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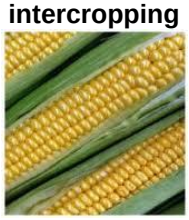
The effect of ginger root powder (Zingiber officinale) supplementation on broiler chicks performance, blood and serum constituents  	**Original Research, B84** **Zomrawi W.B., Abdel Atti Kh.A. and Dousa B.M.** ***Online J. Anim. Feed Res.*, 2(6): 457-460, 2012.** **ABSTRACT:** *A study using one hundred and twenty eight unsexed day old broiler chicks (Ross 308) 32 birds/treatment with four replicates was conducted to evaluate the effect of ginger root powder as natural feed additives on growth performance, blood and serum constituents of broiler chickens. Four dietary treatments were formulated to meet the nutrient requirements of broiler chick containing ginger root powder at levels 0%, 0.5%, 1% and 1.5%. Result showed that significant decreased (P<0.05) were observed in feed intake and weight gain for birds fed 0.5% ginger root powder. There were no significant differences (P>0.05) in feed conversion ratio among all dietary treatments. Treatments had significant decreased (P<0.05) in pre-slaughter weight for birds fed 0.5% ginger root powder. No significant differences (P>0.05) were observed in dressing percentage. There were no significant effect (P>0.05) on serum glucose, total protein and creatinine. Significant differences were observed in serum triglyceride and cholesterol levels. There were no significant differences (P>0.05) among all dietary treatments in Hb percentage, PCV percentage, TRBcs, MCV, MCH and MCHC percentage. The results showed that the inclusion of ginger root powder at levels 0.5% and1% in the diet , had lowering effect on cholesterol levels, and the chick may tolerate up to 1.5% without adverse effect on growth performance and blood parameters.* **Key words:** *Ginger root powder, Broiler, Serum cholesterol*	PDF Watch Online
Effect of different salt concentrations on chemical composition of the fish Hydrocynus spp. 	**Original Research, B85** **Abbas Bakhiet H.H. and Khogalie F.A.E.** ***Online J. Anim. Feed Res.*, 2(6): 461-464, 2012.** **ABSTRACT:** *This piece of work was directed towards the study of the proximate chemical composition to compare the effect of the different salt concentrations on the nutritive value of fish. In both fresh fish and fassiek (salted fish). Proximate analysis targeted the determination of moisture%, protein%, ash%, fat and pH. Contents were determined by wet samples. The proximate composition of the fresh samples was 70.9%, 24.2%, 3.8%, 1.2% and 7.05 for moisture, protein, fat, ash and pH respectively. The proximate composition of fassiekh (moisture, protein, fat, ash and pH) for 15% salt was 60.3%, 21.7%, 3.4%, 10.5% and 6.6 respectively. And for 20% salt was 56.7%, 19.2%, 3.2%, 12.9% and 6.0 respectively. And for 25% salt was 52.2%, 17.6%, 1.9%, 14.1%, and 5.8 respectively. As for the proximate composition of fassiekh it is clearly observed that all the studied parameters are significantly different in fresh treated samples. Variations appeared to be due to the interaction of the salting treatment.* **Key words:** *Proximate, Hydrocynus spp., Chemical composition, Salt*	PDF Watch Online
Growth performance of cobb broilers given varying concentrations of malunggay (*Moringa oleifera* lam.) aqueous leaf extract.  	**Original Research, B86** **Portugaliza H.P. and T.J. Fernandez, Jr.** ***Online J. Anim. Feed Res.*, 2(6): 465-469, 2012.** **ABSTRACT:** *A study was conducted to determine the growth performance of Cobb broilers supplemented with varying concentrations of Moringa oleifera Aqueous Leaf Extract (MoALE) via the drinking water. A total of four hundred day-old chicks were randomly distributed into four treatment groups, replicated four (4) times with twenty-five broilers per replicate. The growth performance of broilers was evaluated based on their feed consumption, live weight, feed conversion ratio (FCR) and return of investment (ROI). Results of the study showed that at 90 mL MoALE (T_3), the feed consumption of broilers was consistently lower than the control group (T_0) and this was statistically significant (P<0.01). The live weight of broilers given 30 mL (T_1), 60 mL (T_2) and 90 mL (T_3) MoALEs were significantly higher than the control group (T_0) and this was also statistically significant (P<0.01). In terms of feed conversion ratio (FCR), the MoALE treated broilers (T_1-T_3) were more efficient converter of feeds into meat than the control group (T_0) and this was statistically significant (P<0.01). Furthermore, the return of investment (ROI) of MoALE treated broilers (T_1-T_3) was significantly higher (P<0.01) than the control group (T_0) with a revenue per peso invested of Php 0.62 in T_1 and T_2, and Php 0.63 in T_3 compared to Php 0.50 in T_0.* **Key words:** *Moringa oleifera, Broiler, Feed consumption, Live weight, Feed conversion ratio*	PDF Watch Online
The evaluation of dry season nutritive value of dominant and improved grasses in fallows in Chivi district, Zimbabwe 	**Original Research, B87** **Tavirimirwa B., Manzungu E. and Ncube S.** ***Online J. Anim. Feed Res.*, 2(6): 470-474, 2012.** **ABSTRACT:** *Five dominant (Cynodon dactylon, Perotis patens, Digitaria eriantha, Brachiaria brizantha, Hypethelia dissoluta) and two improved grasses (Pennisetum purpureum and Cynodon nlemfluensis) were compared for their nutritive value in Chivi district in terms of crude protein (CP), ash, dry matter(DM), neutral detergent fibre (NDF) and acid detergent fibre (ADF). The proximate analysis procedure was used to assess CP, ash and DM while NDF and ADF were estimated using the Van Soest et al. procedure. Significant differences were observed in the nutritive value of improved and dominant grasses. Cynodon nlemfluensis (5.54% CP, 39.04% ADF and 59.11% NDF) and P. Purpureum (5.35% CP, 39.17% ADF and 56.80% NDF) had significantly higher CP values and lower ADF values in comparison with dominant grasses, C. dactylon (3.75% CP, 44.13%ADF and 66.00% NDF), D. eriantha (2.21% CP, 48.78% ADF and 69.04 % NDF), P patens (3.51% CP, 47.51% ADF and 70.31% NDF), B. brizantha (2.37% CP, 50.95% ADF and 67.00% NDF) and H. dissoluta (2.10% CP, 44.49% ADF and 67.24% NDF). In terms of CP content comparisons, improved grasses have the potential to increase the carrying capacity of the fallows. It was concluded that the improved species have high nutritive value compared to the*	PDF Watch Online

