PROXIMATE, ANTI-NUTRITIONAL AND ASCORBIC ACID COMPOSITION OF BAOBAB FRUIT PULP MEAL AND ITS ROLE IN AMELIORATING THE IMPACT OF HEAT STRESS ON THE GROWTH OF BROILER CHICKS

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ABSTRACT
A study was conducted to investigate the nutrient and anti-nutrient compositions of Baobab fruit pulp meal (BFPM) and the ameliorative effect of ascorbic acid on broiler chicks during heat stress. A total of Two hundred and fifty six, day old Cobb 500 broiler chicks were randomly allotted to four experimental treatments (0, 68 136 and 204 mgAA/kg), with four replicates each in a Completely Randomized Design. Results indicated that BFPM contains substantial amount of nutrients with limited anti-nutritional factors. Growth performance of broiler chicks were similar ($p>0.05$) across the treatments expect for FCR which was better ($p<0.05$) for birds feed the control diet and 68 mgAA/kg. Feed cost/kg gain was least for birds feed the control diet. In conclusion, BFPM can be supplemented at 68 mgAA/kg in the diet of broilers during heat stress conditions.

Keywords: Baobab, Ascorbic acid, Growth, Nutrient, Stress

INTRODUCTION
There is increasing demand for poultry products globally (USDA, 2012). This is due to the health benefits of poultry being high in beneficial unsaturated fatty acids, high profit over a short period, and have high acceptability in many culinary traditions and increase in human population. Global warming which can lead to heat stress (HS) is considered one of the most important challenges affecting the performance of birds (Gregory, 2010; Ali *et al*., 2010). Baobab (*Adansonia digitata*) fruit pulp has been found to contain a significant amount of ascorbic acid with limited anti-nutrients; addition of this natural source of vitamin C to poultry diets could be beneficial in alleviating stress problems associated with poultry production (Adeosun, 2012). Abdulrashid *et al*. (2010) described ascorbic acid as an antioxidant which improves performance and alleviates the deleterious effect of heat stress in poultry birds.

MATERIALS AND METHODS
The experiment was conducted at Ahmadu Bello University, Samaru, Zaria during the dry-hot season (March to May). Baobab fruit pulp (*Adansonai digitata*) was purchased from Giwa market in Zaria and used as source of organic Ascorbic acid. The pulp was separated from the seeds by gentle crushing using a mortar to prepare a baobab fruit pulp meal (BFPM). BFPM was analyzed for ascorbic acid content and was supplemented during the diet formulation at 0, 2, 4 and 6% to provide the ascorbic acid content of the feed. Two hundred and fifty six, day old Cobb 500 broiler chicks were randomly allotted to four experimental treatments (0, 68, 136 and 204 mgAA/kg), with four replicates each in a Completely Randomized Design. A maize/soybean meal based broiler starter diets (2900 Kcal/kg and 23% C.P) was formulated according to NRC (1994) nutrient requirement. Feed and water was provided *ad libitum*. All standard routine management practices were strictly adhered to.

Chemical analysis of the dried baobab fruit pulp was carried out according to AOAC (1990) methods to determine the proximate composition (dry matter, crude protein, crude fibre, ether extract and ash contents). The ascorbic acid (vitamin C) content was also determined in the Biochemistry Laboratory of the Department of Animal Science, Ahmadu Bello University, Zaria. Anti-nutritional factors such as tannins, oxalate, phytate and saponin were determined according to the procedures described by (Price *et al*., 1978; Oke, 1966; Reddy *et al.,* 1989 and Hudson and El-Difrawi, 1979) respectively.

Initial weight was measured at the beginning of the experiment, while feed intake and weight gain were recorded weekly using a digital precision weighing balance (Satorius ENTRIS). Known amount of water was offered daily to the birds, ort was also measured at the end of each day, known amount of water was measured into an open container and placed at intervals along the passage within the building and evaporation losses was accounted for daily by measuring the quantity of water left in the container and subtracted from the initial quantity measured using a calibrated measuring cylinder. The ort and evaporation loss was then subtracted from the quantity of water offered to the birds to determine the amount of water consumed daily. Mortality records were taken as they occurred.

DATA ANALYSIS

All data obtained from this experiment were statistically analyzed using General Linear Model Procedure of Statistical Analysis System software package while significant difference among means were compared using the Tukey Procedure (SAS, 2002).

