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Effect of Addition of Baobab (*Adansonia digitata*) Fruit Powder to the Drinking Water of Broiler Chicks on the Performance and Carcass characteristics

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Abstract

The study was carried out to examine the effects of supplementation of Baobab **(***Adansonia digitata*) fruit powder to the drinking water of broiler chicks on the performance and carcass quality. A total of 160 one – day – old unsexed broiler chicks (Ross 308) were used. The experiment lasted 6 weeks (42 day). Isocaloric and isonitrogenous diets were offered to birds. Four different levels of Baobab fruit Powder (0g/L, 1g/L, 2g/L and 3g/L) were added to the drinking water of broiler chicks. Each treatment was offered to 40 chicks (10 chicks X 4 replicates). The experiment was carried out at an open-house system. Live body weight, body weight gain and feed intake were recorded weekly for each replicate. In addition to, feed conversion ratio and protein efficiency rate were calculated weekly. At the end of the experiment (6 weeks of age) two birds from each pen were randomly selected, weighed and manually slaughtered for carcass characteristics and internal organ determination. Results showed absence of significant effect ($P \geq 0.05$) on feed conversion ratio, protein efficiency ratio, Feed consumption, live body weight and body weight gain during starter, finisher and whole periods. Regarding carcass characteristics, the use of Baobab fruits produced significant ($P \leq 0.05$) effects on Absolute and relative weights of liver, relative weight of gizzard, absolute weight of intestine and intestine length. It has been concluded that, inclusion of Baobab fruits into the broiler drinking water at the levels (1g/L, 2g/L and 3g/L) has no significant effect on broiler performance and some items of carcass yields, therefore, more researches are needed to examine inclusion of Baobab into broilers diet and drinking water.

Keywords: Baobab, Water, Broilers, Carcass.

Introduction

In the tropic countries poultry sector faces problem of heat stress as a result of higher temperature during summer season particularly at the open-system. To overcome heat stress and improve poultry performance producers were supplying vitamin C (Ogbamgba *et al*., 2007). But, supplementation of vitamin C will increase the cost of poultry feeding which resembles about 70 – 80% of total cost of production. Therefore, safe and cheapest source of vitamin C will be the optimal solution for heat stress in tropical countries. In addition to, prohibition of using antibiotics in animal feed to improve their performance necessitates finding of safe alternatives to replace antibiotics as

growth promoters. Recently, phytogenic which are products of plant origin such as herbs and spices are used as feed additives in animal feeds to improve their performance and health. Baobab (*Adansonia digitata*) is a large tree located in many countries of Africa. It possess emblematic and cultural importance for African people (Kamatou *et al*., 2011). Vertuani *et al*., (2002) noticed that Baobab fruits regarded as a valuable source of vitamin C and have an antioxidant property. Also anti-inflammatory and antiviral activities of Baobab fruits, leaves and seeds have been detected by Vimalanathan and Hudson (2009). In addition to, Al-Qarawi *et al*., (2003) reported that, Baobab fruits have an ability to protect the liver from damage by chemical toxicity. Parts of Baobab were examined to evaluate their effects in poultry performance and health. Mwale *et al*., (2008) fed guinea fowl keets on Baobab seed cake and observed increase in feed intake and body weight gain. Chimvuramahwe *et al*., (2011) recorded decrease in total feed cost as a result of inclusion of Baobab seed cake into broilers diet. Bale *et al*., (2013) assured previous findings, authors noticed that supplementation of Baobab seed cake to broilers diet increases feed intake and body weight gain and reduces total feed cost. Similar findings obtained by (Saulawa *et al*., 2014; Chisoro *et al*., 2018) who declared higher feed intake and body weight and lower feed cost due to the use of Baobab seed cake in broilers diet. Effects of another part of Baobab on poultry performance and health were evaluated. Adeosun *et al*., (2018) found decline in feed intake, body weight gain and carcass characteristics and inefficient feed conversion ratio as a result of introduction of Baobab leaf meal into broilers diet. Finally, Olubunmi *et al*., (2018) examined responses among broiler performance and carcass traits due to the use of Baobab pulp in their diets during hot-dry season. Authors mentioned absence of significant effect on final body weight, protein retention and feed conversion due to supplying birds with dietary Baobab pulp when compared to control diet. There is rarity of studies about the effects of the use of *Adansonia digitata* (Baobab) in the poultry diet, therefore this research was performed to investigate effects of addition of Baobab fruits powder to the drinking water of broilers on their performance and carcass characteristics.