	dominant grasses therefore have the potential to improve forage quality in terms nutritive value in fallow fields in Chivi. **Key words:** *Dominant grasses; Improved grasses; Nutritive value*	
Occurrence of *salmonella spp* from fresh fish (tilapia nilotica linn) using improved isolation methods No image	**Original Research, B88** **Nwiyi p. and Onyeabor A.** ***Online J. Anim. Feed Res*., 2(6): 475-478, 2012.** **ABSTRACT:** *Fresh fish (Tilapia Nilotica Linn) is a very important source of protein to the population in our country; this is of importance when other sources of animal protein are in short-supply. This freshwater fish may harbor salmonella spp. Which may be a source of pathogen to human hence, this study is important due to the public health implications. A total of 90 samples (30 whole freshwater fish, 30 intestines and 30 gills) were collected from different open market in Aba, South, Aba North and Osisioma Local Government Area all in Abia State, and examined. The objective of this study was to compare between non-pellet method and pellet method of isolation of salmonella spp. from different parts of freshwater fish. In this study, the pellet method was evaluated and compared with the non-pellet. Three selective agars used for the purpose of this study namely: Salmonella-shigella Agar (SSA) xylose Lysine Deoxycholate Agar (XLD) and Bismuth sulfite Agar (BSA). There was significance difference (P<0.05) with the pellet method on the 30 Tilapia sample. The frequency of occurrence in pellet method was 66.66%, 50.00% and 26.66% growth on SSA, XLD and BSA while non-pellet method presented occurrence of 33.33%, 23.33% and 13.30% for SSA, XLD and BSA respectively. It was observed that salmonella sp was found more on the whole body of Tilapia nilotica than the gill and intestine presenting 66.66%, 50.00% and 20.00% respectively. The result confirms that pellet method isolated higher number of salmonella sp than non – pellet method.* **Key words:** *Tilapia nilotica, salmonella sp., Isolation, "pellet and non-pellet method"*	 
Nutritive evaluation of two flood grasses in White Nile – Sudan 	**Original Research, B89** **Mahala A.G., Elnadeef Y.M.A., Amasaib E.O. and Atta Elmnan B.A.** ***Online J. Anim. Feed Res*., 2(6): 479-482, 2012.** **ABSTRACT:** *Flood grasses (Echinochloa stagnina and Echinochloa pyramidalis) were evaluated as animal feed in term of chemical composition and in vitro digestibility. Crude protein (CP) content was significantly (P < 0.05) higher in Echinochloa stagnina (9.7%) than in Echinochloa pyramidalis (6.5%). Acid-detergent fibre (ADF) (51.6%), Nitrogen-free extractive (NFE) (31.4), Neutral-detergent fibre (NDF) (69.8) and Ether extract (EE) (0.69) in Echinochloa stagnina were lower than in Echinochloa pyramidalis (55.7%, 35%, 73%, 0.95%) for ADF, NFE, NDF and EE respectively. Sodium (Na) content (0.7%) was significantly (P > 0.05) higher in Echinochloa pyramidalis than in Echinochloa stagnina (0.3%) and Calcium (Ca), Phosphorus (P), Potassium (K) and Magnesium (Mg) were (0.30% and 0.40), (0.60% and 0.60%), (1.60% and 1.70%) and (0.20% and 0.40%) in Echinochloa stagnina and Echinochloa pyramidalis respectively. In vitro dry matter digestibility (IVDMD) of Echinochloa stagnina (63%) was significantly (P > 0.05) higher than in Echinochloa pyramidalis (56%) as well as the values of Digestible acid-detergent fibre (DADF) (69.8%: 54%), Digestible neutral-detergent fibre (DNDF) (71%: 58.5%), and Digestible crude fibre (DCF) (38.3%: 33%). From obtained results it can be concluded that the two species of Echinochloa contribute most of livestock nutrients requirement. Further research required to improve their nutritional value, digestibility and feed intake.* **Key words:** Flood grass, *Echinochloa stagnina, Echinochloa pyramidalis,* Animal nutrition	 
Seroprevalence and isolation of chicken infected with salmonella haematological and pathogical evaluation  	**Original Research, B90** **Nwiyi P. and Omodamiro O** ***Online J. Anim. Feed Res*., 2(6): 483-487, 2012.** **ABSTRACT:** *The research was conducted to study seroprevalence of bird infected with salmonella and to evaluate the pathology of the affected cockerel chicken in Abia and Umudike both in Aba north and Ikwuano local government area of Abia State, as well as isolate salmonella. This study was carried out from February to June, 2010. Samples used were blood cloaca and liver swabs. Other organs like intestine, ovary, spleen and lungs were also used. The serum plate agglutination method was used. Others are gross, histopathology, morphological, cultural and biochemical tests. The total percentage of seroprevalence was 45.0%. Gross lesion showed congestion, enlargement of the liver and petechial hemorrhages in the intestine. Hematological features showed that there were decreased red blood cells on hemoglobin while the white blood cells increased. And there was no significance difference. (P<0.05) At history, congestion, massive lymphocytes infiltrates in the liver paranchyma. The sum of 54 seropositive salmonella sampls from birds were isolated. Further study would also be carried out to investigate the pathogenesis, serotyping and sensitivity test.* **Key words:** *Isolation and Seroprevalence, chicken, salmonella, heamatology, histology*	 
Nutritive value of maize (*zea mays*) and dolecous (*lablab purpureus*) as affected by phosphorous fertilization and intercropping 	**Original Research, B91** **Amasaib E.O., Balgees A Atta Elmnan, Mahala A.G. and Fadel Elseed A.M.A.** ***Online J. Anim. Feed Res*., 2(6): 488-492, 2012.** **ABSTRACT:** *A field experiment was conducted at the Demonstration Farm of University of Khartoum to determine the effect of phosphorous fertilization and intercropping on the nutritive value of* Zea mays *and Lablab purpureus. The field experiment was arranged as Split Plot Design with four replications. The main plots were (Lablab purpureus as sole crop,* Zea mays *as sole crop, Lablab purpureus and* Zea mays in the *mixture). The sub plot treatments were phosphorous fertilization at the rate of (0, 50 and 75 kg P_2O_5 / ha) which were then referred to as P_0, P_1 and P_2 respectively. The plants measured were Lablab purepureus as pure stand, Lablab purepureus in the mixture, Zea mays as the pure stand and the Zea mays in the mixture. Samples of 45 days cut from sowing were used to assess the ash, crude protein (CP), ether extracts (EE), crude fiber (CF), neutral detergent fibre (NDF) and*	 

