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EFFECT OF PROCESSING ON THE PERFORMANCE AND CARCASS YIELD OF BROILERS FED DIFFERENTLY PROCESSED SORREL *HIBISCUS SABDARIFFA* SEED MEAL

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ABSTRACT
A seven weeks feeding trial was conducted to determined the effect of processing on the performance and carcass yield of broilers fed differently processed sorrel *Hibiscus sabdariffa* seed meal as replacement for groundnut cake. One hundred and twenty (120) day-old broiler chicks were randomly weighed and assigned to five (5) dietary treatments in a group of twenty four (24) birds each, each treatment was replicated twice with twelve (12) birds per replicate in a completely randomized block design (CRBD). The different processing methods adopted were soaking, boiling, soak and boil and sprouting for T2, T3, T4, and T5 respectively as raw (T1) was used as the control. The differently processed sorrel seed meal were incorporated to replaced 50% of the groundnut cake portion of the formulated diets. The birds were fed the experimental diets and water was provided without restriction through out the experimental period. The results showed that the daily feed intake ranged from 167.86g/day – 179.64g/day and the corresponding daily weight gain also ranged from 35.24g/bird – 39.17g/bird. The daily feed intake, daily weight gain and feed conversion ratio did not differ significantly (P>0.05) among all the treatments. The group fed raw sorrel seed meal (T1) recorded the highest dressed weight (1448.80g) and T5 was superior than T2, T3, and T4. Therefore, 50% of the GNC could be replaced with processed sorrel seed meal in broilers diet without adverse effect on the performance and carcass yield of the chicken.
Keywords: *Processing, sorrel seed meal, broilers, performance, carcass*.

INTRODUCTION
The problem of malnutrition particularly protein malnutrition is a known fact in most of the developing nations of the world. These nations are mostly located in the warm-humid tropics where the percentage of animal protein consumption represents about one-tenth of the level of consumption in most of the advanced countries (Esonu, 2001). Ekenyem et-al (2010) has attributed these nutritional anomalies on the geometric increase in the Nigeria human population without a commensurate increase in livestock production, high dependence on foreign livestock products and high cost of livestock feed ingredients.
Similarly, the competition between man and livestock for feed human and animal needs (Madubuike, 1992) has been identify as one of the major causes of poor animal protein intake among Nigerian populace, Babatunde et-al (1990). The role of legumes as forage and seeds as source of protein supplement in livestock feeding has been a long time fact. Although a tropical legume that is a non-conventional feed ingredient sorrel (*Hibiscus Sabdariffa*) seed is a potential protein feed supplement (Esonu, 2001). The sorrel seed *H.sabdariffa* contain anti-nutritional factors such as tannins which in most cases limit their incorporation in animal feed formulation. However, Tewe and Ologhobo (1986) reported that anti-nutritional factors in plants are usually reduced by heat treatment. The

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nutritional value of legumes can be improved by soaking in water germination toasting and boiling, heat treatment inactivate reduce and/or destroy the inherent anti-nutritional components in feedstuff (Iyayi and Egharevba, 1998). There have been limited studies on the use of sorrel seeds as livestock feed. Therefore, the objective of this study is to determine the effect of substituting groundnut cake with differently processed sorrel *Hibiscus sabdariffa* seed meal on the performance and carcass yields of broilers.

MATERIALS AND METHODS

Experimental Site

The study was conducted at the poultry production unit of the Teaching and Research Farm of the University of Maiduguri, Borno state, Nigerian. It lies between latitude 11^0 – $15^{''}$ North and Longitude 30^0 – $05^{''}$ East and had an altitude of 354m above sea level (Alaku, 1983). The mean relative humidity ranges from 30-50% with an ambient temperature ranges between 30 – 40 ^{0}C and an annual rainfall ranged from 300mm – 700mm (Ugherughe and Ekedolun, 1986).

PROCESSING OF SORREL SEEDS

The sorrel seeds were subjected to these processing methods

- Raw sorrel seed were cleansed milled and incorporate into diet T1 (RSSM) as the control.
- Sorrel seeds were soaked in water for 24hours, sun dried for 3days then milled and incorporated into diet T2 (SSSM).
- Sorrel seeds was soaked in water for 24hours and boiled for one hour at 100^0c later sundried for 3 days then milled and incorporated into diet, T4 (SBSSM).
- Sorrel seeds were boiled for one hour and were sun dried for 3 days then milled and incorporated into diet T3 (BSSM).
- Sorrel seed was soaked in water for 24 hours later removed and covered with a jute bag and allowed to sprout after 3 days. The sprouted seeds were sun-dried for 3 days, later milled and incorporated into diet T5 (SPSSM).