Materials and Methods

The site and experimental birds

The experiment was conducted at the poultry unit (open-house system) of Faculty of Agricultural Technology and Fish Sciences, University of Alneelain, Jebal-Awlia, Khartoum South. One Hundred and sixty one-day-old unsexed commercial (Ross 308) broiler chicks were purchased from a commercial hatchery. Birds were weighed (43.6 g ± 1.7 g) and randomly assigned to 12 floor pens ($1m^2$ each) with wood shavings.

Baobab (*Adansonia digitata*) fruit

Baobab fruit was purchased from the local market at Omdurman. Then crushed and analyzed to determine their composition. Table 1 showed chemical composition of Baobab.

Experimental water

The source of the water was the tap water that comes from the White Nile river, at Poultry Unit which belongs Faculty of Agricultural Technology and Fish Sciences, University of Alneelain, Jebal-Awlia, Khartoum South. Four treatments of water were performed by addition of various levels of Baobab powder (0g/L, 1g/L, 2g/L and 3g/L). Each treatment was offered to group of chicks (10 birds X 4 replicates).

Experimental Diet

Isocaloric and isonitrogenous starter and finisher diets were formulated according to nutrient specifications of National Research Council (NRC, 1994). Pre-starter

diet was offered for the first 5 days. Then chicks were fed on starter diets till the third week. After that chicks offered a finisher diets. The composition of starter and finisher diets were shown in Table 2.

Management

Each pen was equipped with 1 metallic drinker and 1 metallic tubular feeder. Feed and water were provided *ad-libitum*. Drinkers and feeders were kept clean and regularly leveled using red brick, cuboids. A continuous lighting was used throughout the experimental period by a combination of natural and artificial light. The bulbs were hanged about one foot height from the floor during the first two weeks and then maintained to about 6 feet. The birds were given mix vaccine (IB+ Newcastle clone) at 5 days of age, and infections bursal disease (Gumboro) vaccine at 14 days of age, and replicated at 21 days of age and Newcastle disease vaccine at 28 days of age.

Experimental procedures

Weekly feed intake, live body weight and body weight gain were determined on replicate basis. Feed conversion ratio (FCR) was calculated as feed intake per weight gain. Protein efficiency ratio (PER) was calculated as weight gain per protein consumed. Water consumption and water consumption/Feed consumption were determined for the whole period. Mortality was recorded as it occurred. At the end of the experiment (6 weeks of age), the birds were fasted from feed for an overnight and then weighed. Two birds from each pen were randomly selected and manually slaughtered for carcass characteristics determination.

Table 1 showed chemical composition of Baobab.

Ingreedients	% dry matter basis
Dry matter	90.63
Crude protein	11.99
Ether extract	6.32
Crude fiber	8.05
Ash	7.23
Moisture	9.06

Table2. Composition of broilers starter and finisher diets.

Ingredients%	Starter diet%	Finisher diet%	
Sorghum	63.77	69.95	
Ground nut	24.5	17.0	
Wheat bran	0.5	2.0	
Super concentrate*	5.0		5.0
Vegetable oil	3.5		3.5
Lysine	0.14		0.1
Methionine	0.16		0.11
Limestone	1.4	1.44	
Dicalcium phosphate	0.13	0.0	
Choline	0.20	0.20	
Enzyme	0.20	0.20	
Mycotoxin binder	0.20	0.20	
Nacl	0.30	0.30	
Calculated analysis			
ME (Kcal/Kg)	3189.11	3210.88	
CP%	23.02	20.19	
Crude fiber%	4.18	3.80	
Ether extract%	7.19	6.80	
Ca%	1.06	1.00	
Available phosphorus%	0.45	0.42	
Lysine %	1.11	1.01	
Methionine%	0.58	0.50	
Methionine+Cystine%	0.79	0.69	