dry matter digestibility. The data were statistically analyzed using complete randomized design. The results revealed that intercropping and phosphorous fertilization caused a significant (P<0.05) increased on the CP content and dry matter digestibility of all forages under estimation. Intercropping and phosphorous fertilization caused slight increase on the Ash content for all crops in this study. Moreover, Intercropping and phosphorous fertilization caused a decrease on the CF and NDF content of all forages under estimation but with no significant difference. However, Intercropping caused non–significant effect (P<0.05) on the EE content of Zea mays *while, intercropping had a positive influence (P<0.05) on the EE content of Lablab purpureus. The data obtained indicated that phosphorous fertilization caused non–significant effect on the EE content of all crops in this study (P<0.05) except Lablab purpureus in the mixture with Zea mays which increased significantly (P<0.05) by increasing phosphorous level. It can be concluded that intercropping and phosphorous fertilization improved the nutritive value of both maize and lablab bean.*
Key words: *Nutritive Value, Digestibility, Forage Corn, Dolecous, Intercropping, Phosphorous Fertilization*

Immune Responses of Broiler Chicks Supplemented with High Levels of Zinc

Original Research, B92
Sajadifar S., Miranzadeh H. and Moazeni M.
***Online J. Anim. Feed Res.*, 2(6): 493-496, 2012.**

ABSTRACT: *The objective of this study was to evaluate if the high levels of zinc can improve different aspects of broilers' immune system. One hundred and forty-four 1-d old broiler chicks were used in the current study with three dietary zinc (40, 120 and 200 mg/kg). At 2, 22, 32, 42 days of age, the blood serums were tested for antibody titer against Newcastle disease vaccination, using the standard Haemagglutination Inhibition test. On day 42 the sum of nitrite and nitrate (based on the reduction of nitrate to nitrite by cadmium) were measured and the weights of spleen and bursa of fabricius were recorded on a relative live weight basis. At 42 d, antibody response of level 200 mg/kg diet was significantly higher than control. Adding levels of 120 and 200 mg Zn/kg diet significantly increased the weight of bursa and spleen respectively (P< 0.05) compared with the control. Also level of 200 mg Zn/kg diet showed the highest amount of nitrite and nitrate in compare with other levels. The use of 200 mg Zn/kg diet in broilers diet could be considered as a natural promoter of cell-mediated immunity.*
Key words: *Antibody titer, Broiler, Immune organs, Newcastle disease, Nitrite and nitrate, Zinc*

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THE EFFECT OF GINGER ROOT POWDER (zingiber officinale) SUPPLEMENTATION ON BROILER CHICKS PERFORMANCE, BLOOD AND SERUM CONSTITUENTS

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ABSTRACT: *A study using one hundred and twenty eight unsexed day old broiler chicks (Ross 308) 32 birds/treatment with four replicates was conducted to evaluate the effect of ginger root powder as natural feed additives on growth performance, blood and serum constituents of broiler chickens. Four dietary treatments were formulated to meet the nutrient requirements of broiler chick containing ginger root powder at levels 0%, 0.5%, 1% and 1.5%. Result showed that significant decreased (P<0.05) were observed in feed intake and weight gain for birds fed 0.5% ginger root powder. There were no significant differences (P>0.05) in feed conversion ratio among all dietary treatments. Treatments had significant decreased (P<0.05) in pre-slaughter weight for birds fed 0.5% ginger root powder. No significant differences (P>0.05) were observed in dressing percentage. There were no significant effect (P>0.05) on serum glucose, total protein and creatinine. Significant differences were observed in serum triglyceride and cholesterol levels. There were no significant differences (P>0.05) among all dietary treatments in Hb percentage, PCV percentage, TRBcs, MCV, MCH and MCHC percentage. The results showed that the inclusion of ginger root powder at levels 0.5% and1% in the diet , had lowering effect on cholesterol levels, and the chick may tolerate up to 1.5% without adverse effect on growth performance and blood parameters.*

ORIGINAL ARTICLE

Key words: *Ginger root powder, Broiler, Serum cholesterol*

INTRODUCTION

Growth promoters or feed additives are primarily included to improve the efficiency of the bird's growth and /or laying capacity, prevent disease and improve feed utilization. Among all growth promoters, the most commonly used are antibiotics, although nowadays their use is decreasing towards total extinction (Biovet, 2005). Some growth promoters act as pro-nutrients because of the role they play in enhancing the physiology and microbiology of the animal. Many active ingredients from plant are considered as pro-nutrients and recently been tried in animal feeds (Biovet, 2005). Zingiber officinale is a perennial plant commonly known as ginger. Ginger may act as a pro-nutrient because of its the vast active ingredients that has been present in it. Herbs Hands Healing (2011) reported that ginger contains volatile oils like borneol, camphene, citral, eucalyptol, linalool, phenllandrene, zingberine, zingiberol (gingerol, zingirone and shogaol) and resin. Ginger's have medicinal properties are chemicals responsible for the taste, the most noteworthy being gingerol and shogaol. Ginger speeds digestion, and enhances by a protein digesting enzyme (zingibaine) found in ginger. It has antibacterial and anti-inflammatory actions, and ginger rhizome is known to lower blood cholesterol level in man. Ginger rhizome is widely used as a spice or condiment (Larsen et al., 1999). Therefore, objectives of this study were to evaluate the effect of ginger root powder supplementation as natural feed additives on broiler growth performance and blood constituents.