Management and Experimental Design

One hundred and twenty (120) day old Anak-2000 mixed sex broiler chicks were purchased from ECWA Rural Development Farms, Bukuru, Plateau State. The chicks were brooded for two weeks and fed commercial starter diet, water was offered *ad-libitium*. The chicks were given all the require vaccinations at the appropriate schedules.

When the birds were two weeks, they were randomly weighed and assigned to five (5) treatment groups of 24 birds each. Each treatment was replicated twice in a completely randomized block design (CRBD) with twelve (12) birds per replicate. Five experimental diets were formulated for starter/finisher. The differently processed sorrel seed meal were incorporated each to replaced 50% of the groundnut cake (GNC) portion of the diets. The dietary treatments, T1, T2, T3, T4 and T5 had raw, soaked, boiled, soaked and boiled and sprouted sorrel seed meals respectively. The ingredient composition of the experimental starter/finisher diets were presented in Tables 1 and 2.

Data Collection

After two weeks of brooding initial weights of the birds were taken, then they were randomly weighted and assigned to the treatment groups, final live weight daily feed

intake and daily weight gain were taken and the feed conversion ratio was computed while mortality was recorded as it occurred. At the end of the experiment, four birds were randomly selected from each treatment, the birds were weighed and starved of feed overnight. The fastened weight was determined in the morning as live weight before slaughter. The birds were individually slaughtered and the slaughter weight, dressed weight, dressing percentage and other cut-up parts weights were determined for individual bird while the mean values for each treatment were calculated.

Chemical Analysis

The chemical composition of the differently processed sorrel seeds meal and the experimental diets (starter and finisher) were carried out according to the AOAC (1990) method.

Statistical Analysis

All data generated were subjected to analysis of variance (ANOVA) (Steel and Torrie, 1980) significant ($P<0.05$) difference means were separated using least significant difference.

Table 1: Ingredient composition of the starter experimental diet

	Treatments				
Ingredient	**T1**	**T2**	**T3**	**T4**	**T5**
Maize	54.00	54.00	54.00	54.00	54.00
GNC	13.00	13.00	13.00	13.00	13.00
Sorrel seed	13.00	13.00	13.00	13.00	13.00
Wheat offal	10.00	10.00	10.00	10.00	10.00
Fish Meal	5.00	5.00	5.00	5.00	5.00
Blood Meal	1.50	1.50	1.50	1.50	1.50
Bone meal	1.40	1.40	1.40	1.40	1.40
Limestone	1.30	1.30	1.30	1.30	1.30
Salt	0.30	0.30	0.30	0.30	0.30
Premix *	0.30	0.30	0.30	0.30	0.30
Methionine	0.20	0.20	0.20	0.20	0.20
	100.00	100.00	100.00	100.00	100.00

Table 2: Ingredient composition of the finisher experimental diet

	Treatments				
Ingredient	**T1**	**T2**	**T3**	**T4**	**T5**
Maize	56.00	56.00	56.00	56.00	56.00
GNC	12.00	12.00	12.00	12.00	12.00
Sorrel seeds	12.00	12.00	12.00	12.00	12.00
Wheat offal	10.00	10.00	10.00	10.00	10.00
Fish Meal	5.00	5.00	5.00	5.00	5.00
Blood Meal	1.25	1.25	1.25	1.25	1.25
Bone meal	1.50	1.50	1.50	1.50	1.50
Limestone	1.50	1.50	1.50	1.50	1.50
Salt	0.30	0.30	0.30	0.30	0.30

Premix *	0.25	0.25	0.25	0.25	0.25
Methionine	0.20	0.20	0.20	0.20	0.20
	100.00	100.00	100.00	100.00	100.00

RESULTS AND DISCUSSION

Proximate Composition of the Differently Processed SSM

The results of the chemical composition of the differently processed sorrel seed meal is presented in Table 3. The crude protein content of the raw, soaked, boiled, soaked and boiled and sprouted ranged between 21.00 – 22.84% CP. The higher CP was recorded in T3 (Boiled) and was close to the 23.90% reported by Alabi et al, (2010). The crude fibre (CF) levels were between 17.50 – 19.50% which were comparatively higher than the 7.12% that was obtained by Dashak and Nwanegbo (2002).

