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EFFECT OF FEEDING DIETS CONTAINING ROSELLE SEEDS (HIBISCUS SABDARIFFA) WITH OR WITHOUT ENZYMES SUPPLEMENTATION ON BROILERS PERFORMANCE, CARCASS TRAITS AND SERUM CONSTITUENTS

By

A. Mukhtar. Mukhtar, Abdal-Rahim,Bakheit
College of Agriculture Studies, Department of Animal Production- Sudan University of Science and Technology Khartoum North, Shambat, P.O.Box:407

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ABSTRACT: *This experiment was conducted to assess the nutritional effect of Roselle seed, as a protein source, with or without enzyme (xylem 500) on the performance, carcass yields and blood serum constituents. One hundred and ninety six, seven day old unsexed Cobb broiler chicks, were subjected to a42- day experimental period. Chicks were divided into seven groups of 28 chicks each of 4 equal replicates and were randomly assigned to different experimental diets (A, B, C, D, E, F and H), The first group , fed the control diet (A), groups 2, 3, and 4 fed diets B,C and D containing 5., 10. and 15.% Roselle seeds respectively, however groups 5,6,and 7 fed diets E, F and H containing 5, 10, 15% Roselle seeds supplemented with enzyme respectively. Diets were formulated to meet the requirements of broiler chicks according to NRC (1994). The experimental diets were fed for 6 weeks. The evaluated parameters covered growth performance, slaughter and carcass values, serum metabolites, and electrolytes and economic efficiency.*

Results showed no significant differences between the performance (weight gain, feed intake, feed conversion ratio and mortality rate) of chicks fed on diets containing various levels of Roselle seeds with or without enzyme.. Results also showed no significant differences due to inclusion of Roselle seeds or enzyme supplementation on dressing percent, carcass components, commercial cuts and meat quality.

Moreover ,the results show significant differences in serum cholesterol and level of AST activity between the control group and the other experimental groups .However ,no significant differences were detected between all groups in total protein, uric acid, Ca and ALT.

The economical efficiency proved that Roselle seeds could be included in broiler diets as plant protein source up to 15% when supplemented with enzyme (xylam 500).

INTRODUCTION

The development of poultry industry in the world is facing many problems, mainly the feed, which represents about 75% of the total cost of production, due to demand competition between human and animals for grains, scarce in crop production n and human population growth. Protein and energy are the most costly components in poultry diets, specially the plant protein (Mukhtar**,** 2007**)**. Shortage of cereals and oil cakes has recently been a serious issue in poultry production in Sudan. Therefore the poultry nutritionists keep looking for economic alternatives of protein sources to decrease the production cost. Broilers are the more efficient in converting raw feedstuffs and their by- products into high

protein food which is urgently needed to improve the nutrition standards of the human.

Roselle seeds (RS,) Karkade, local name of Roselle seeds(RS) reported to contain 21.35%, protein 15.4% ether extract 21.04% MJ/kg metabolizable energy, 11.98% crude fiber and it's a good source of calcium and phosphorus (Mukhtar, 2007;Aruna et al., 2007 and Abu Elgasim et al., (2008) . Recently Kwari et al., (2011) found that Rosella seeds contain 38.57% CP, 13.5% EE, 16.5% CF, 5.18% argnine, 2.58% lysine and 1.33% Methionine.

The seed oils also reported to contain unusual fatty acids, namely epoxy oleic and cytopropenoid) Bakheit *et al*., 1993). Morton, 1987, Ojokoh et *al.,* 2002; Mukhtar, 2007 and; Kwari *et, al*., 2011) reported that Rosselle seeds contains 11.98% insoluble fiber (arabino - xylanase) which decreases feed consumption, growth rate and feed utilization. These adverse effects could possibly overcome by addition of dietary enzymes.

The objective of this study was to investigate the nutritional value of Roselle seeds as protein source with or without enzyme supplementation on the performance, carcass characteristics, blood constituents and serum metabolites and enzyme activities of broiler chicks.

Materials and Methods:

The experiment was carried out at the poultry production farm, College of Agricultural Studies, Sudan University of Science and Technology, during the period from 7th April to 27th may 2012, in which the ambient temperature ranged between 30.8 and 34.30o C.

The Roselle seeds were purchased from the local market. Roselle seeds were cleaned and milled by electrical miller, and a sample of Roselle seeds flour (RSF) was taken for the approximate analysis. According to the result of approximate, seven experimental diets were formulated to meet the requirement of broiler chicks according to NRC (1994).

