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ORIGINAL ARTICLE

THE EFFECT OF FEEDING BROILER CHICKS ON PROSOPIS PODS FLOUR SUPPLEMENTED WITH COMBINATIONS OF MICROBIAL XYLAM AND PHYTASE ENZYMES

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ABSTRACT: Dietary combinations of xylam and phytase, (500 xylam and 1000 phytase g/ ton); (750 xylam and phytase 1000 g/ ton); (500xylam and phytase 1500 g/ ton); (750 xylam and phytase1500 g/ ton) were added to control diet, using 168 chicks, four replicates, each of 7 chicks. All diets were formulated to be iso-caloric (3100 K cal/Kg) and iso-nitrogenous (crude protein 22.8%) to meet the nutrient requirements for broiler). Experimental parameters covered performance, slaughter and carcass data and economic appraised. The results showed that addition of combinations of microbial xylam and phytase enzymes, to diet containing Prosopis pods improved significantly ($p \leq 0.05$) the body weight gain, feed intake and feed conversion ratio values of broiler chicks throughout the experimental period. No significant differences were observed between Prosopis pods diets supplemented with the enzymes, with the control diet in body weight gain, feed intake and feed conversion ratio values of broiler chicks. The mortality rate was not significantly influenced by the dietary treatments. The results indicated that there were no significant differences among all treatment groups in percentages of carcass dressing , Giblets (liver, heart and gizzard), commercial cuts (thigh, drumstick and breast) and their percent of meat, meat chemical composition (moisture ,protein ,fat and ash) and subjective meat quality parameters (tenderness ,juiciness ,flavor and color) of broiler chicks. Economically appraised values were profitability ratio (1.94) of group C (500 xylam + 1000 gm / ton phytase) was the highest of the test groups.

KEYWORDS: Prosopis Pods, Microbial Xylam, Phytase Enzymes.

INTRODUCTION

As the world population increases, the demand for more poultry feed will escalate and the shortage of food especially those high in calorie and protein values, in certain areas of the world has become of the increasing concern. The relative efficiency of the production of the feed from plant, as compared to that of animals, causes legumes to be looked upon as a more economic source of proteins and calories. Sinha, (1977) recorded that there are some legumes of great potential that have not fully developed or utilized for food or feed. Prosopis is one of them (Mukhtar, 2012). Prosopis spp. which is known locally as mesquite, are ever green leguminous trees or shrubs that occur in arid and semi –arid zones? In these regions Prosopis trees for shade and forage for wide life and domestic animals, and the indehiscent pods are palatable to man and animals. Prosopis is an extremely hardly, drought-tolerant plant. The potential uses of Prosopis as food, feed, fuel and building materials have been reviewed by Ausol, (2011) and Munassur (2011). Prosopis powder is also high in calcium, magnesium, potassium, iron and zinc, also rich in amino acids lysine (Amsden, 2006). The inclusion or supplementation of both energy and protein supply for grazing animals has been the subject of man studies throughout the world, particularly in those semi–arid North east, characteristically high carbohydrates contents and reasonable protein value (Barbosa, 1977). In Sudan the tree flowers year round. The fruiting period, which peaks in Dec to Jun coincides with the dry season. Prosopis pods, is known for its high sugar (16%) and protein (12%) contents, are attractive to animals (Mohamed, 2001). Several efforts were made to control it but they were not sustainable as long term funding has never been guaranteed. Uprooting of Prosopis Programmed and initiated by Federal Ministry of Agriculture in 1995 with little success (Eltyeb *et al.*, 2001). Now the Prosopis is considered one of the most important species for forestation and consequently as a solution for some problems like fodder, shortage, in addition to its protective value against wind (Fagg and Stewart, 1994). Dietary fiber represents 30% of the pulp and is largely insoluble (Mohamed, 2001). More than

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half of the fiber fraction consists of neutral poly-saccharides. The high level of non–starch poly-saccharides (NSP) and phytic acid which acts as anti–nutritional factors , due to that poultry virtually no indigenous phytase and non–starch polysaccharides enzyme activities (NSPase) in their gastro-intestinal tract to hydrolyze the phytase and NSP molecule, also microbial xylanase increased nutrient absorption and increased diffusion of pancreatic enzymes in digesta also changes hemi-cellulose to sugar so that nutrients formally trapped within the cell wall are realized (Munassur, 2011) .

This study conducted to evaluate different levels of commercial dietary enzymes (xylanase and phytase) combinations on performance, carcass characteristics and economical evaluation of broiler chicks fed on 15% Prosopis juliflora pods based diet.