The ether extract (EE) content were also between 5.50 – 10.50% and it was within the range of 10.14% reported by the same authors. The Ash values were 14.50, 9.00, 6.50, 10.50 and 8.00 for T1, T2, T3, T4 and T5 respectively. The Nitrogen free extract (NFE) values of the differently processed sorrel seeds were between 39.50 – 45.66% and is above the result of 29.80 – 38.00% reported by Duwa et al, (2012).

Table 3: Proximate composition of the differently processed sorrel seeds

Nutrient	RSSM	SSSM	BSSM	SBSSM	SPSSM
Dry matter	91.80	90.65	91.70	92.55	92.00
Crude protein	21.00	21.79	22.84	21.53	22.14
Crude fiber	19.50	18.00	18.50	19.00	17.50
Ether extract	5.50	8.50	6.50	9.00	10.50
Total ash	14.50	9.00	6.50	10.50	8.00
Nitrogen free extract	39.50	42.71	45.66	39.97	41.86
ME (Kcal/kg)*	2624.75	3010.94	2992.51	2944.55	3155.71

Calculated: ME (Kcal/kg)*= 37 x % CP + 81 x EE + 35.5 x % NFE (Pauzenga, 1985).

Proximate Composition of the Experimental Diets

The protein contents revealed that both starter and finisher diets contained values closely to the recommended range values of 20-22% for broiler starter (Oluyemi and Roberts, 2000) and 18 – 20% CP for broiler finisher (Saskatchewan, 2000). The Ether extract values ranged between 5.50 – 8.00% and 8.00 – 8.50% for starter and finisher diets respectively, which is within the range of 5-7% recommended by NRC (1996) in a diet. Crude fibre values recorded in this study ranges from 12.50 – 15.50% and 13.50 – 17.00% for broiler starter and finisher diets respectively. These results were higher than the 7.71 – 8.85% and 6.00 – 8.50% for starter and finisher reported by Duwa et al, (2012). The Ash content of both broiler starter and finisher diets were (8.00% - 10.00%) and are higher than the 3.00% and 2.70% recommended by Olomu (1995). The Nitrogen free extract content of 49.11 – 53.30% and 47.42 – 49.56% for starter and finisher were within the reported values of 45.21% - 54.75% by Aruna et al (2007).

Table 4: Proximate composition of the experimental diet (starter)

Nutrient	T1	T2	T3	T4	T5
Dry matter	90.95	91.15	90.60	90.75	91.25
Crude protein	20.39	18.99	18.73	18.55	18.20
Crude fibre	12.50	15.00	15.50	13.00	13.50
Ether extract	8.00	5.50	5.50	7.50	6.50
Total ash	10.00	8.00	8.00	8.00	9.50
Nitrogen free extract	49.11	52.51	49.27	53.30	52.30
ME (Kcal/kg)*	3145.84	3012.24	3130.60	3186.00	3056.55

Table 5: Proximate composition of the experimental diet (Finisher)

Nutrient	T1	T2	T3	T4	T5
Dry matter	92.00	92.20	91.15	86.10	90.85
Crude protein	19.08	18.44	18.55	18.20	18.03
Crude fibre	13.50	15.00	17.00	17.00	14.50
Ether extract	8.50	8.00	8.50	8.30	8.00
Total Ash	11.50	9.00	8.50	8.50	10.00
Nitrogen free extract	47.42	49.56	47.45	48.00	49.47
ME (Kcal/kg)*	3077.87	3089.66	3059.33	3049.70	3071.30

Performance Parameters

The productive performance of broilers fed diets containing differently processed sorrel seed meal is shown in Table 6. There were no significant ($P>0.05$) differences among the treatment means in all the parameters measured. Although the final weight shows that T1 was superior (2080g) than the other treatments and T2 and T3 recorded the same weight of 1930g each. The variations in the final weight may be due to the individual birds ability to utilized the feeds available. The final weight recorded in T1 is within the range of 2031.3 – 2440.0g reported by Ojewola and Ewa (2005). The mean daily feed intake was not significantly ($P>0.05$) different in all the treatment groups the value ranged between 167.86 – 179.64g which is higher than the reported 160g/day/bird (Olomu, 1995; Duwa et al, 2012). The mean daily weight gain too was not significantly ($P>0.05$) different. The daily weight gain values were between 35.24 – 39.17g. thus, there were some numerical differences on this parameter. T1 has 39.17g which is higher than the other treatments, T2 recorded the lowest values of 35.24g. There were no significant ($P>0.05$) difference for feed conversion ratio. Mortality was recorded, birds fed T1 recorded the highest mortality (4birds) which T2, T4 and T5 recorded mortality of 1bird each and T3 did not recorded any mortality. The higher mortality rate recorded in T1 may be attributed to the anti-nutritional factors present in the raw sorrel seeds meal which was not processed before incorporation into the experimental diet. However, the lower mortality recorded in the other treatments could be as a result of the various methods of processing in which the sorrel seeds were subjected to