*Cp 35%, ME 1900 kcal/kg, C.fiber 2.50%, EE 1.5%, Ash 35%, Ca 7.0%, Av. P 4.5%, Lysine 11%, Methionine 4.2%, Methionine+Cystine 4.3%. Vitamin A stabilised 250.000 I.U./Kg, Vitamin D3 stabilised 50.000 I.U./Kg, Vitamin E stabilised 500 mg/Kg, Vitamin K3 (hetrazeen) 40 mg/Kg, Vitamin B1 = thiamin 20 mg/Kg, Vitamin B2 = riboflavin 100 mg/kg, Vitamin B6 = pyridoxine 30 mg/Kg, Vitamin B12 = cyanocobalamin 300 mcg/Kg,

Niacin 600 mg/Kg, Folic acid 15mg/Kg, DL-Ca. Pantothenate 160 mg/Kg, Choline Chloride 7.000 mg/Kg, Biotin 1.000 mcg/Kg, Copper 300 mg/Kg, Zinc 1.100 mg/Kg, Iron 600 mg/Kg, Manganese 1.200 mg/Kg, Cobalt 4.0 mg/Kg, Iodine 20.0 mg/Kg, Selenium 4.0 mg/Kg, Anti-oxidant Added, Phytase Added, Mould inhibitor Added, Salinomycin 1200 mg/kg.

Experimental design and statistical analysis

Data were subjected to statistical evaluation by the general linear model (GLM) procedures of SAS (SAS Institute, 2003) using completely randomized design (CRD). Moreover, Duncan's multiple range tests (Steel and Torrie, 1980) was used to compare the treatment means with significant differences.

Results and Discussion

The influences of addition of Baobab fruit to the broiler diets on the feed consumption, weight gain, feed conversion ratio and protein efficiency ratio during starter, finisher and overall periods are shown in Tables 3, 4 and 5, respectively. As shown in Tables 3, 4 and 5 supplementation of Baobab fruit to the broiler diet doesn`t produce significant ($P \geq 0.05$) effect on feed consumption, weight gain, feed conversion ratio, protein efficiency ratio and live body weight during starter (0-3 weeks), finisher (4-6 weeks) and whole (0-6 weeks) periods. Present results agreed results obtained by Olubunmi *et al*., (2018) who observed insignificant ($P \geq 0.05$) effect on final body weight, body weight gain, protein retention and feed conversion due to supplying birds with dietary Baobab pulp in comparing to control diet. In reverse to these results, significant effects ($P \leq 0.05$) have been reported on feed intake and body weight gain (Mwale *et al*., 2008) on total feed cost (Chimvuramahwe *et al*., 2011) on feed intake, body weight gain and total feed cost (Bale *et al*., 2013; Saulawa *et al*., 2014; Chisoro *et al*., 2018) due to addition of Baobab seed cake to the broiler diet. Other opposite findings reported by Adeosun *et al*., (2018). Authors found decline in feed intake, body weight gain and carcass characteristics and inefficient feed conversion ratio as a result of introduction of Baobab leaf meal into broilers diet. Disagreement may be due to use of different parts of Baobab that have different chemical compositions, or may be due to different processing methods that parts of Baobab were subjected to.

Table 3. Effects of supplementation of Baobab fruit powder to the drinking water of broiler chicks during the starter period (0 – 3 weeks).

	Different levels of Baobab powder				
	0g/L control	**1g/L**	**2g/L**	**3g/L**	**±SEM**
Feed Consumption (gm/bird/week)	686.1±103.5	650.5±65.4	654.3±34.2	655.5±30.0	27.88
Weight Gain (gm/bird/week)	543.7±28.9	538.4±33.9	541.1±21.0	516.1±17.6	17.15
Feed Conversion Ratio (kg feed/ kg weight)	1.30±0.23	1.20±0.17	1.20±0.55	1.30±0.09	0.023
Protein Efficiency Ratio (Body wt gain/protein consumed)	3.50±1.00	3.60±0.80	3.60±0.45	3.40±0.70	0.064

- Values are mean of four replicate groups of 10 birds each.

SEM: Standard error of the mean difference.

a-c values in the same raw with different superscripts are significantly different ($P \leq 0.05$).

Table 4. Effects of supplementation of Baobab fruit powder to the drinking water of broiler chicks during the finisher period (4 – 6 weeks).