MATERIAS AND METHODS

The experiment testing different levels of (Xylam and phytase combination on the performance and carcass characteristics of broiler chicks fed diets containing Prosopis pods were carried out. The experiment was conducted during the period from 19th December 2010 to 23rd January 2011. The average weekly temperature ranged between 16.9 C° and 31.8 C°. The period of each experiment was five weeks.

Full mature prosopis pods were harvested from Khartoum North (Shambat area) and stretched in a well-ventilated opened building for two days till they were dried. Pods were cleaned, and milled in an electric mill to pass through a forty mesh sieve. Milled pods then subjected to a process of drying for overnight, after that sealed in plastic bags to avoid insect infestation, and stored for chemical analysis according to AOAC, 1988.

A total number of 168 one day old (Ross 308) unsexed broiler chicks were purchased from a commercial company (Inma for poultry production company), Omdurman –Sudan. Transported to the student poultry premises, College of Agricultural Studies, Sudan University of Sciences and Technology, Shambat. All chicks were weighted with an average of initial weight 45 g. one day old. The chicks were adopted to premises and feed over 7 days before the start of the experiment. The chicks were then allotted randomly to 6 groups with 3 replicates and 7 chicks per each. Ground brooding/rearing system was adopted for the five weeks of the experimental period; Chicks were brought vaccinated against Marek's disease on hatchery. On farm, the chicks vaccinated against Gumboro disease at 11and 28 days of age and Newcastle disease at 22 days of age. Soluble multivitamin compounds (Pantominevit – Pantex, Holand B.V. 5525 ZG Duizel Holland) and antibiotic (Neomycin, Avico, Jordan) were given to the chicks before three days of the vaccination and 3days after the vaccination in order to guard against stress.

An open wire mesh–side poultry house was used. The house was concrete floor, with local materials, conjugated metal sheet s roof and a solid brick western–Eastern wall up to 3meters eaves height and 4–5 meters for apex. Sixteen pens, 1 m each, inside the house were prepared using wire mesh partitioning. Each pen was equipped with one feeder and drinker to allow ad libitum consumption of food and water. Light was provided 24 hours, in the form of natural light during the day and artificial light during night. Five bulbs (60 watt) were used for this purpose. The house was cleaned and disinfected before the commencement of the experiment.

Microbial xylam and phytase enzymes used in this experiment were prepared from bacteria Bacillus stabiles and E.coli respectively which produced by Nutrex company for feed enzyme production, (Achterstenhoek 5, 2275 Lille, Belgium).

Six experimental diets A,B,C,D,E and F were formulated to be iso-caloric (3100 Kcal/Kg) and iso- nitrogenous (22.8 %) to meet the nutrient requirement of broiler (NRC, 1994) as follows:

(A) Diet (standard control) without Prosopis pods or enzyme.

(B) Diet (control which contained 15% Prosopis pods without enzyme)

(C) Diet (B) supplemented with 500 g xylam / ton +1000 g phytase/ton.

(D) Diet (B) supplemented with 750 g xylam / ton +1000 g phytase/ton.

(E) Diet (B) supplemented with 500 g Xylam / ton + 1500 g Phytase/ton.

(F) Diet (B) supplemented with 750 g xylam / ton + 1500 g phytase/ton.

The percent composition and calculated analysis of the experimental diets were presented in table 1 and 2.

Table 1: Composition of the experimental diets used in the experiment

Ingredients	A	B	C	D	E	F
Sorghum (feterate)	65.75	49.11	49.11	49.11	49.11	49.11
Prosopis pods	-	15.00	15.00	15.00	15.00	15.00

Ground nut cake	13.00	21.86	21.86	21.86	21.86	21.86
Sesame cake	15.00	5.10	5.10	5.10	5.10	5.10
Concentrate *	5.00	5.00	5.00	5.00	5.00	5.00
Oyster shell	1.00	0.7	0.7	0.7	0.7	0.7
Oil	-	2.68	2.68	2.68	2.68	2.68
Vit. and Min. **	-	0.2	0.2	0.2	0,2	0.2
Salt	0.25	0.25	0.25	0.25	0.25	0.25
Methionine	-	0.1	0.1	0.1	0.1	0.1
Phytase	-	-	0.1	0.1	0.15	0.15
Xylam	-		0.05	0.075	0.05	0.075
Total	100	100	100	100	100	100