Microbial xylam 500 (composed of 8000 U/gm a-amylase and 1260 U/gm 1-4 Bxylanase) produced by Murex Company for feed enzymes production was used in this experiment. The experimental diets were formulated as follows:

Diet A served as control diet. Diets B, C and D were formulated to contain graded levels (5, 10 and 15%) of RSF respectively. Diets E, F and H were similar to diets B, C and D but they were supplemented with 50 gm x Xylam/ kg diet. The experimental diets are presented in Table (1).

A total of one hundred and ninety six, seven- day- old unsexed broiler chicks, cob strain, were purchased from commercial chicks Production Company in Khartoum, for the first week chicks were fed on a commercial pre-starter. After a week of adaptation period, chicks were randomly distributed to treatment groups with four replicates of seven chicks per each replicate. Feed and water were provided *ad libitum*. Chicks were vaccinated against Gumboro disease at 13 days age. Soluble multivitamin compound and antibiotic (Neutrate) were given to chicks before and after 3 days of vaccinations, in order the guard against stress. Chicks were kept in an open wire mesh, sided poultry house.

Chicks of each replicate were group weighed at w eekly intervals and feed consumption was recorded at the time of weighing. Body weight gain, and feed conversion ratio (FCR) were calculated weekly and the mortality was recorded daily.

At the end of the experiment chicks that their body weights close to group average were selected from each treatment group, after they were fasted overnight except from water and they were weighed individually and they were slaughtered for carcass characteristics. Blood samples from each bird were collected in heparinized test

tube and centrifuged at 1800 for 15 minute, then – plasma was stored at -20^{o}C for later analysis, after bleeding the slaughtered chicks were scaled in hot water, feather plucked manually, —head, feet and shanks were removed and eviscerated for carcass characteristics. Hot carcass, heart, gizzard, liver and abdominal fat bad were weighed individually. The carcasses were chilled at 4^{0} c for 24 hours for carcass characteristics and meat yield. The chilled carcasses were weighed (cold weight) and then they were sawed into two halves. The left side then divided into the commercial cuts (breast, thigh, and drumstick). Each cut weighed individually then deboned. The meat from commercial cuts was frozen for analysis and panel taste- the right side for carcasses stored at 4^{0}C.

Stored meat samples were cut into small pieces, minced twice and three samples were taken to determine moisture, protein, fat and ash content according to AO AC (1995). The stored separated serum from the collected samples was analyzed to determine total serum cholesterol concentration, total protein, uric acid and transaminase enzyme activities (AST and ALT) calorimetrically using enzymatic colorimetric test.

The stored carcasses meat were slightly seasoned wrapped individually in aluminum foil and roasted at 190 ^{o}C for 70 minutes with average internal temperature of 88 ^{o}C and served warm to panelists to score for color, flavor, tenderness and juiciness of meat (Cross *et al*.,1978)

The hot and cold carcass yields were calculated as a percentage of the pre-slaughter live body weights of broiler chicks: the weights of heart, gizzard, liver and abdominal fat – were expressed as a percentage of live body weight. The commercial cuts were expressed as a percentage of hot carcasses. Meat of each cut was expressed as a percentage of the weight of its cut.

The collected data were subjected to analysis using one-way Analysis of Variance (ANOVA) following complete randomize block design and the comparison of means determined using Duncan's multiple range tests (Duncan, 1955).

Table (1): Composition of experimental diets

Ingredients	Control (A)	5% R.S (B)	10% R.S (C)	15% R.S (D)
Sorghum	64.75	63.0	60.0	57.0
Wheat bran	1.3	1.9	1.2	1.5
Groundnut cake	13.0	13.0	12.5	10.0
Sesame cake	14.0	10.0	10.0	10.0
Roselle seeds	0.0	5.0	10.0	15.0
Concentrate	5.0	5.0	5.0	5.0
Oyster shell	0.6	0.7	0.62	0.66
Salt	0.25	0.25	0.25	0.25
Vitamins mixture	0.2	0.2	0.2	0.2
Lysine	0.72	0.5	0.05	-
Methionine	0.1	0.15	0.05	-
Vegetable oil	0.08	0.3	0.1	0.39
Calculated composition:				
ME kcal/kg	3102.89	3102.42	3109.24	3103.6
Crude protein%	22.00	21.56	21.66	21.55
Crude fiber%	4.18	4.08	3.97	3.91
Calcium%	1.0	1.0	1.0	1.0
Phosphorus%	0.41	0.59	0.64	0.6
Lysine%	1.83	1.83	1.83	1.83
Methionine%	0.55	0.51	0.56	0.56

