WORLD JOURNAL OF PHARMACY AND PHARMACEUTICAL SCIENCES
SJIF Impact Factor 5.210
Volume 4, Issue 11, 261-271 Research Article ISSN 2278 – 4357

RESPONSE OF BROILER CHICKS TO DIETS CONTAINING SUNFLOWER CAKE SUPPLEMENTED WITH XYLANASE ENZYME

Abdurrahman Mahmoud Mursi[1] and Mukhtar Ahmed Mukhtar*[2]

[1]Department of Animal Production, Elsheikh Abdalla El-Badri University.

[2]Department of Animal Production, College of Agricultural Studies, Sudan University of Science and Technology, Khartoum North, Shambat, P.O. Box 407, Sudan.

Article Received on
03 Sep 2015,

Revised on 24 Sep 2015,
Accepted on 15 Oct 2015

***Correspondence for Author**
Mukhtar Ahmed Mukhtar
Department of Animal Production, College of Agricultural Studies, Sudan University of Science and Technology, Khartoum North, Shambat, P.O. Box 407, Sudan

ABSTRACT

The experiment was carried out to evaluate the inclusion of various levels (5, 10 and 20%) of sunflower meal (SFM) with and without commercial enzyme (Xylam 500) on the performance of broiler chicks. Total of one hundred and ninety seven day old unsexed broiler chicks were used. Four experimental diets (A, B, C and D) containing graded levels of SFM (0.0, 5.0, 10.0 and 20.0%) with and without enzyme formulated, the same diets were supplemented with xylam 500 enzyme to have eight experimental diets, each treatment was further subdivided into three replicates with seven chicks per replicate and they were distributed in a complete block randomized design (CBRD). Results showed that chicks fed on control diet supplemented with enzyme received significantly the heaviest body weight, body weight gain, more feed intake and best feed conversion ratio compared to chicks fed on control diet without enzyme. It also showed a numerical increase in BW, BWG and FI with the level increase of sunflower seed cake with or without enzyme. However, chicks fed on control diet without enzyme and chicks fed on 20% SFC with enzyme recorded the lowest and heaviest body weight, body weight gain and feed intake respectively. Results showed no significant differences in commercial cuts values and their meat/bone ratio. Also there is no significant difference in fat accumulation, non carcass components (meat, gizzard and liver). Meat commercial analysis showed no significant differences for all parameters. Results obtained revealed that SFM can be used as a source of vegetable protein in broiler diets up to 20% without any adverse effects on the broiler performance and carcass yield. Results showed that the supplementation of

commercial enzyme (xylam 500) to diets containing SFM improved the broiler chicks' performance and economical benefits.

KEYWORDS: fat accumulation, non carcass components (meat, gizzard and liver).

INTRODUCTION

Success of poultry industry depends on good management, good hygiene and economic sufficient feed. Poultry industry in the Sudan now is facing great problems, mainly the feed, which represents about 75% or more of the total cost of production, due to the competition between human and animal, scarce in crop production and human population growth (Mukhtar and Abd-Rahim, 2012). Protein and energy are the most costly components in poultry diets, especially the plant protein (Mukhtar, 2007, Khan et al., 2006).

Sunflower seed meal (SFM) is considered as a good source of vegetable protein and vegetable oil, Syda et al., (2011) studied the substitution of groundnut Meal by SFM. They concluded that SFM can be used as an alternative protein source ingredient up to 26% in layer diets and can replace 100% groundnut meal without hazard effects. However, in recent years there is an increase in the interest of commercial cultivation production in the Sudan. However, high fiber content of sunflower seed meal increased viscosity of gut contents, poor digestibility and poor chicks' performance (Rad and Keshavarz, 1976; Furlan et al., 2001). The testa of SFM is rich in non-starch polysaccharides (NSPs) which reduce the digestibility of the SFM (Annison, 1993). These negative effects can be overcome by supplementation of diets with suitable exogenous enzymes (Gracia, 2003; Mariam et al., 2013; Mukhatr and Abd-Rahim, 2012 and Munasser, 2011).