Broiler concentrate*: Crude protein 40%, crude fat 3%, crude fiber 1.5%, lysine 13.5 %, methionin 5.9 %, meth + cytine 60.25 %, calcium 6.8 %, phosphorus 7%, sodium 1.5 % Me. 2122K Cal /Kg. Added vitamins and minerals per Kg: vitamin A 250,000 IU, V. D 3 60,000IU, V. E 800 ppm, v. K 3 60 ppm, v, B6 50 ppm,V. B2 300ppm, V. C 4.000, ppm, Biotin 2000 ppm, Folic acid 30 ppm, choline chloride 10,000 ppm, Iron (Fe) 1.000 ppm, copper (cu) 300 ppm, zinc (zn) 1.000 ppm, Manganese (mn) 1.600 ppm, Iodine 20 ppm, cobalt 12 ppm, Antioxidant added. ** Vitamins and minerals: Supplements per Kg product: V. A 300,000 IU, V. D3 100,000 IU, V.E 4.00 ppm, V.K 98 ppm, V.B2 1.320 ppm, V. B 12 4.0 ppm, pantothenate 2.0 ppm, Niacin 20.0 ppm, Folic acid 100 ppm, Coline 50.0 ppm, Copper 15.0 ppm, Iodine 250 ppm, Selenium 50 ppm, Manganese 24 ppm, Zinc 20 ppm, Iron 10 ppm, Coccide 25 ppm, Antioxidant b125 ppm.

Table 2: Calculated analysis of the experimental diets used in third experiment

Ingredients %	A	B	C	D	E	F
Dry matter	94.85	95.49	95.49	95.49	95.49	95.49
Crude protein	22.7	22.8	22.8	22.8	22.8	22.8
Crude fiber	4.35	3.54	3.54	3.54	3.54	3.54
Ether extract	3.35	3.54	3.54	3.54	3.54	3.54
Ash	4.65	4.77	4.77	4.77	4.77	4.77
N F E	59.8	56.33	56.33	56.33	56.33	56.33
Calcium	1.06	1.07	1.07	1.07	1.07	1.07
Total phosph.	0.79	0.82	0.82	0.82	0.82	0.82
Avail. Phosph.	0.5	0.4	0.4	0.4	0.4	0.4
ME.cal/kg	3117	3079	3079	3079	3079	3079

Average body weight, weight gain and feed consumption (g) for each group were determined weekly throughout the experimental period. Heath of the experimental stock and mortality data were closely observed and recorded daily.

At the end of the six week the birds were fasted over night with only water allowed. Birds were weighed individually before slaughtering by severing the right and left carotid and jugular vessels, trachea and esophagus. After bleeding they were scaled in hot water, hand plucked and washed. The head was removed close to skull, feet and shanks were removed at the hock joint. Evisceration was accomplished by a posterior vertical cut to remove the visceral organs. Hot carcass, liver; heart and gizzard were separately weighed. The hot carcass was prepared for analysis by removal of the skin and neck near to the body and each was weighed separately. The carcass was then divided into right and left sides by mid sawing along the vertebral column and each side was weighed. The left side was divided into three commercial cuts; breast, drumstick and thigh. Each cut was weighted separately and deboned (Mohamed, 1998). The meat was frozen and stored for chemical analysis and panel test. The samples were stored for 24 hours in a refrigerator and triplicate samples were analyzed at Food Research Centre Laboratories-Shambat, for chemical analyzed of protein, moisture, fat and ash contents according to the AOAC, (1988).

The right side (drumstick, thigh and breast) cuts for each testing groups were stored in the refrigerator. Cuts were slightly seasoned wrapped individually in aluminum foil and roasted at 190°c for 70 minutes and allowed to cool to room temperature in about 10 minutes. Taste panel group of ten well trained people tested color, flavor, tenderness and juiciness of meat (Cross *et al.*, 1978). The scale of the taste panel was from 1-8 degrees. The samples were served randomly to each judge.

Completely randomized design was used in this experiment, the data were tabulated and subjected to one way analysis of variance (ANOVA) by using the SAS computer program (Hajati, 2010). The least significant differences (LSD) were used for treatment means separation as outline by Steel and Torrie. All values were presented as means and standard error. The level of significantly difference set up at $P<0.05$.