RESULT AND DISCUSION

Results of the Proximate Analysis and Anti-Nutritional Factor Contents of Baobab Fruit Pulp

The result of the proximate composition (Table 1) indicates that Baobab Fruit Pulp Meal (BFPM) contains 95.95 dry matter, 6.38% crude protein, 4.31% crude fibre, 3.94% ether extract, 73.87% Nitrogen Free Extract and 11.50% Ash. The ascorbic acid content was 340 mg/100g of BFPM. Table 2 shows the results of the Anti-Nutritional Factors present in the Baobab Fruit Pulp. The Baobab Fruit Pulp contains 3.5% Tannin, 0.28% Phytate, 1.14 mg/100g Oxalate and 22.6 mg/100g Saponin. The values of the chemical analysis fell within the range of values earlier reported (Magdi, 2004; Adeosun, 2012). Similarly the ascorbic acid content of 340 mg/100g obtained from the chemical analysis fell within the range of 150 to 499 mg/100g reported by Manfredini *et al.* (2002) and it high content of ascorbic acid makes it a good source of organic ascorbic acid for utilization in animal nutrition. The result of the chemical analysis of Baobab Fruit Pulp Meal showed no indication that it contains high levels of anti-nutritional factors (Adeosun, 2012) that can pose any serious threat to its utilization in poultry diets especially if used at low levels of inclusion.

Table 1: Proximate and Ascorbic Acid Composition of Baobab Fruit Pulp

Component	%
Dry Matter	95.95
Crude Protein	6.38
Crude Fibre	4.31
Ether extract	3.94
Nitrogen Free Extract	73.87
Ash	11.50
Ascorbic acid	340 mg/100g

Table 2: Anti-Nutritional Factor in Baobab Fruit Pulp

Anti-nutrient compound	Baobab fruit pulp
Tannin (%)	3.5
Phytate (%)	0.28
Saponin (mg/100g)	22.6
Oxalate (mg/100g)	1.14

Effect of Ascorbic Acid Supplementation on Performance of Starter Broiler Chicks (Day 1-28)

The growth performance of starter broiler chicks fed varying levels of ascorbic acid is shown in Table 3. All the parameter measured were similar (p>0.05) except for feed conversion ratio (p<0.05). Chicks fed the control diet and 68 mgAA/kg diet had a better feed conversion ratio (1.39) than the other groups, values ranged from 1.39 to 1.56. Chickens fed the control diet had least feed cost per kg gain. The similar performance of broilers in this study except for FCR is consistent with the report of Muhammad *et al*. (2016) but in contrast with the report of (Lohakare, 2005; Talebi and Khademi, 2011; Adeosun, 2012; Jahejo *et al*., 2016; Youssef *et al*., 2017) who reported that ascorbic acid significantly improved the performance of broiler chickens during heat stress. Adeosun (2012) reported a better FCR in broiler chicks fed BFPM at 3.5 and 7% inclusion levels during the dry-hot season and 3.5% inclusion level during the wet-cool season. Similarly, Jahejo *et al*. (2016) reported a lower FCR in broilers fed 200 mgAA/kg than the control. Furthermore, Talebi and Khademi (2011) reported a lower FCR in heat stressed broilers fed varying levels of glucose combined with either 200 or 300 ppm of AA in drinking water during a 42 days period. The high (p>0.05) mortality recorded in 204 mgAA/kg supplemented groups could be due to the higher quantity of BFPM that made the feed more dusty in nature and might had led to more sever chronic respiratory disease (CRD) as revealed by the post mortem examination.

Table 3: Effect of Ascorbic acid Supplementation on Performance of Starter Broiler Chickens (day 1-28)

	Dietary levels of Ascorbic acid (mg/kg diet)					
Parameters	**0**	**68**	**136**	**204**	**SEM**	**P value**
Initial weight (g/bird)	39.85	40.63	41.10	42.50	0.72	0.1178
Daily feed intake (g/b/d)	43.70	42.27	45.76	44.65	1.93	0.6350
Daily weight gain (g/b/d)	31.33	30.27	29.42	28.79	1.01	0.3525
Final weight (g/bird)	916.98	888.03	864.76	848.48	27.74	0.3684
Feed conversion ratio (g)	1.39^a	1.40^a	1.56^b	1.55^b	0.04	0.0143
Daily water intake (ml/b/d)	128.07	127.50	123.19	136.01	6.50	0.5840
Feed cost/kg gain (₦/kg)	166.06	179.99	213.14	225.01	-	-
Mortality (%)	4.69	6.25	4.69	10.94	2.89	0.4066

^{a,b} Means with different superscript on the same row differ significantly (p<0.05).

CONCLUSION

BFPM is a good source of natural ascorbic acid and contain other nutrients that is required for poultry production and should be supplemented to the diets of poultry at 68 mgAA/kg during adverse temperature condition.

RECOMMENDATION

During heat stress, BFPM should be supplemented in the diet of broilers at 68 mgAA/kg. Further research should be conducted towards supplementing BFPM in levels other than those in the present study as natural source of ascorbic acid during hot temperatures.

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