Commercial xylam 500 is assumed to degrade high fiber content of NSP resulting in increased nutrient availability to poultry chicks (Khan et al., 2006; Taverneri et al., 2008; BinBarik, 2010; Munasser, 2011 and Mariam, 2013).

Therefore, objectives of this study were to investigate the nutritional value of SFM as protein source with and without enzyme supplementation on the performance, carcass characteristics, blood constituents, serum metabolites, enzyme activities and economic feasibility of broiler chicks.

MATERIALS AND METHODS

The study was carried out at poultry production farm, College of Agricultural Studies, Sudan University of Science and Technology.

The experimental diets were formulated to be iso-nitrogenous, iso-caloric to meet the minimum requirements of broiler chicks as recommended by the National Research Council (NRC, 1994). The ingredients composition, calculation and determined of the experimental diets illustrated in table (1).

The commercial microbial xylam 500 (composed of 8000 U/gm, amylase and 1620 U/gm 1-4 -xylanase, produced by Murex Company for Feed Enzymes Production) obtained from Khayrat ElNile, Khartoum, Sudan.

The experimental diets were formulated as follow

Diet A served as negative control (without SFM and enzyme) diets B, C and D were contain different levels (5, 10 and 20%) of SFM respectively. Diets E, F, G and H were similar to diets A, B, C and D respectively, but they were supplemented with 50 gm xylam/Kg diet.

Table (1): Composition and nutritive content of based diet and diets with different Levels of *sunflower meal SFM (experimental diet)*

	Control	5%	10%	20%
Dura	65.5	64.0	61.35	54
Ground nut	13.0	12.85	12.0	10
Sesame cake	15.0	12.0	10.0	8.0
Concentrate	5.0	5.0	5.0	5.0
SFC	_	5.0	10.0	20.0
Shell	1.0	0.65	0.7	0.74
Salt	0.25	0.25	0.25	0.25
Lys.	0.1	0.13	0.185	0.26
Meth.	0.15	0.12	0.255	0.2
V. oil	_	_	0.260.26	1.55
Total	100%	100%	100%	100%

One hundred and ninety two seven day-old, unsexed broiler chicks, (Abor-acer) with average 40 gm weight were used after a week of adaptation period. During the first three days the chicks were given multi-vitamins AD3E+coliston 0.2ml/1L drinking water. During the first week chicks were fed with the per-starter. Chicks were randomly distributed to eight treatment groups with three replicates of eight chicks per each. Feed and water were provided freely. Chicks were vaccinated against Gumboro (Hipra Gumboro) at 8 days of age and

against Newcastle disease at 19 days old. Soluble vitamin compound and antibiotics were given to the chicks before and after three days of the vaccination to guard against stress. The chicks were kept on 24 hour light program; the chicks in each replicate were housed in clean disinfected separated pens of an open system. Wood-shaving was used as litter material in each pen. A randomized block experimental design with four treatments in a 4×2 factorial arrangement (4 sunflower meal inclusion levels: 0, 5, 10, and 20%; and supplementation or not of enzyme) with 3 replicates of 8 chicks each.

Table (2): analysis of nutritive value of base diet and experimental diets with different levels of sunflower meal and enzyme supplementation

Treatment	Sample type	DM %	Ash %	C.P %	E.E %	C.F %
Control (-)	Diet A	92.40	7.05	25.162	4.80	5.80
Control (+)	Diet E	92.10	6.94	20.698	4.60	6.20
SFC 5% (-)	Diet B	92.10	7.05	24.553	4.80	6.40
SFC 5% (+)	Diet F	91.00	7.03	25.771	5.20	5.60
SFC 10% (-)	Diet C	91.50	6.78	23.958	6.20	4.40
SFC 10% (+)	Diet G	91.00	7.03	21.666	8.40	9.60
SFC 20% (-)	Diet D	91.90	6.94	25.208	8.80	9.20
FSC 20% (+)	Diet H	91.80	7.73	24.375	4.60	6.20

Chicks were kept in an open wire mesh-side poultry house. The pens ($1m^2$) inside the house were prepared using mesh partitioning. Each pen was supplied with 2.5 gallon drinker and 5 Kg feeder which were cleaned and disinfected before starting feeding trial. The feeders and drinkers heights were adjusted according to the progressive growth of the chicks.