RESULTS

Data obtained for the performance of chicks fed on diets containing 15% Prosopis pods flour supplemented with combinations of microbial xylam and phytase were shown in Table 3. Chicks fed on control diet recorded significantly (P<0.05) higher weights in body weight gain and significantly (P>0.05) the best value for feed conversion ratio compared to group B (diet containing Prosopis pods without enzyme), also chicks groups fed on diets supplemented with different combinations of xylam and phytase (C,D,E and F) recorded significantly (P<0.05) highest body weight gain and best values for feed conversion ratio compared to chicks fed on diet B. However, there was no significant (P>0.05) difference between control group and chicks fed on diets supplemented with enzymes combinations in all parameters of performance. There was no significant (P>0.05) difference between all tested groups in feed intake and mortality rate.

Data concerning dressing percentage and body weight components and commercial cuts were shown in Table 4. Carcass dressing was expressed as a percent of final body weight, while body components were expressed as a percentage of hot carcass weight. Results showed no significant (P>0.05) difference between the tested groups.

Collected data for Commercial cuts (thigh, drumstick, and breast) were tabulated in Table 4. Result revealed that there was no significant (P>0.05) difference between treatment groups. All treatment groups' values were similar. The values of meat of each selected commercial cuts was not affected significantly (P>0.05) by different treatments.

Table 3: Effect of different levels of xylam and phytase enzymes combinations on performance of broiler fed diets contained Prosopis pods for 5 weeks.

Treatment	A	B	C	D	E	F	SE
Initial body weight g/bird	198	200	182	191	199	193	
Final body weight g/bird	2037	1908	1900	2056	1956	1975	
Body weight gain g/bird	1840	1708	1820	1910	1830	1840	0.0354
Feed intake g/bird	3950	4000	3930	3921	3940	3960	102.1
Feed conversion ratio	2.14	2.34	2.17	2.16	2.15	2.15	0.100
Mortality %	0.00	0.25	0..00	0.00	0.00	0.00	0.102

Means on the same raw with no superscripts were not differ significantly (P>0.05).
(A)= Standard control (without Prosopis pods or enzymes). (B)= Control +contained 15% Prosopis pods without enzymes). (C)= B+500 g xylam +1000g phytase. (D)= B +500g.xylam +1500 g Phytase. (E)= B+750 g xylam +1000 g phytase. (F)= B +750 g xylam +1500 g phytase. NS = Not significant. SE ±= Standard Error. LSD=Least significant difference.

Table 4: Effect of different levels of xylam and phytase enzymes combinations on commercial cuts and their values of meat expressed as percentage of broiler fed on diet contained Prosopis pods.

Treatment	A	B	C	D	E	F	SE
Dressing%	70.19	70.34	70.14	70.13	70.17	70.16	
Drumstick %	16.00	15.99	16.19	16.11	16.18	16.15	0.3746
Breast %	23.40	23.42	23.42	23.39	23.40	23.41	1.017
Thigh %	19.30	19.21	19.27	19.29	19.30	19.28	0.3746
Heart %	0.87	0.85	0.89	0.88	0.86	0.89	0.0791
Liver %	2.30	2.29	2.28	2.44	2.38	2.30	0.2214
Gizzard%	2.33	2.18	2.34	2.33	2.32	2.33	0.1924

Means on the same raw with the superscripts letters were not significant (p> 0.05).
(A)=Standard control. (B) = control +contained Prosopis 15% pods without enzymes. (C) =B+500 g Xylam +1000 g Phytase. (D) =B +500 g xylam + 1500 g phytase. (E) =B+750 g xylam + 1000 g phytase. (F)= B +750 g xylam + 1500 g phytase. NS =Not significant.
SE= Standard Error. LSD=Least significant difference.

Meat chemical composition aspects (moisture, crude protein, ash, and ether extract) were shown in table 5. The results indicated that there was no significant (P >0.05) effect among the treatment groups in crude protein, ether extract and ash content but there was a significant (P<0.05) effect in moisture content, that group B recorded lower moisture mean value than other tested groups. Chicks purchase, management and feed cost values of meat is total revenues - profitability ratio/Kg meat (1.94), (1.13) of group C (500 Xylam + 1000 phytase) and D (500 Xylam + 1500 phytase) respectively were the highest of the test groups.

The average subjective meat quality scores (color, tenderness, flavor, and juiciness) were not differ significantly (P>0.05) among all treatment groups. Score given for all parameters are above moderate acceptability as shown in table 5.

Table 5: Effect of different levels of xylam and phytase enzymes on meat chemical composition of broiler fed on diets contained Prosopis pods.