	Different levels of Baobab powder				
	0g/L control	**1g/L**	**2g/L**	**3g/L**	**±SEM**
Feed Consumption (gm/bird/week)	2281.2±161.5	2130.0±124.8	2114.2±113.8	2114.2±150.1	69.41
Weight Gain (gm/bird/week)	1167.4±122.7	1054.0±113.6	1115.8±66.3	1103.0±134.7	56.69
Feed Conversion Ratio (kg feed/ kg weight)	1.96±0.30	2.03±0.40	1.90±0.22	1.95±0.50	0.05
Protein Efficiency Ratio (Body wt gain/protein consumed)	2.48±0.46	2.40±0.70	2.56±0.39	2.50±1.00	0.07

- Values are mean of four replicate groups of 10 birds each.
SEM: Standard error of the mean difference.
a-c values in the same raw with different superscripts are significantly different ($P \leq 0.05$).

Table 5. Effects of supplementation of Baobab fruit powder to the drinking water of broiler chicks during the whole period (0 – 6 weeks).

	Different levels of Baobab powder				
	0g/L control	**1g/L**	**2g/L**	**3g/L**	**±SEM**
Live Body weight (gm)	1754.8±145.4	1636.0±151.4	1700.5±101.6	1662.7±134.2	67.29
Feed Consumption (gm/bird/week)	2967.3±217.0	2780.4±177.0	2768.5±139.0	2796.5±127.0	84.36
Weight Gain (gm/bird/week)	1711.1±165.2	1592.4±184.9	1656.9±129.2	1619.2±215.1	67.28
Feed Conversion Ratio (kg feed/ kg weight)	1.74±0.56	1.75±0.92	1.67±0.43	1.73±0.94	0.03
Protein Efficiency Ratio (Body wt gain/protein consumed)	2.72±1.46	2.70±1.50	2.83±0.74	2.73±1.70	0.05
Water consumption (ml)	7686.5±329.0	7511.9±618.0	7449.0±380.0	7523.8±174.0	203.9
W consumption/F consumption	2.60±0.15	2.70±0.12	2.69±0.09	2.69±0.12	0.06

- Values are mean of four replicate groups of 10 birds each.
SEM: Standard error of the mean difference.
a-c values in the same raw with different superscripts are significantly different ($P \leq 0.05$).

As shown in Table 6, introduction of Baobab fruit powder into drinking water of broilers produces significant ($P \leq 0.05$) effect on some carcass characteristics, but the level effect of Baobab fruits on these items is not constant. Supplementation of 1g/L Baobab fruit results in significant ($P \leq 0.05$) higher absolute and relative weight of liver, absolute weight of intestine and longer intestine compared to addition of 2g/L Baobab fruit. Increase in liver weight is an indication of increased liver metabolic activities which leads to increase utilization of nutrients (energy, amino acids, minerals and vitamins) for maintenance instead of growth and fattening (Woyengo *et al*., 2011). Higher weight and increased length of intestine may be attributed to improved digestive and absorption functions of the intestine (Awad *et al*., 2009). Use of Baobab fruit in broilers drinking water at the level of 3g/L causes significant ($P \leq 0.05$) higher relative weight of gizzard and insignificant ($P \geq 0.05$) higher absolute weight of gizzard when compare to addition at the level of 1g/L. Increased weight of gizzard may be due to inclusion of higher crude fiber which required more muscular activities to break down feed ingredient (Obun *et al*., 2008).

Table 6. Effects of supplementation of Baobab fruit powder to the drinking water of broiler chicks on the carcass quality.