Chicks of each replicate were group weighted at weekly intervals and feed consumption was recorded at the time of weighing and the data were used to determine the performance parameters. Mortality was recorded daily throughout the experiment period.

At the end of experiment, 6 weeks, three birds that their body weights were close to group average from each treatment, were selected, after they were weighted individually. Blood samples were collect from two birds Per group in heprinized test tubes, centrifuged and stored for analysis. Selected birds were slaughtered, scaled in hot water after bleeding, feather plucked manually then washed and eviscerated. Hot carcass, heart, head, gizzard, abdominal fat and liver were weighted, carcasses were chilled at 4o C for 24 hours, then weighted (cold weight), then were sawed into two halves. The left side then divided into the commercial cuts (breast, thigh, and drumstick). Each cut was weighted individually then deboned to determine

the weight of meat and bone of each cut. The meat was frozen for chemical analysis and panel test.

Stored meat samples were cut into small pieces twice and duplicate samples were analyzed for crude protein, fat, ash and moisture content as described by the AOAC (2000). Diets were analyzed for DM by oven during method, ash by muffle furnace, CP by Kjeldahl method, EE by Soxhlet fat analysis. Nitrogen free extract (NFE) and metabolizable energy (ME) were calculated by (Ellis, 1981) formula.

The stored right side of carcass of each bird was slightly seasoned, wrapped in aluminum foil and roasted at 190o C for 70 minutes with average internal temperature of 88o C and served warm. Ten semi-trained taste panels were used to score color, flavor, tenderness and juiciness of meat (Cross et al., 1978), samples were served randomly to each judge and at room temperature. Water was provided for the panelists to rinse their mouth after tasting each sample.

The hot and cold carcass weights were expressed as a percentage of live weight. The commercial cuts were expressed as a percentage of hot carcasses. Non-carcass components (heart, liver, gizzard and legs) were expressed as a percentage of the weight of its cut.

The collected data were subjected to statistical analysis using analysis of variance technique. Multiple means comparisons were made using Duncan's Multiple Test (Steel and Torrie, 1986).

RESULTS

Results of broiler chicks performance fed on different levels of sunflower seed cake were illustrated in table (3). results showed that chicks fed on control diet supplemented with enzyme received significantly ($P<0.05$) the heaviest body weight, body weight gain, more feed intake and best feed conversion ratio compared to chicks fed on control diet without enzyme . Results also showed a numerical increase in body weight, body weight gain and feed intake with the level increase of sunflower seed cake with or without enzyme.

However, chicks fed on control diet without enzyme and chicks fed on 20% SFC with enzyme recorded the lowest and heaviest body weight, body weight gain and feed intake respectively.

Chicks fed on both control diet and 5% SFC supplemented with enzyme recorded significantly (P>0.05) the best FCR value while those fed on 10% SFC without enzyme showed significantly (P>0.05) the lowest FCR value compared to both control groups.

Results in table (5) showed no significant (P>0.05) differences in commercial cuts (breast, drumstick and thigh) weights values with or without enzyme for all SFC levels. Also there is no significant differences (P>0.05) between commercial cuts meat and bone ratio.

Results showed no significant (P>0.05) differences in fat accumulation, gizzard, head, heart and leg weight for chicks fed on different levels of SFC with or without enzyme as in table (4). However chicks fed on different levels of SFC without enzyme showed numerically heavy weight for liver.

Meat showed no significant (P>0.05) difference, for the parameters ash, erode protein, dry matter and fat deposition for all experimental chicks as explained in table (6).