MATERIALS AND METHODS

Experimental diets

The dried ginger used in this experiment was obtained from the local market then ground into powder. Four diets were formulated to meet the nutrient required of the broiler chicks, diets 1, 2, 3 and 4. Diet 1 served as a control 0% (without ginger root powder inclusions). Diets 2, 3 and 4 contained 0.5%, 1% and 1.5% of ginger root powder respectively. The ingredient composition and calculated analysis of the experimental diets is shown in Table 1.

To cite this paper: Zomrawi W.B., Abdel Atti Kh.A. and Dousa B.M. 2012. The effect of ginger root powder (Zingiber officinale) supplementation on broiler chicks performance, blood and serum constituents. *Online J. Anim. Feed Res.*, 2(6): 457-460.
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Table 1 - Ingredients composition and calculated analysis of the experimental diets

	Levels of ginger root powder %			
Ingredients	**0**	**0.5**	**1**	**1.5****
Sorghum	65.85	65.4	65.1	64.93
Groundnut meal	15	14.2	14	14
Sesame meal	11.25	12	12	11.97
Wheat brand	1	1	1	0.7
Super concentrate*	5	5	5	5
Di-calcium	1.25	1.25	1.25	1.25
Salt	0.25	0.25	0.25	0.25
Lysine	0.15	0.15	0.15	0.15
Vitamin premix	0.25	0.25	0.25	0.25
Total	100	100	100	100
Calculated analysis				
ME (Kcal/Kg)	3110.4	3107	3104	3105
Crude protein %	22.09	22.07	22.03	22.05
Crude fat%	4.50	4.53	4.52	4.52
Crude fiber%	4.24	4.28	4.32	4.34
Calcium%	1.13	1.14	1.14	1.14
Available phosphorus%	0.47	0.47	0.47	0.47
Methionine%	0.46	0.46	0.46	0.46
Lysine%	1.19	1.19	1.19	1.18

*Super concentrate per kg = 40%Cp, 2000 kcal ME, 10% Ca, 1.38% Av. P, 12% Lysine, 3% Methionine. **Ginger analysis = 2601mj/kg, 89.29 DM%, 15,5 CP%,2.55 EE%, 13.56 CF%, 59.78 NFE%,8.6 Ash%.

Experimental birds and management

One hundred and twenty eight unsexed day old commercial broiler chicks (Ross 308) were used for the study. The birds were divided into 4 treatments (32 birds/treatment) with four replicates using completely randomized design (CRD). The birds were raised open sided house. In order to boost their immunity they vaccinated against Newcastle disease and infectious bronchitis on the eighth and 28th days of age, while Gumboro vaccine was administered on the 14th day of the experiment. Water and feed were provided *ad-libitum*.

Weekly feed intake and body weight was recorded. Mortality was recorded throughout the period of the study as it occurred. Feed conversion ratio (FCR) was calculated. At the end of the experiment 2 birds per replicate (8 birds/treatment) were randomly selected, leg banded, weighed and slaughtered for carcass evaluation. Pre-slaughter weight, dressing weight were obtained to calculated dressing percentage for each bird. The blood samples were taken from jugular vein during slaughtering and collected into tubes and allowed to clot and sera separated by centrifugation at 3000 rpm for 5 minutes.

Chemical analysis

Plasma glucose and cholesterol were determined by enzymatic calorimetric methods using Kit GOD-PAP (Randox Laboratory Ltd. London). Plasma total protein was determined as shown by (King and Wootton, 1965). Creatinine according to Jaff reaction method. Hemoglobin concentration (Hb) was determined using Hemoglobin – Drabkin Kit. The packed cell volume (PCV) of Erythrocytes of whole blood was measured using a microhaematocrict centrifuge (Hawksley, London). The Erythrocytes (RBC) were counted using Hayems solution. Mean corpuscular volume (MCV), Mean Corpusular heamoglobib (MCH) and Mean corpuscular haemoglobin concentration (MCHC) also were calculated.

Statistical analysis

All the data obtained were subjected to analysis of variance. The software used was the statistical package for social science (SPSS). Differences of means determined by the Duncan Multiple Range Test as described by Steel and Torrie (1980).

RESULTS

The overall growth performance of broilers chicks fed the various levels of ginger root powder is shown in table (2). Feed intake were decreased significantly ($P<0.05$) in treatment 0.5% compare to other treatments, weight gain also were significantly ($P<0.05$) lower in the treatment 0.5% compared to other treatments. There were no significant differences in feed conversion efficiency among the treatments ($P>0.05$). Pre-slaughter weight were significantly lower ($P<0.05$) in treatment 0.5% compared to other treatments. There were no significant differences ($P>0.05$) in dressing percentage among the treatments. Mortality were not significantly affected ($P>0.05$) by the treatments.

Serum constituent's results and shown in Table 3. Serum glucose, total protein and creatinine had not differ significantly affected by the dietary treatments ($P>0.05$). Serum triglyceride were significantly lower ($P<0.05$) for control group and 0.5% supplemented with ginger root powder compared to other treatments, serum cholesterol were significantly lower ($P<0.05$) in 0.5% and 1% groups compared to 0% (control group).

