature lacks information for comparison.

It is concluded that, in some instances, the negative effect of tannin is not correlated with tannin level and that the same tannin level does not produce similar effects in broilers performance and carcass characteristics. Tannin level should not be taken as a guide to speculate or assess tannin effects in broiler diets, and sorghum varieties having high tannin content should not always be regarded as harmful to broiler performance.

REFERENCES

Abbas, T.E.E. and Musharaf, N.F. (2008). The effect of germination of low-tannin sorghum grains on its nutrient content and broilers chick's performance. *Pakistanian Journal of Nutrition* 7 (3), 470 -474

Ahmed, A.E. (1985). *Sorghum Grain Tannin Content and its Effects on Performance of Growing Chicks*. M.Sc. thesis. University of Khartoum, Sudan.

Andrews, R.P. and Balder, N.A. (1985). Amino acids and analysis of feed constituents. *Journal of Science Tools* 5, 32-44.

AOAC, (1994). *Official Methods of Analysis* (15th edition.). Association of Official Analytical Chemists (AOAC). Washington, D.C., U.S.A.

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. *British Journal of Nutrition* 51, 485 – 491.

Cocht, M. (2006). Enzymes for feed industry: Past present and future. *World's Poultry Science Journal* 60, 5-12

Damrun, B.L.; Price, G.M. and Harms, R.H. (1968). Evaluation of various bird resistant and non - resistant varieties of grain sorghum for use in broiler diets. *Poultry Science* 47, 1648-1650

Elkin, R.G.; Featherston, W.R. and Rogler, B.C. (1978). Investigations of leg abnormalities in chicks consuming high tannin sorghum grain diets. *Poultry Science* 57, 757 – 762

Elkin, R.G.; Featherston, W.R. and Rogler, B.C. (1995). Condensed tannins are only partially responsible for variations in nutrient digestibility of sorghum grain cultivars. *Poultry Science* 74, (supplement 1) 125 (Abstract).

Ellis, S.N. (1981).The nutrient composition of Sudanese animal feeds. Bulletin (1). Central Animal Nutrition Research Laboratory. Kuku, Khartoum North, Sudan.

Gomez, K.A. and Gomez, A.A. (1984). *Statistical Procedures for Agricultural Research* (2nd edition.), pp. 97- 120. John Wiley and Sons New York, U.S.A.

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. *Tropical Animal Health and Production* 35, 189 – 196.

Herstad, O. (1980). Effect of different tannin content in sorghum grains on the feed value of chickens. *Chemical Abstracts* 92, 507.

Ibrahim, S.; Fisher, C.; Elalaily, H.; Soliman, H. and Anwar, A. (1988). Improvement of the nutritional quality of Egyptian and Sudanese sorghum grains by the addition of phosphates. *British Poultry Science* 29, 721 – 728.

Issa, s. (2009).Nutritional value of sorghum for poultry feeds in West Africa. PhD thesis, Kansas State University

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.

Lodhi, G.N.; Singh, D. and Ichponani, J.S. (1976). Variation in nutrient contents of feedstuffs rich in protein and reassessment of the chemical methods for ME estimation for poultry. *Journal of Agricultural Sciences* 86, 293-303.

Luis, E.S. and Sullivan, T.W. (1982). Nutrient composition and feeding values of proso millets, sorghum grains and corn in broiler diets. *Poultry Science* 61, 311 – 320.

Musharaf, N.A. and Latshaw, J.D. (1991). Effect of tannin extraction on the feeding value of grain sorghum in broiler starter diets. *Sudan Journal of Animal Production* 4, 53-64.

NRC (1994). *Nutrient Requirements of Poultry* (9th edition.). National Research Council (NRC) Revised. National Academy of Science, Washington, D.C., U.S.A

Nyachoti, C.M.; Atkinson, J.L. and Lesson, S. (1997). Sorghum tannins: a review. *Worlds Poultry Science Journal* 53, 5-21.

Price, M.L.; Van Scoyoc, S. and Butler, L.G. (1978). A critical evaluation of the vanillin reaction as an assay for tannin in sorghum grain. *Journal of Agriculture and Food Chemistry* 26, 1214 – 1218

Reyes Sanchez, S.E.; Cortez Cuevas, A.; Morales Barrera, E. and Avila Gonzalez, E. (2000). DL – Methionine addition in high tannin sorghum grains diets for broilers. *Tecnica Pecuaria on Mexico* 38, 1 – 8.

Teeter, R.G.; Sarani; S.; Smith, M.O. and Hibberd, C.A. (1986). Detoxification of high tannin sorghum grain. *Poultry Science* 65, 667-671.

Trevino, J. (1992). Effects of tannin from faba bean (*Vicia faba*) on the digestion of starch by growing chicks. *Animal Feed Science and Technology* 37, 345 – 349.

تأثير مواد الذرة الرفيعة الدابغة على أداء الدجاج اللاحم وخصائص بيحتها*

ملتون ملينقاسوك[1] وسالم جبريل[2] وعبد الحافظ الطاهر أحمد[3]

[1،2،3]كلية الموارد الطبيعية، جامعة جوبا، الخرطوم بحرى– السودان
[2]جامعة بحرى، الخرطوم بحرى - السودان

المستخلص : أُجريت تجربة لدراسة تأثير مواد الذره الرفيعه الدابغة على أداء الدجاج الاحم وخصائص ذبيحته. تم تكوين سبع علائق تحتوى على حبوب الذرة الشامية الخالية من المواد الدابغة كشاهد وستة أصناف من الذرة الرفيعة كل إثنان منهما يحتويان على كميات منخفضة و متوسطة وعالية من المواد الدابغة. تمت تغذية هذه العلائق لعدد 196 كتكوتاً ذكوراً وإناثا من سلالة الهابارد لمدة خمسة أسابيع. إحتوى الصنف صفراء من الذرة الرفيعة ذو المحتوى المنخفض من المواد الدابغة على أعلى كمية من الأحماض الأمينية تليه الأصناف ذات المحتوى العالى من المواد الدابغة. لم تظهر نتائج الدراسة نمطاً واضحاً لتأثير زيادة المواد الدابغة على أداء وخصائص ذبيحة الدجاج الاحم ، حيث كان أداء وخصائص الذبيحة للفراخ التي تمت تغذيتها بأصناف الذرة الرفيعة التي تحتوي على كميات عالية من المواد الدابغة أكثر من أداء وخصائص ذبيحة رصيفاتها التي غُذيت بالأصناف التي تحتوي على كميات متوسطة من المواد الدابغة . كذلك أظهرت النتائج فروقاً معنوية في أداء وخصائص ذبيحة الفراخ الآحم التي تمت تغذيتها على أصناف من الذرة الرفيعة تحتوى على مستويات متساوية من المواد الدابغة. دلت هذه النتائج على إمكانية وجود عوامل أخرى تؤثر على القيمة الغذائية للذرة الرفيعة و أن محتوى المواد الدابغة في الذرة الرفيعة ليس هو العامل الأوحد الذى يؤثر على قيمتها الغذائية.

*جزء من أطروحة قدمها الباحث الأول لنيل درجة الدكتوراة فى الإنتاج الحيوانى من جامعة جوبا