All levels of SFM with or without enzyme supplementation recorded profit. However, 20% with enzyme recorded the best profitable ratio (1.282) followed by 20% without enzyme and control with enzyme (1.218) compared to control without (1.216).

Table (3): performance of broiler chicks fed on different levels of SFM with or without enzyme.

Treatment	Enzyme	Final body weight	Weight gain	Feed intake	FCR
Control	With	2,402.3^{ab}	2241.0^{ab}	4010.4^{bd}	1.79^{c}
	Without	2127.5^{c}	1959.8^{c}	3768.4^{c}	1.92^{b}
Sunflower5%	With	2308.4^{abc}	2147.7^{abc}	4001.5^{d}	1.86^{bc}
	Without	2285.6^{bc}	2118.0^{bc}	4027.1^{bd}	1.90^{b}
Sunflower 10%	With	2414.3^{ab}	2240.1^{ab}	4366.5^{ab}	1.95^{ab}
	Without	2304.2^{abc}	2139.3^{abc}	4320.1^{abc}	2.03^{a}
Sunflower 20%	With	2564.3^{a}	2391.3^{a}	4518.0^{a}	1.90^{b}
	Without	2469.0^{ab}	2298.3^{ab}	4444.8^{a}	1.94^{ab}

*a-b-c-d values in the same raw with different letters are significantly different

Table (4): the effect of experimental diets on non component carcass

treatment	enzyme	Fat	gizzard	head	heart	leg	liver	neck
control	With G	36.7^{a}	62.7^{a}	45.3^{a}	11.3^{a}	68.3^{a}	45.3^{a}	78.0^{ab}
	Without A	21.3^{a}	49.3^{a}	44.7^{a}	13.7^{b}	92.3^{a}	55.3^{a}	93.3^{a}
Sunflower 5%	With E	27.3^{a}	47.7^{a}	44.7^{a}	10.7^{a}	70.7^{a}	43.0^{a}	74.3^{ab}
	Without B	35.7^{a}	58.0^{a}	45.3^{a}	10.3^{a}	81.0^{a}	51.3^{ab}	67.7^{b}
Sunflower 10%	With F	35.0^{a}	52.3^{a}	44.0^{a}	13.7^{b}	85.0^{a}	49.7^{abc}	91.0^{a}
	Without C	29.7^{a}	61.3^{a}	45.3^{a}	13.3^{b}	85.7^{a}	52.0^{abc}	68.6^{b}
Sunflower 20%	With H	26.3^{a}	62.0^{a}	48.3^{a}	13.3^{ab}	88.3^{a}	49.7^{a}	75.0^{ab}
	Without D	35.0^{a}	61.7^{a}	47.7^{a}	11.3^{b}	92.3^{a}	54.0^{abc}	84.6^{ab}
SE+		10.614	8.466	4.52	1.908	13.345	8.215	9.36

A-b-c the value in the same raw with different letters is significantly different.

Table (5): effect of experiment treatment on percent of commercial cuts from final body weight

Treatment	enzyme	Breast*	Drum*	Thigh*	Bone breast**	Meat breast**	bone drum**	Meat drum**	bone thigh**	Meat thigh**
control	With G	16.4^{ab}	8.0^{a}	7.5^{a}	16.3^{ab}	86.7^{a}	13.5^{a}	88.4^{a}	23.6^{ab}	76.4^{a}
	Without A	16.6^{ab}	8.0^{a}	6.0^{ab}	7.5^{c}	87.6^{a}	11.3^{a}	86.5^{a}	18.9^{b}	77.1^{a}
Sunflower 5%	With E	17.8^{ab}	7.8^{a}	6.5^{a}	17.4^{a}	86.6^{a}	14.6^{a}	85.3^{a}	25.2^{ab}	74.8^{a}
	Without B	16.3^{ab}	7.0^{a}	6.8^{ab}	7.2^{c}	88.8^{a}	14.9^{a}	85.1^{a}	22.5^{ab}	77.5^{a}
Sunflower 10%	With F	17.8^{ab}	7.2^{a}	6.5^{a}	13.5^{abc}	86.6^{abc}	13.5^{a}	86.5^{a}	21.7^{b}	78.3^{ab}
	Without C	16.6^{ab}	7.7^{a}	6.6^{a}	10.2^{abc}	89.8^{ab}	13.5^{a}	86.5^{a}	18.2^{b}	77.8^{a}
Sunflower 20%	With H	16.4^{ab}	7.7^{a}	6.9^{a}	9.5^{bc}	90.0^{ab}	16.3^{a}	83.8^{a}	29.0^{a}	71.0^{ab}
	Without D	17.7^{ab}	6.9^{a}	6.5^{a}	9.7^{abc}	90.1^{ab}	14.5^{a}	85.5^{a}	24.2^{ab}	75.8^{a}
SE+		1.64	0.542	0.669	3.39	3.334	2.837	2.917	3.11	3.11