Broiler concentrate: Crude protein 40%, crude fat 3%, crude fiber 1-5% Lysine 13-5%, Methionine 5-9%. Methionine + cystic 60.25%, calcium 6.8% Phosphorus

***Vitamin a**nd Minerals supplemented per kg: at. A 300.000 IV, at D_3 100.000IV, at E 4.00ppm, at K 98ppm, at B_2 1.320ppm, at B12 400ppm, pantothenate 2.0ppm, Niacin 20.0ppm, Folic acid 100ppm, copper 15.0ppm, iodine 250ppm, selenium 50ppm, Manganese 24.0pp, Zinc 20.0ppm, Iran 10.0ppm, coccid 25.0ppm Anti oxidant 125ppm.

Table (2): Performance OF broiler chicks fed graded levels of Roselle seeds with or without enzymes supplementation**.**

Item	Initial weight (g/b)	Final weight (g/b)	Body weight gain (g/b)	Feed intake (g/b)	FCR (g feed/g gain)	Mortality %
A	136.7	1239.25	1158.55	2830.25	2.18	3.06
B	141.75	1229.75	1088.0	2362	1.94	3.06
C	137.6	1136.0	998.4	2372.25	2.12	2.55
D	133.45	1135.5	1004.35	2486.75	2.19	1.53
E	133.28	1141.5	1008.15	2525.5	2.23	4.59
F	135.1	1180	1044.9	2623.25	2.27	1.02
H	137.65	1312.25	1174.6	2650.5	2.04	0.51
SEM±	2.66^{NS}	60.22^{NS}	60.08^{NS}	111.1^{NS}	0.155^{NS}	-
LSD	7.92	178.74	178.52	330.12	0.46	-

Values are means of 12 chicks per dietary treatment SE± standard error of means.
NS: are not significant difference (P> 0.05).
A= Control, B= RS 5% , C= RS 10 % , D= RS 15% , E= RS 5%+ enzyme, F= 10%+ enzyme, H= 15%+ enzyme.

Table (3): Effect of experimental treatments on weight of commercial SEM cuts and carcass components.

Items	A	B	C	D	E	F	H	SEM ±
Hot carcass weight (g)	1105	1003.33	980	1058.33	10 60	1086.67	1200	96.93
Breast*	170	140	158	161.7	173	155	195	20.35
Breast meat**	138.33	116.67	120	135	150	130	153.33	18.18
Drumstick *	10167	90	88.33	88.33	108.33	93.33	116.67	9.77
Thigh*	88.33	71.67	66.67	73.33	70.0	66.67	80.0	7.95
Wing*	66.67	60.6	55.0	65.0	60.0	63.33	61.67	7.96
Gizzard %	35.0	30.0	30.0	28.67	33.33	30.0	31.67	2.07
Heart%	6.67	8.33	8.33	5.0	8.33	5.0	8.33	1.45
Liver%	36.67	38.33	38.6	36.6	35.0	30.0	31.67	3.27
Abdominal fat %	23.33	25.0	30.0	25.0	31.67	30.0	31.6	3.53

* AS a percent of hot carcass ** AS a% of their commercial cut

Values are means of 3 chicks/ treatment.

A= Control, B= RS 5% , C= RS 10 % , D= RS 15% , E= RS 5%+ enzyme, F= 10%+ enzyme, H= 15%+ enzyme.

Table (4): Chemical composition of carcass meat of the experimental chicks

Items	Moisture	CP %	EE %	Ash%	Flavor	Color	tenderness	Juiciness
A	75.7	21.4	1.6	0.89	5.5	6.6	5.0	5.6
B	75.1	22.0	1.1	1.02	5.3	6.8	5.8	5.6
C	70.1	22.2	1.8	0.98	6.3	5.3	5.5	6.0
D	74.6	22.7	1.9	1.04	5.5	6.0	6.6	6.0
E	74.7	21.9	2.2	1.04	5.0	6.0	5.1	6.3
F	77.1	21.1	2.0	0.98	5.0	5.5	5.0	6.3
H	76.9	21.4	2.0	1.02	6.0	5.1	6.1	5.0

Column bearing no letter showed no significant ($p>0.05$).
A= Control, B= RS 5% , C= RS 10 % , D= RS 15% , E= RS 5%+ enzyme, F= 10%+ enzyme, H= 15%+ enzyme.