Table 6: Performance of broilers fed differently processed sorrel seed meal

Parameter	T1	T2	T3	T4	T5
Final live wt (g/bird)	2080.00	1930.00	1930.00	1945.00	2000.00
Initial wt (g/bird)	435.00	450.00	390.00	445.00	435.00
Ave. live wt (g/bird)	1645.00	1480.00	1540.00	1500.00	1565.00
Ave. daily feed intake (g/bird)	179.64	167.86	178.57	171.31	177.31
Ave. daily wt gain (g/bird)	39.17	35.24	36.24	35.71	37.26
Feed conversion ratio	4.58	4.78	4.80	4.84	4.88
Mortality	4	1	-	1	1

Carcass Characteristics

The carcass yield is presented in Table 7. There were no significant (P>0.05) differences among the treatment diets for all the parameters measured with the exception of the values for slaughter weight, shanks and head weights which were significantly (P>0.05) different among the treatment groups. The result obtained shows that higher live weight can lead to higher dressed weight. T4 recorded higher slaughter weight (1937g), this is in confirmation of the evident that heavy appearance in broilers is associated with high percentage of edible meat (Ojewola and Ewa, 2005). This is an indication that the test diet (T4) will support tissues development to a certain part Bamgbose et al., (1998). The shanks weight for T4 (101.24g) was significantly (P<0.05) higher than T5 (80.58g) but compared favourably with T1, T2, and T3 with the corresponding shanks weights of 91.66g, 92.71g and 93.30g respectively. The poorer yield and/or weights demonstrated by T1 could be partly due to the lack of processing of the test ingredient (Raw sorrel seeds) which contained anti-nutritional factors (Tannins) which might have affected the efficiency of utilization of the diets by the birds. Similarly, differences in the head weight may be due to the same reasons.

Table 7: Carcass yield of Broilers fed differently processed SSM

Parameters	T1	T2	T3	T4	T5	SEM
No. of birds slaughter	4	4	4	4	4	-
Live weight (g)	1962.50	1887.50	1837.50	2012.50	1837.50	99.27^{NS}
Slaughter weight (g)	1900.00^{ab}	1825.00^{bc}	1787.50^{c}	1957.50^{a}	1775.00^{c}	29.83*
Dressed weight (g)	1448.80	1348.90	1375.15	1441.75	1343.15	79.71^{NS}
Dressing %	76.05	73.86	77.44	74.36	75.63	2.74^{NS}
Drumstick weight	203.79	196.05	203.01	191.78	84.59	15.18^{NS}
Thorax weight (g)	139.65	127.15	132.88	143.42	121.66	11.44^{NS}
Shanks weight (g)	91.66^{ab}	92.71^{ab}	93.30^{ab}	101.24	80.58^{b}	5.54*
Head weight (g)	57.08	51.48^{ab}	50.45^{ab}	54.81^{ab}	47.90^{b}	2.41*
Wings weight (g)	175.01	170.95	172.27	165.78	163.18	8.62^{NS}
Breast weight (g)	348.55	316.34	307.86	330.44	335.26	24.14^{NS}
Back weight (g)	183.10	190.54	197.10	213.62	192.08	20.62^{NS}
Neck weight (g)	107.22	93.14	99.75	102.51	96.98	7.36^{NS}
Thighs weight (g)	271.26	232.20	254.04	266.60	230.93	18.94^{NS}

a, b, c,…..Means in the same row bearing different superscripts differ significantly (P<0.05)

CONCLUSION

The desire of every poultry (broiler) farmer is to produce an appreciable size of broiler chicken with a minimal cost of production. The results of this study revealed that replacing 50% of groundnut cake portion with process sorrel seed meal in a broiler diet (starter and finisher) is possible without negative effects on the performance and carcass yield of the birds. Therefore, processed sorrel seeds meal is recommended as an alternative plant protein source to groundnut cake in a broiler diet. However, the search for other processing methods that will reduce the levels of tannins and other anti-nutritional factors in Hibiscus sabdariffa seeds should be encouraged.

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