*as % of final body weight **as% of their cuts

a-b-c-d values in the same raw with different letters are significantly different

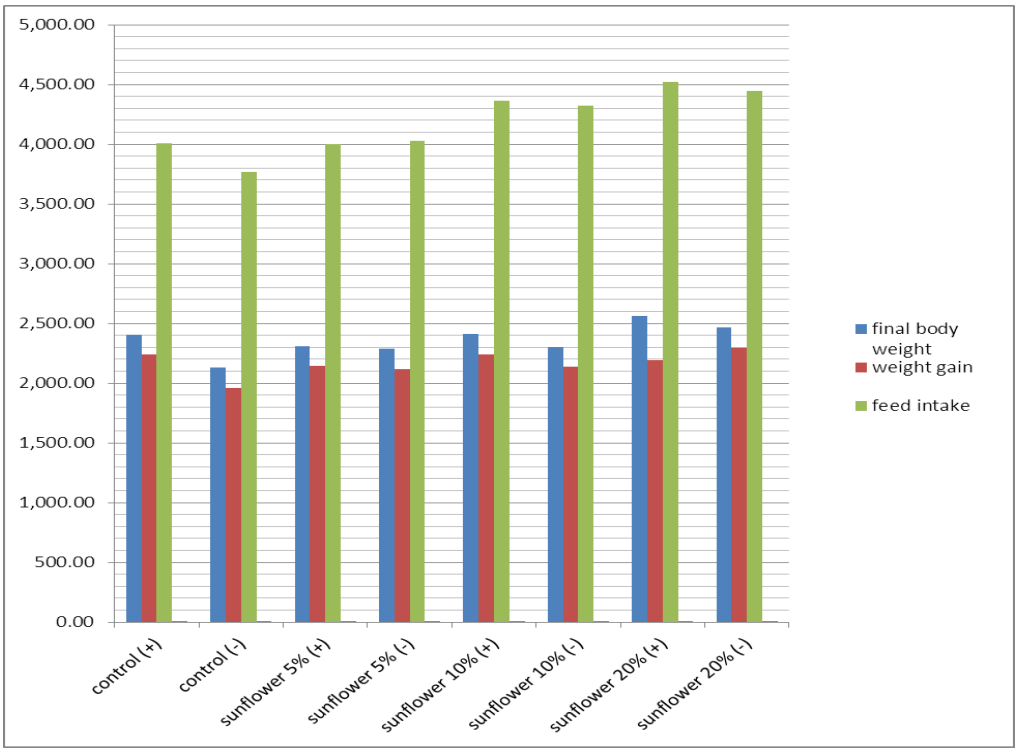

Table (6): effect of experimental diets on Meat analysis

Treatment	Enzyme	ASH	CP	DM	FAT
control	With G	3.93[a]	24.88[a]	32.84[a]	4.52[a]
	Without A	3.91[a]	25.63[a]	32.44[a]	4.53[a]
Sunflower 5%	With E	3.95[a]	24.56[a]	32.61[a]	4.79[a]
	Without B	3.95[a]	24.68[a]	32.78[a]	4.37[a]
Sunflower 10%	With F	3.93[a]	25.18[a0]	32.81[a]	4.67[a]
	Without C	3.92[a]	25.36[a]	32.56[a]	4.66[a]
Sunflower 20%	With H	3.94[a]	24.90[a]	32.39[a]	4.69[a]
	Without D	3.96[a]	25.16[a]	32.69[a]	4.40[a]
SE+	-	0.0831	0.2828	0.1257	0.2478