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Blood parameters results are shown in Table 4. There were not significant differences among all groups with respect to hemoglobin concentration (Hb), packed cell volume% (PCV), the erythrocytes (RBC), mean corpuscular volume (MCV), mean corpuscular hemoglobin (MCH) and mean corpuscular hemoglobin concentration (MCHC).

Table 2 - Effect of dietary ginger root powder on growth performance of the broilers

Parameter	Levels of ginger root powder %					
	0	0.5	1	1.5	SEM	Sig
Feed intake (g/bird)	3160.31 [b]	2764.78 [a]	3163.69 [b]	3228.31 [b]	89.06	*
Weight gain (g/bird)	1447.56 [ab]	1267.47 [a]	1468.63 [b]	1449.37 [ab]	55.91	*
Feed conversion ratio	2.18	2.19	2.15	2.24	0.045	NS
Pre-slaughter weight (g/bird)	1489.06 [b]	1310.28 [a]	1506.55 [b]	1492.81 [b]	55.25	*
Dressing (%)	75.88	75.91	76.26	75.15	0.86	NS
Mortality (%)	0.00	0.50	0.50	0.25	0.24	NS

[a,b]: Mean with different superscripts along rows are significantly different (P<0.05). NS=Non-significant difference (P>0.05). SEM = standard error of treatment means

Table 3 - Effect of dietary ginger root powder on serum constituents of the broilers

Parameter	Levels of ginger root powder %					
	0	0.5	1	1.5	SEM	Sig
Glucose (mg/dL)	151.67	171.63	177.67	177.67	9.35	NS
Total protein (g/dL)	5.58	2.63	3.9	4.9	1.09	NS
Triglyceride (mg/dL)	44 [a]	25.67 [a]	62.33 [b]	99.33 [c]	10.65	*
Cholesterol (mg/dL)	94.33 [b]	66.33 [a]	58.33 [a]	128 [c]	7.46	*
Creatinine (mg/dL)	0.17	0.11	0.17	0.15	0.03	NS

[a,b]: Mean with different superscripts along rows are significantly different (P<0.05). NS=Non-significant difference (P>0.05). SEM = standard error of treatment means

Table 4 - Effect of dietary ginger root powder on some hematological parameters

Parameter	Levels of ginger root powder %					
	0	0.5	1	1.5	SEM	Sig
Hb %	58.06	55.94	56.92	59.06	17.07	NS
PCV %	30	25.75	26	26.75	2.37	NS
TRBcs (x106/µL)	2475000	2600000	2566666.7	2900000	320683.22	NS
MCV (fl)	138.48	103.8	101.3	94.73	22.83	NS
MCH (pg)	64.01	58.18	57.83	53.93	5.17	NS
MCHC %	51.60	56.02	57.81	58.67	2.43	NS

[a,b]: Mean with different superscripts along rows are significantly different (P<0.05). NS=Non-significant difference (P>0.05). SEM = standard error of treatment means

DISCUSSION AND CONCLUSION

Feed intake were significantly lower in birds fed 0.5% ginger root powder, whereas it showed similar value to the control group in birds fed 1% and 1.5% ginger root powder. This may be due to associated effect of the feed ingredients of 0.5% level (Scott et al., 1982). This result could be compared with the work of Ademola et al. (2009) who reported higher feed intake of broilers on diet supplemented with ginger. The results were however not in agreement with the report of Herawati, (2010) who stated that broilers fed 2% dried supplementary red ginger meal had significantly lower feed intake than those on the control diet. The decreased feed intake resulted in corresponding decrease in weight gain and pre-slaughter weight in this group, Feed conversion ratio were not significantly differ among all groups, this results disagreed with the work of Moorthy et al. (2009) and Onimisi et al. (2005) who reported significantly better feed conversion ratio in ginger fed groups of broilers compared to control. The dressing percentage did not differ significantly among the dietary treatments.

Serum triglyceride were significantly lower for control group and 0.5% supplemented with ginger root powder compared to other treatments, this result cannot be explained. Serum cholesterol were significantly lower for birds supplemented with 0.5% and 1% compared to the control group. This effect may be attributed to the ginger possesses anti-hypercholesterolemia activity. This is consistent with the well-observed effect of ginger on lowering blood cholesterol level (Fuhrman et al., 2000; Andallu et al., 2003).

In conclusion it seem that inclusion of ginger root powder in the broiler chicks diet at levels of 0.5% and 1% decrease serum cholesterol concentration. Chick tolerate up to 1.5% without adverse effect on performance and blood constituents.

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EFFECT OF DIFFERENT SALT CONCENTRATIONS ON CHEMICAL COMPOSITION OF THE FISH *hydrocynus spp.*

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ABSTRACT: *This piece of work was directed towards the study of the proximate chemical composition to compare the effect of the different salt concentrations on the nutritive value of fish. In both fresh fish and fassiek (salted fish). Proximate analysis targeted the determination of moisture%, protein%, ash%, fat and pH. Contents were determined by wet samples. The proximate composition of the fresh samples was 70.9%, 24.2%, 3.8%, 1.2% and 7.05 for moisture, protein, fat, ash and pH respectively. The proximate composition of fassiekh (moisture, protein, fat, ash and pH) for 15% salt was 60.3%, 21.7%, 3.4%, 10.5% and 6.6 respectively. And for 20% salt was 56.7%, 19.2%, 3.2%, 12.9% and 6.0 respectively. And for 25% salt was 52.2%, 17.6%, 1.9%, 14.1%, and 5.8 respectively. As for the proximate composition of fassiekh it is clearly observed that all the studied parameters are significantly different in fresh treated samples. Variations appeared to be due to the interaction of the salting treatment.*

ORIGINAL ARTICLE

Key words: *Proximate, Hydrocynus spp., Chemical composition, Salt*

INTRODUCTION

Fish and fishery products are highly nutritious, in addition to the high percentages of animal protein, they provide several other nutrients such as vitamins A and B especially in the liver, and E and K vitamins, and they are good sources of some minerals like calcium, phosphorus and iron (Lunven, 1982). The global contribution of fish as a source of protein is high, ranging from 10% to 15% of the human food basket across the world (Wilson, *et al,* 2007). Despite the fact that the nutritional value of fish is well known, it nevertheless plays only a limited role in the diet of many countries. Therefore, it seems appropriate to find new processing methods for this compared valuable raw material so as to increase consumer interest. Compared to mammalian meat, fish meat has more water and less connective tissue, which contains very little elastin (Kolakowska, 2001). In the Sudan fish is considered a major source of protein and energy for many communities, especially among the Nilotic tribes of south and some of the Nubian ethnic groups of the far North (Jackson, 1923).