	Different levels of Baobab powder				
	0g/L control	**1g/L**	**2g/L**	**3g/L**	**±SEM**
Dressing% on hot base	70.2±4.10	72.3±0.34	72.2±1.90	71.1±2.80	1.33
Absolute wt of heart (g)	7.93±1.40	6.70±0.94	8.05±1.90	7.33±0.80	0.70
Relative wt of heart	0.65±0.14	0.53±0.08	0.68±0.11	0.60±0.11	0.06
Absolute wt of liver (g)	37.6^{ab}±1.70	41.7^{a}±8.50	27.9^{b}±5.20	33.2^{ab}±5.30	3.84
Relative wt of liver	3.05^{ab}±0.30	3.22^{a}±0.70	2.37^{b}±0.20	2.61^{ab}±0.50	0.24
Absolute wt of gizzard (g)	21.2±2.90	20.7±4.30	21.8±3.80	26.5±3.20	1.79
Relative wt of gizzard	1.73^{ab}±0.30	1.61^{b}±0.30	1.86^{ab}±0.30	2.08^{a}±0.30	0.13
Intestine length (cm)	180.0^{ab}±73.4	189.8^{a}±21.6	153.5^{b}±19.2	173.5^{ab}±12.1	10.33
Absolute wt of intestine (g)	73.8^{a}±12.3	79.7^{a}±11.8	56.6^{b}±7.40	65.9^{ab}±9.50	5.22
Relative wt of intestine	6.06±1.40	6.22±0.80	4.83±0.30	5.35±1.70	0.60
Absolute wt of abdominal fat (g)	47.7±2.40	43.3±13.50	50.4±18.5	45.1±17.5	7.25
Relative wt of abdominal fat (g)	3.87±0.30	3.34±0.90	4.17±1.10	3.45±0.80	0.41

- Values are mean of four replicate groups of 10 birds each.
SEM: Standard error of the mean difference.
a-c values in the same raw with different superscripts are significantly different ($P \leq 0.05$).

Conclusion

It has been concluded that, inclusion of Baobab fruits into the broiler drinking water at the levels (1g/L, 2g/L and 3g/L) has no significant effect on broiler performance and some items of carcass yields, therefore, more researches are required to evaluate inclusion of Baobab (*Adansonia digitata*) into broilers diet and drinking water.

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أثر إضافة مسحوق ثمرة القونقليز إلى ميالا الشرب للدجاج اللاحم على الأداء وخصائص الذبيحة

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المستخلص

صُممت التجربة من أجل دراسة أثر استخدام مستويات مختلفة من مسحوق ثمرة التبلدي (القونقليز) في مياه الشرب على أداء الدجاج اللاحم وخصائص الذبيحة. أُستخدم في هذه التجربة عدد (160) كتكوت لاحم غير محدد الجنس من سلالة (Ross 308) عمر يوم. تم اعطاء الكتاكيت اربعة معاملات مختلفة من مياه الشرب (0جرام/لتر و1جرام/لتر و2جرام/لتر و 3جرام/لتر). وقُسمت الكتاكيت إلى اربعة مجموعات بكل مجموعة 40 كتكوت (10 كتاكيت X 4 تكرارات)، مُنحت كل مجموعة احدى المعاملات المذكورة أعلاه. تم تسجيل الوزن الحي والوزن المكتسب ووزن العلف المستهلك ومعدل التحويل الغذائي وكفاءة تحويل البروتين اسبوعياً لكل تكرار. بعد نهاية فترة التجربة (6 أسابيع) تم اختيار عدد (2 دجاجة) من كل معاملة عشوائياً ثم ذبحهما ووزن كل من الكبد والقانصة والأمعاء والقلب ودهون الأحشاء ثم قياس طول الأمعاء وتحديد نسبة تصافي الذبيحة والوزن الحار. أوضحت النتائج عدم وجود تأثير معنوي ($P\geq0.05$) على معدل التحويل الغذائي وكفاءة البروتين والوزن الحي والعلف المستهلك والوزن المكتسب نتيجة لإضافة مسحوق ثمرة القونقليز إلى مياه شرب الدجاج اللاحم. اما فيما يتعلق بخصائص الذبيحة فقد دلت النتائج على وجود أثر معنوي ($P\leq0.05$) على الوزن الفعلي والنسبي للكبد والوزن النسبي للقانصة والوزن الفعلي للأمعاء وطول الأمعاء. يُستخلص من هذه النتائج أن استخدام مسحوق ثمرة القونقليز في مياه شرب الدجاج اللاحم بمستوى (1جرام/لتر و2جرام/لتر و 3جرام/لتر) ليس له تأثير على أداء الدجاج اللاحم و بعض خصائص الذبيحة ولذلك لا بد من اجراء مزيد من الدراسات لمعرفة تأثير استخدام مسحوق ثمرة القونقليز في مياه شرب وعلف الدجاج اللاحم.