Table (7): economical study of adding SFM with or without enzyme supplement

Treatment	enzyme	Total cost	Total revenue	profit	Profitability ratio
Control	With	19.3335	45.0754	25.7419	1.218
	Without	20.2398	51.5430	31.3032	1.216
Sunflower 5%	With	20.0535	48.7140	28.6605	1.113
	Without	20.3889	49.3971	29.0082	1.127
Sunflower 10%	With	21.3863	49.1993	27.8130	1.080
	Without	21.1315	51.5223	30.3908	1.181
Sunflower 20%	With	21.4312	52.7919	31.3607	1.218
	Without	22.0004	54.9999	32.9995	1.282

DISCUSSION

Sunflower is a promising new edible oil crop in Sudan. Sunflower meal is considered as a good source of vegetable protein (30.7_41.6%), high fiber content (8.9_13.0%) of it

increased viscosity of gut contents, poor digestibility and poor chicks performance (Furlan et al., 2001). These negative effects can be overcome by supplementation of diets with suitable exogenous enzyme (Gracia et al., 2003, Tavernari et al., 2005). Proximate analysis showed variations in sunflower, meal Sayda et al., (2011), these variations might be attributed to location, micro and macro- environmental factors or to the different processing methods.

Results obtained for chicks fed on different levels of SFM showed that the group fed on control diet supplemented with enzyme recorded significantly the best performance compared to other tested groups, also numerical increase in body weight, feed intake and weight gain with increase of SFM levels with or without enzyme. These negligible results might be due to the high fiber content of SFM, its deficient in lysine and low content of vitamins. These results were in line with the findings of Mandal et al., (2003), who added undecorticated SFM in different levels replacing part of soybean meal in broiler diet reported no significant effect in body weight gain and feed intake. Results obtained for dressing percentages, legs, neck, non-carcass components (liver, heart, gizzard.), abdominal fat, commercial cuts and their meat/bone ratio were not affected significantly neither by the SFM levels nor enzyme supplementation. These results were in line with findings of Arabi (2006) who reported that these parameters did not affect by enzyme supplementation.

Results obtained showed that meat yield and the average of subjective quality scores (color, flavor, tenderness and juiciness) were not affected significantly by dietary treatments, all being at moderate values. These results were agreed with the results of (Mukhtar et al., 2013a).

The apparent health of the experimental chicks was good throughout the experimental period and in all treatments.

This might be due to that environmental temperature during the experimental period fell within thermo neutral zone, or due to good sanitation or that supplementation of diets with SFM did not affect on mortality rate. Also Makkawi, (2009), Bin Baraik (2010) and Mariam, (2013) found lower mortality with the diets supplemented with enzyme The results of economical evaluations of the experimented diets showed that the inclusion of SFM to broiler diets improved the performance of chicks and resulted in economical benefits. Profitability ratio (1.282) for 20% SFM supplemented with enzyme recorded the highest value, although,

all chicks fed on different levels of SFM with and without enzyme recorded high ratio of profit compared to control groups.