In the Sudan, nearly 70% of the total fish landings are consumed fresh, the rest is cured either by salting, fermentation or sun drying very little of the local fish supply is smoked, except in the southern Sudan where smoked and very dry fermented fish products are very popular among the local community (FAO, 1992).

Salting is a traditional method of processing fish in many countries of the world. Its often used in combination with drying and smoking salting the fish removes water and lowers the water activity (water available for the support of microbial growth which causes the spoilage) if fish is placed in a solution of salt (brine) stronger than that in the tissues, water will pass from the tissues in to the brine until the strength of the two solution is equal. This phenomenon is known as osmosis. As water passes in to the brine salt will pass in to the tissues. Concentration of (6-10%) salt in the tissues will prevent the action of most spoilage bacteria (Clucas and ward 1996). The objective of this research work was to study the effect of fermentation and salting on chemical composition of *alkass* fish.

MATERIALS AND METHODS

Materials

Fresh Hydrocynus spp. were collected from EL Mawrada fish market. A total of18 kg each fish have about 150-200g were preserved in iced container and transferred to the fisheries laboratory in Sudan university Department of fisheries and wildlife science for *Hydrocynus spp).*

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Preparing and Processing

Random samples were chosen to do the chemical analysis of fresh fish. Preparing fassiekh takes place as follows: first fresh fishes were individually gutted and washed by tap water and placed on a plastic dishes to dry and then weighted on sensitive balance (FEJ-2000B). The addition of salt is made relevant to weight of the fish, fish were divided in to three groups each of 6 kg, Then subjected to different salt concentrations (15%, 20%, and 25%). Each fish was salted separately, with coarsely ground salt, applied all over the body especially on the gill area and the cavity of the gutted specimens. Then the fish were stacked in layers separated by layers of salt on plastic container and covered with a heavy cover. Random sample were taken on the 10th day for the chemical analysis for each group.

Methods

Proximate composition analysis: Proximate composition analysis was determined using the method AOAC, 1984. The moisture content of fresh and salted fish was determined by drying the meat in at oven 105c until a constant weight was obtained, crude protein content was calculated by converting the nitrogen content determined by Kjeldahl's method (6.25 _ N) Fat was determined using the Soxhlet system Ash content was determined by dry ashing in afurnace oven at 525 _C for 24 h.

pH Measurement: The PH was determined with a glass electrode of a newly calibrated Digital PH meter (JENWAY-3015ph meter) at room temperature. One gram of fresh and salted fish were blended with 10 ml distilled water, and stirred well with a magnetic stirrer, then centrifuged well, and supernatant was taken for measurement

Statistical analysis

Statistical analysis was performed with the SPSS software. by analysis of variance. Significance was established at $P<0.01$

RESULTS

This study was carried out to evaluate the effect of different salt concentration level (15%, 20%, and 25%) on the nutritive value of hydrocynus spp. (moisture, protein, fat, ash and the ph.). The result obtained was presented in Table 1.

Table 1 - The effect of salt concentration on the proximate composition of *hydrocynus spp.*

Parameters / Salt (%)	Moisture (%)	Protein (%)	Fat (%)	Ash (%)	PH
0	70.9 ±1.2^{a}	24.2 ±0.21^{a}	3.8 ±0.95^{a}	1.2 ±0.95^{a}	7.05± 0.95^{a}
15	60.3 ±0.77^{b}	21.7±0.49^{b}	3.4 ±0.35^{ab}	10.5 ±0.70^{b}	6.6 ±0.21^{b}
20	56.7 ±1.9^{c}	19.2 ±0.56^{c}	3.2 ±0.28^{b}	12.9 ±0.28^{c}	6.0 ±0.95^{c}
25	52.2±0.19^{d}	17.6 ±0.35^{d}	1.9 ±1.0^{c}	14.1 ±0.14^{d}	5.8 ±0.95^{c}
Significance	**	**	**	**	**

** = P<0.01

DISCUSSION

Proximate composition

The chemical composition of fish is an important aspect in fish processing as influences both the keeping quality and the technological characteristics of the fish. It is directly related to the moisture, protein, fat and ash contents of the muscle (Huss, 1988). These parameters were taken in consideration during the comparative study of nutritive value of fresh and salted fish products beside mineral contents. The data presented in Table 1 shows the proximate composition of raw fish and *Fassiekh*.

Moisture content

It's generally understood that microorganisms need water in an available form to grow in food products. The control of moisture content in foods is one of the oldest exploited preservation strategies. Food microbiologists generally describe the water requirements of microorganisms in terms of the water activity (aw) of the food or environment. Water activity is defined as the ratio of water vapor pressure of the food substrate to the vapor pressure of pure water at the same temperature (Jay, 2000).

The moisture content of raw fish in fresh basis was 70.9%, while *fassiekh* with different concentrations of salt (15%, 20%, and 25%) was 60.3%, 56.7%, 52.2% respectively. The fresh fish moisture content was agree with Remijo (1992) who found that the moisture content of fresh *Labeo spp.* fish was (70.4-71.2%), and lower than the result reported by Mohamed (2008)who found that the moisture content of fresh *hydrocynus spp* was (72.9- 74.4) and agree with Ahmed (2006) who found that the moisture content of fresh fassiekh fish species is (81.9-72.9).