Table (5): Serum analysis of experimental chicks fed on diets containing Roselle seed with and without enzyme:

Treatment	Chol. mg/dl	TP (g/dl)	UA (mg/dl)	Ca (mg/dl)	AST (U/L)	ALT (U/L)
Control diet	144.8	3.10	3.68	10.53	319.6	0.25
5 % R.S	102.0	2.27	3.58	10.00	294.5	-2.3.0
10% R.S	108.0	2.24	3.23	9.80	255.7	-4.0
15% R.S	122.1	2.72	3.50	10.10	265.0	2.5
5% R.S +E	121.9	2.62	3.52	9.9	283.26	-3.0
10% R.S + E	118.9	2.73	3.39	10.4	263.15	-1.0
15% R.S + E	110.4	2.91	3.52	10.9	288	0.0

Chol=cholesterol, TP=total protein, UA=uric acid, Ca=calcium, AST= asparate amino transfers, ALT= alanine amino transferase. R.S = Roselle Seed, E=enzyme(zylam500).
- Column bearing the same letter or no letter showed no significant ($p>0.05$)

RESULTS

Performance of the experimental chicks:

Chemical analysis of RS revealed that it contains 21.35% CP and about 21% CF and 17.43% EE.

The effect of feeding different levels of Roselle seeds (R.S) with or without enzyme (Xylam 500) is shown in Table (2). Data obtained for body weight showed no significant differences (P> 0.05) between all treatment groups compared to the control group.

Body weight of chicks insignificantly decreased with the inclusion of R.S and, the supplementation of Xylam enzyme to the diets containing R.S insignificantly improved the body weight of chicks. Chicks fed on diets containing 15% R.S supplemented with enzyme recorded the highest body weight. The same trend was detected for body weight gain.

The results revealed that chicks fed the control (A) consumed more feed compared to the all experimental groups followed the by chicks fed 15% R.S supplemented with enzyme (H). The supplementation of Xylam to the diets improved feed intake compared to chicks fed diets containing R.S without enzyme supplementation.

Feed conversion ratio showed no significant (P> 0.05) difference between all the tested groups. The treatments had no significant (P> 0.05) effect on the viability of chicks, although the chicks fed diet containing 15% R.S supplemented with Xylam recorded the lowest rate of mortality.

Carcass measurements:

The effects of inclusion of Roselle seeds to broiler diets on weight of body parts (gizzard, heart, liver and abdominal fat) were expressed as a percentage of hot eviscerated body weight .The weight of the commercial cuts (breast, thigh, drumstick) are presented in Table (3).

The results showed no significant (P> 0.05) effect due to R.S inclusion or supplementation with enzyme on the percentages of dressing, carcass body components commercial cuts and their meat values.

Meat Quality:

Meat chemical composition is shown in Table (4). The results show that the treatment effects on the chemical composition (moisture, dry matter, crude protein, ether extract and ash), was not significant (P> 0.05) Chicks fed diets containing Roselle seeds without enzyme recorded numerically increase of crude protein percentage , compared to the chicks fed control diet and the other tested groups. However, the chicks fed diets containing Roselle seeds supplemented with enzyme recorded numerically high percent of ether extract compared to the other tested groups. Values recorded for subjective meat quality (color, tenderness, juiciness and flavor) showed no significant (P> 0.05) differences.

Serum metabolite electrolyte and enzymes activities:

Results for serum metabolite electrolytes and enzyme activities are tabulated in Table (5). Mean values of total protein, uric acid and calcium showed no significant difference (P> 0.05), while group A recorded significant (P< 0.05) higher level in serum cholesterol compared to all tested groups.

Values obtained for alanine amino transferase (ALT) revealed no significant differences (P> 0.05) between all groups although, group A recorded the highest value numerically. The same trend was detected for asparate amino transfers (AST) enzyme. The level of AST enzyme activity was significantly (P< 0.05) higher for group A, however, the inclusion of R. S with or without enzyme to broiler diets reduced AST activity.

The total cost of production increased numerically with the increase of

prosopis pods flour in the diets compared to the control diet by7.82, 8.95 and 6.93 for 5%, 10% and 15% respectively. However, the profit per kg increases with Xylam supplementation. However, chicks in group H (15% RS with enzyme) recorded the highest revenue (17.867) and profitability ratio (1.09).