Items	A	B	C	D	E	F	SE
Moisture %	70.90	70.74	70.93	70.91	70.92	70.89	0.218
Crude protein%	19.30	19.29	19.31	19.33	19.32	19.30	0.0775
Ether extract %	8.80	8.78	8.81	8.79	8.80	8.81	0.0837
Ash %	0.79	0.77	0.80	0.81	0.82	0.81	0.0183
Tenderness	6.33	6.31	6.30	6.32	6.34	6.35	0.0025
Color	6.20	6.18	6.21	6.23	6.22	6.20	0.0023
Flavor	6.13	6.15	6.16	6.17	6.14	6.16	0.0021
Juiciness	5.93	5.95	5.93	5.92	5.91	5.91	0.0024

Means on the raw having different superscript letters were differ significantly ($p<0.05$).
(A)= Standard control (without Prosopis pods or enzymes). (B)= Positive control (with 15% Prosopis pods without enzymes. (C)=B +500 g xylam + 1000g phytase. (D) =B + 500 g xylam + 1500 g phytase. (E)= B +750 g xylam + 1000 g phytase. (F)=B + 750 g xylam +1500 g phytase. NS=Not significant ($P> 0.05$). *= Significant at ($P<0.05$). SE= Standard Error. LSD=Least significant difference.

DISCUSSION

In this study, results showed that chicks on diet B showed significantly ($P>0.05$) low values in body weight gain and feed conversion ratio compared to those fed on control diet, also results showed that addition of different combinations of xylam and phytase enzymes to diets contained 15% Prosopis pods significantly improved the body weight gain, feed intake and feed conversion ratio throughout the experimental period. No significant differences were observed between different enzymes combinations and negative control in performance of broilers. These results agreed with those of Bin Baraik, (2010) and Wu *et al.*, (2004) who, reported that combinations of xylanase and phytase in wheat – bran diet did not improved significantly the performance of chicks than that obtained when the enzyme used individually. The findings were confirmed by Mukhtar, (2012) who found that the individual addition of xylanase improved significantly the nutritive value of the diet. On the contrary, Ravindran *et al.*, (2000) found no beneficial effect of phytase or xylanase alone on the weight gain of broiler chicks, but they reported a liner improvement when higher concentration of combination of the two enzymes was used. Also these results disagreed with Oslukosi *et al.*, (2007) who, reported that the addition of combination of phytase and cocktail of xylanase and protease (XAP) to corn – soy bean based diet improved the performance of broiler chicks, but the improvement is more likely from phytase, because phytase alone was able to improve daily weight gain. The results showed that the addition of xylanase and phytase enzymes combinations at all levels to diets contained 15% Prosopis pods effect on dressing percentages, carcass yield and internal organs (liver, heart and gizzard) percentages of the experimental chicks. This result was in agree with the result of Bin Baraik, (2010) who found that xylanase and phytase enzymes individually or in combinations did not affected on dressing percentage , carcass yield and internal organs of broiler chicks. The results of this experiment showed no significant differences in commercial cuts (thigh, breast and drumstick) percentage and their percent of separable tissues. These results agreed with the results of Bin Baraik, (2010) and Makkawi, (2009). The results of the experiments also revealed that feeding of test enzymes had no significant effect on broiler meat chemical composition (moisture, ether extract, crude protein and ash) values. These results were confirmed by the subjective quality values in broilers meat (tenderness, color, juiciness and flavor) they all being at moderate values. These results were agreed with Bin Baraik, (2010) who found that phytase addition had no significant effect on either subjective or objective meat quality attributes. While, Makkawi, (2009) found that the quality parameters were not affected by inclusion of xylam enzyme to broiler diets. Also these findings were in agree with the results of Bin Baraik, (2010) who found no significant effect on the subjective and objective quality values due to use of xylanase and phytase enzymes individually or in combinations. The health of the experimental chicks was good and the mortality rate was in normal range. This might be to good management. The results were in agreement with that of Bin Baraik, (2010); Munassur (2011) and Makkawi, (2009). The results of economical evaluations of the experimental diets showed that supplementation of microbial enzymes combinations to diets contained 15% Prosopis pods improved the performance of broiler chicks and resulted economically benefits. Profitability ratio (1.94) for 500 g xylam/ton + 1500 g phytase/ton) was the highest on the tested groups for the experiment.

CONCLUSION

Phytase enzymes combinations added to diet containing 15% Prosopis pods improved the performance of broiler chicks at different phases of growth similar to that obtained by the control group. The addition of xylanase and phytase enzymes combinations had no significant effect on carcass characteristics and internal organs of broiler chicks. Supplementation of diet containing 15% Prosopis pods diets with xylanase and phytase combinations resulted in economic benefits.

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