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Salting treatment decreased significantly at (P<0.05)the moisture content of fish due to adding coarse salt Which results to be drawn out of the fish tissues causing slight dehydration (Clucas and Ward, 1996).

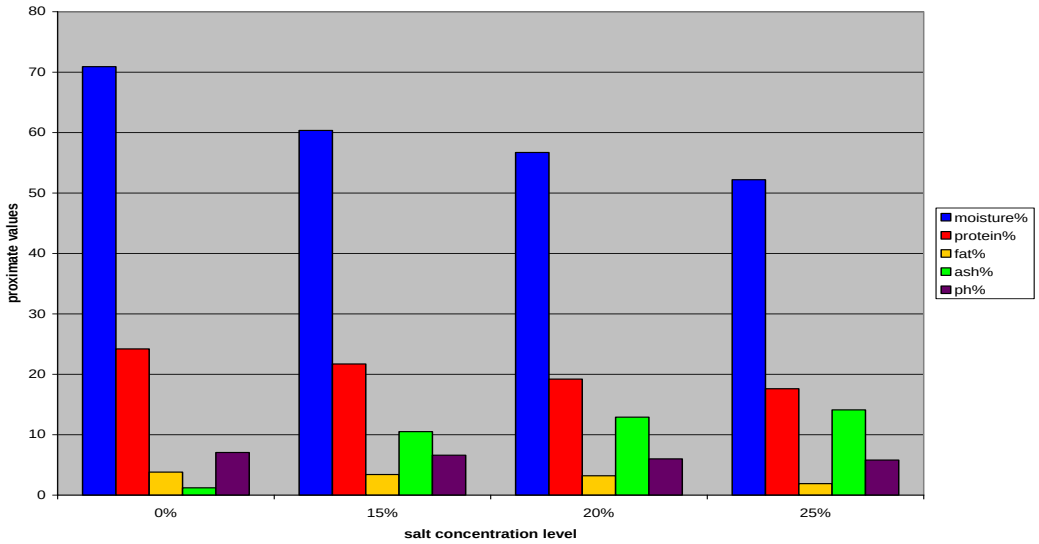

Figure 1 - The effect of different salt concentration on proximate Composition of *Hydrocynus spp.*

Protein content

With regard to the data shown in Table1 the protein content was 24.2 % in fresh fish, while in fassiekh salted with different percentages (15%, 20%, and 25%) was 21.7%, 19.2%, 17.6% respectively. This agrees with the findings of Clucas and Ward, 1996), who reported that flesh from healthy fish contained (15-24%) protein. This result agree with Ahmed (2006) who found that protein content of fresh and salted fish is as flows (20.5-18.9%) and (19.57-16.54%). And the result is not agree with Mohamed (2008) who found that adding of salt is result in increased the protein content of the fish .The decrease of protein level was found to be significantly, proportional to the salting treatment, (P<0.05), as this is due to the protein being dissolved in the brine, (Clucas and Ward, 1996).

Fat content

As illustrated in Table 1 it is clear that fat content of fresh fish was 3.8% while in salted fish (15%, 20%, 25%) was 3.4%, 3.2%, and 1.9%, respectively, the result of fat content in fresh fish is lower than the result reported by Mohamed (2008) who found that the fresh *hydrocynus spp* has 4.9% fat level. and lower than the result range (6.68%) which was given by Omer (1984) for dry *hydrocynus spp*. Also the result is higher than that presented by Ahmed (2006) who found that the fat content was (1.4-2.2%) and (1.62-0.88%) for fresh and salted fish respectively. There was significant difference in fat contents among different salt concentration level and the fresh fish, this variation might be due to loss of fat with excluded fluids with osmotic effect.

Ash content

The ash of fresh fish was (1.2%) and salted fish (15%, 20%, and 25%) under investigation was (10.5%, 12.9%, and 14.1%) respectively. The ash content of fresh and salted fish is on the normal range that recorded by Ahmed (2006) who reported that the ash contents was (1.1%-1.7%) on fresh fish and (10.21%-13.86%) on *fassiekh* using *Hydrocynus spp*. Also there was significant difference at (P<0.05) in ash content among different salt concentration level.

pH

The highest pH was found for fresh fish is (7.05), while fassiekh (15%, 20%, 25%) had the lowers pH value is (6.6, 6.0, and 5.8) respectively .This result is higher than that reported by (Riebroy, et *al* 2008), who found that the pH in Thai-fermented fish mince for fresh fish is (6.3), while fermented is (4.6). Jessen (1995) reported that LAB (*Lactobacillus or Pediococcus*) and *Micrococcaceae (Staphylococusi or Micrococcus)* are usually used for sausage fermentation. Inoculation with *lactobacilli* resulted in a rapid pH decrease. This result is in the normal ranges reported by Ahmed (2006), Agab and Shafie (1989), Eltom (1989).

CONCLUSIONS

We conclude from this study that: Due to the use of salt, the growth of pathogenic microorganisms was controlled. Adding of salt result in lowering the protein in the products. Thus the best salt percentage is considered to be 15% (by weight).

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Recommendations

More researches are needed in the field of the Sudanese fish preservation so as to overcome the problem of post–harvest losses, and to maximize the utilization of our rich fisheries resources. Future detailed studies concerning the improvement of the storage condition of the preserved fishery products are needed so as to increase the shelf life of the products. The serious need for scientific standards and specifications concerning fresh fish nutritive value and suitability of different preservation methods to different fish species according to their meat chemical composition, and the determination of the maximum storage time of the product to secure nutritional benefits and prevent food related problems.