REFERENCE

1. Annison, G. The role of wheat non-starch polysaccharide in broiler nutrition. Aust. J. Agri. Res. 1993; 44(3): 405-422.
2. Arabi SA. (2006). Effect of phytase on proteins and electrolyte utilization for broiler Chickens. Ph.D Thesis, Faculty of Agricultural Studies, Sudan University of Science and Technology, Khartoum, Sudan.
3. BinBarik B. S. S. (2010). Influence of xylanase and phytase enzymes, individually or combination on performance and carcass characteristics in broiler feed diet containing wheat bran. This submitted in accordance with the requirement of the Sudan University of science and Technology for the degree of doctor of physiology.
4. Cross CK, Bharucha KR, Telling GM. determination of volatile N-nitrosamines in bacon cook-out fat by nitrite release and thin-layer chromatography of fluorescent amine derivatives. J Agric Food Chem, 1978; 26(3): 657-60.
5. Ellis, N. (1981). The nutrients composition of Sudanese animal feeds. Bulletin (1): Northern and Central Sudan.Central Animal Nutrition Research Laboratory. Kuku Research Centre, Khartoum-North, Sudan.
6. Furlan, A. C., C. Mantouani A. E. murakami, I. Moreira, C. Scapinello, E. N. Martins. Use of sunflower meal in feed for broilers. Journal of Animal Science. 2001; 30: 158-164.
7. Gracia , M. I. , M. J. Aranibar , R. Lazaro P. medel and G.G. Mateos, Alpha-amylase supplementation of broiler diets based on corn, Polt. Sci., 2003; 82: 436-442.
8. Khan, S.H, R: Sardar and B.Siddique. Influence of enzymes on performance of broilers fed sunflower-corn based diets Pakistan vet. J. 2006; 26(3): 109-114.
9. Makkawi DH. (2009). Effect of dietary xylam 500 enzymes and metabolizable energy level on the performance and carcass characteristics of broilers. M.Sc. Thesis. Sudan University of Science and Technology.
10. Mandal A. B., P. k. Tyaga, A. V. Elangovan, S. Kaur and A. Johri. Utilizing sunflower seed meal along with maize or maize and pearl millet in the diet of broilers. Ind. J. Poult. sci., 2003; 38: 243-248.
11. Mariam A. E. Y., Mukhtar A. M. and Mohammed K. The effect of feeding broiler chicks on prosops pods Fluor supplemented with combinations of microbial xylem and phytase enzymes. Journal of current Research in Sci., 2013; 1(2): 90-95.

12. Mukhtar A.M. The effect of feeding Rosella (Hibiscus Sabdarlla) seed on broiler chicks' performance.Research journal of anim. and vet. sci., 2007; 2: 21-23.
13. Mukhtar.A.Mukhtar and Abdal-Rahim, Bakhei. Effect of feeding diet containing Roselle seeds (Hibiscus sabdariffa) with or without enzymes supplementation on broilers performance, carcass traits and serum constituents. Egypt. Poultry Science, 2012; 33(I): 17-27.
14. Mukhtar MA, KA Mohamed, Amal OA and Ahlam H. Response of boroiler Chicks to different Dietary level of Spearmint oil (SPO) as natural Growth promoter .University of Bakht Alruda Scient Journal,. 2013a; 6: 175 –n 183.
15. Munasser F. N. H. (2011). Effect of feeding different levels of prosopis pods with and without xylanase on performance of broiler chicks. This submitted in accordance with the requirement of the Sudan University of science and Technology for the degree of Msc.
16. National Research Council. (1994) Nutrient Requirement of poultry (9th) revised. National Academy of Science. Washington DC, U.S.A.
17. Rad F. H. and K. Kesharaz, Evaluation of nutritional value of sunflower meal and possibility of substitution of sunflower meal. Poult. Sci., 1976; 55: 1757-1765.
18. Steel RGD and Torrie JH. (1986). Principles and procedures of statistics. A Biometrical Approach (2th ed.) Mc Graw Hill Book Company, Ins.NY, USA.
19. Syda A. M. Ali, Haydar O. Abdallah and Abasid M. A. Sunflower meal as an alternative protein source to groundnut meal in laying hens ration. Egypt poult. sci. rol. 2011; 31(4): 745-753.
20. Tauernari, F. C. ; L. F. T. Albino , R. L. Morata , W. M. Dutra Junior , H. S. Rosragno , M. T. S. Viana. Inclusion of sunflower meal with or without enzyme supplementation in broiler diets. Revesta Brasileira Vience Avicola, 2008; 10(4): 233-238.