DISCUSSION

The results obtained show that no significant differences in the performance of chicks fed diets containing various levels of RS with or without enzyme, These results agree with the findings of Mukhtar,(2007); Abu Elgasim et al.,(2008); Yagoub and Abdullah,(2007) and Kwari et al., (2011).

The supplementation of enzymes mixture to the experimental diets insignificantly improved body weight gain and feed consumption. This might be due to that enzyme improve nutrient digestion, reduced endogenous amino acid losses, and improved diet palatability. These results are in accordance with the findings of Bedford, (1996); Bin Baraik, (2010) and Munassr , (2011), who added xylem 500 to broiler diets containing high level of crude fiber (wheat bran and prosopis pods).

The results show no significant effect of the experimental treatments on non-carcass components (liver, gizzard, heart and abdominal fat), commercial cuts and their separable tissues and meat analysis due to the level of RS or enzymes supplement. These results agree with those of Mukhtar, (2007); Bin Baraik, (2010) and Munassr, (2011).

The results of serum metabolites, electrolytes and enzymes activity show significantly higher serum cholesterol and AST enzyme activity in the control group. However, the inclusion of RS with or without enzyme in broiler diets showed no significant impact on the mean values of total protein, uric acid, calcium and ALT activity. These results agree with those of El – bagir et al., (2006), who found similar trend when added essential oils in the broiler diets.

The economic evaluation revealed that the inclusion of Roselle seeds up to 15% with enzymes supplementation improved the performance of broiler chicks and resulted in higher profit. This result is in line with that of Idris (1984) who reported economic value of the inclusion of Roselle seeds cake in broiler rations.

Based on the obtained results, it may be concluded that Roselle seeds can be incorporated in broiler diets up to 15% with enzymes supplementation without any adverse effects on parameters measured.

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الملخص العربي

اثر تغذية الدجاج اللاحم على علايق تحتوى على بدرة الكركدي مع او بدون الانزيم على الاداء العام,خصائص الدبيج والدم

عبد الرحيم بخيت, مختار اجمد مختارعلي

تم اجراء هذة التجربة لتقييم التاثير التغدوي لبدرة الكركدى مع او بدون الانزيم كمصدر بروتيتى على الاداء العام ,خصائص الدبيح وقياسات الدم. تم تقسيم عدد 196 كتكوت غير مجنس عمر اسبوع من سلالة الرومى (308) عشوائيا فى 7 مجموعات تجريبية بكل معامله 4 مكررات متساوية وتم توزيعها فى سبعه علائق تجريبيه. تغدت المجموعه الاولى على الليقه القياسيه,والمجموعات الاولى, الثانيه والثالثة فقد تغدت على علائق تجتوى على بدرة الكركدى 5 ,10 و15% على التوالى, بينما تم تغدية المجموعات على نفس العلائق السابقه بالترتيب(الاولى ,الثنيه والثلثه) ولكن مع اضافة الانزيم , تم تركيب العلائق لمقابلة احتياجات الدجاج اللاحم (1994). استمرت التجربه لمدة 6 اسابيع تم خلالها احد قياسات النمو ,قيم وخصائص الدبيح والنشاط الآنزيمى والمعادن والتقييم الآقتصادى.

اظهرت النتائج عدم وجود اي فروقات معنوية في الاداء العام(وزن الجسم المكتسب، العليقة المستهلكة , معدل التحويل الغذائى والنسبه المئويه للنفوق) للكتاكيت التى تغدت على العلائق التجريبيه. كما اظهرت النتائج عدم وجود اي فروقات معنوية نتيجة لاضافة بدرة الكركدى او الانزيم على نسب التصاقى ,الاعضاء الداخلية , القطع التجارية ونسب اللحم بكل منها والتركيب الكيميائي وقياسات اللحم الانطباعيه للدجاج اللاحم.كما اظهرت النتايج الخاصه بقياسات الدم وجود فروقات معنوية مستوى الكلسترول النشاط الانزيمي AST فى الدم , بينما لم تسجل اي فروقات معنويه بين جميع المجموعات التجريبيه في البروتين الكلى ,حمض اليوريك , الكالسيوم و ALT وبناء على نتائج هده الدراسه,وبالنظر للناجيه الاقتصادية يمكن اضافة بدور الكركدى مع اضافة الانزيم في علائق الدجاج اللاحم كمصدر بروتيني حتى نصبة 15%.