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GROWTH PERFORMANCE OF COBB BROILERS GIVEN VARYING CONCENTRATIONS OF MALUNGGAY (*Moringa oleifera* Lam.) AQUEOUS LEAF EXTRACT

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ABSTRACT: *A study was conducted to determine the growth performance of Cobb broilers supplemented with varying concentrations of Moringa oleifera Aqueous Leaf Extract (MoALE) via the drinking water. A total of four hundred day-old chicks were randomly distributed into four treatment groups, replicated four times with twenty-five broilers per replicate. The growth performance of broilers was evaluated based on their feed consumption, live weight, feed conversion ratio (FCR) and return of investment (ROI). Results of the study showed that at 90 mL MoALE (T_3), the feed consumption of broilers was consistently lower than the control group (T_0) and this was statistically significant ($P<0.01$). The live weight of broilers given 30 mL (T_1), 60 mL (T_2) and 90 mL (T_3) MoALEs were significantly higher than the control group (T_0) and this was also statistically significant ($P<0.01$). In terms of feed conversion ratio (FCR), the MoALE treated broilers (T_1-T_3) were more efficient converter of feeds into meat than the control group (T_0) and this was statistically significant ($P<0.01$). Furthermore, the return of investment (ROI) of MoALE treated broilers (T_1-T_3) was significantly higher ($P<0.01$) than the control group (T_0) with a revenue per peso invested of Php 0.62 in T_1 and T_2, and Php 0.63 in T_3 compared to Php 0.50 in T_0.*

ORIGINAL ARTICLE

Key words: *Moringa oleifera, Broiler, Feed consumption, Live weight, Feed conversion ratio*

INTRODUCTION

Chicken industry is one of the most dynamic of world agribusiness trade. Hence, research on meat production globally indicates poultry as the fastest growing livestock sector especially in developing countries. Philippines is not exempted since the outlook for Philippine chicken industry appears optimistic because the demand for chicken products is expected to increase along with population and income growth of the country. However, Philippine broiler industry faces threats from cheaper imports as a result of its higher cost of production system (Chang, 2007).

The continuing survival and growth of Philippine broiler industry depends on its ability to compete globally, which is therefore dependent largely on the efficiency of its production system. As an alternative to the desire of improving economic status in poultry production, researchers revolutionized the application of feed and water additives by focusing on organic or natural supplements instead of using synthetic medicaments (Zeweil et al., 2006).

Synthetic growth enhancers and supplements in poultry nutrition are expensive, usually unavailable and possess adverse effects in bird and human. Sub-therapeutic levels of antibiotics given to poultry as growth enhancer may result to the development of antibiotic-resistant bacteria, which are hazardous to animal and human health.

Meanwhile, the use of organic supplements such as probiotics and herbs, are generally believed to be safer, healthier, and less subject to hazards. Thus, herbs and herbal products are incorporated in livestock feeds and water instead of synthetic products in order to stimulate or promote effective use of feed nutrients which result in more rapid gain, higher production and better feed efficiency. Moreover, herbs contain active substances that can improve digestion and metabolism and possess bacterial and immunostimulant activities (Ghazalah and Ali, 2008).

Malunggay (*Moringa oleifera* Lam.) is one of the herbs containing bioceutical agents that could substitute synthetic growth enhancers and supplements in broiler and other livestock production. Some of the published studies pertaining to its potential involved the study of Lannaon (2007). He reported that performance of Starbro broilers given with Malunggay (*M. oleifera*) leaf decoction, revealed the improvement of feed consumption, daily weight gain, final weight and profit compared to the control group. Furthermore, Du et al. (2007) evaluated the effects of dietary supplementation of *Moringa oleifera* on growth performance, blood characteristics and immune response of Arbor acres strain broilers. It was found out that increasing supplementation of *Moringa oleifera*

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decreases contents of uric acids, triglycerides and albumin/globulin ratio in the serum of broilers. Hence, immune response of broilers increases significantly. Yang et al. (2007) evaluated the effect of *Moringa oleifera* on the growth performance, immune function, and ileum microflora in broilers. Results showed that dehydrated leaves of *Moringa oleifera* when given in the diet, revealed significant enhancement of duodenum traits, increased *Lactobacillus* counts in ileum while reducing *E. coli* and enhancement of immune system in broilers were observed. Fuglie (2008) reported the study conducted by BIOMASA using *Moringa oleifera* as poultry feed, swine feed and cattle feed. Study showed that nutrient value of *M. oleifera* as poultry and swine feed could be further increased through addition of an enzyme phytase to break down phytates in the ration. This will result to increased utilization of some minerals and absorption of phosphorus found in *Moringa oleifera.* In addition, Price (1985) as cited by Davis (2000), reported that chicken will not voluntarily consume Moringa leaves and leaf powder when given as feed. However, processing the leaves will give twenty two percent protein content desired for chicken ration. A simple process reported was done by mixing the leaves with water and running the mixture through a hammer mill, then mashing it to 70^{0}C for 10 minutes. The proteins will then clump and settle in the bottom, ready for freeze drying. The dried products are incorporated to chicken ration. Moreover, Food and Agriculture Organization (1996) included *Moringa oleifera* as one of the protein substitutes derived from plants in the form of leaf meal for non-ruminant animals aside from *Leuceana leucocephala, Manihot esculenta, Trema orientalis, Morus indica and Sesbania rostrata.* These leaf meals are reported to be produced industrially and used widely in animal feed. In poultry and swine industry, these leaf meals are mainly used to supplement vitamins and trace minerals.

This study was proposed to determine the growth performance of Cobb broilers given varying concentrations of *M. oleifera* aqueous leaf extract through infusion process, where the bioactive compounds of plants are extracted without destroying it like what happen in decoction or boiling (Fernandez, 1990). The study aims to determine the weekly feed consumption, live weight and feed conversion ratio, and to find out the return of investment for one cropping of Cobb broilers supplemented with *Moringa oleifera* aqueous leaf extract (MoALE).

Results of the study could provide insights to pharmaceutical companies on developing organic supplements from plant source. Likewise, this could provide awareness to the broiler industry on the use of *M. oleifera* aqueous leaf extract via drinking water to improve growth performance of broilers.

MATERIALS AND METHODS

Broiler Management

Sixteen pens, with an area of twenty-five ft^2 each and can accommodate twenty-five broilers, were constructed at the CVM-Broiler Production Unit. The walls and floors of pens were disinfected with Lysol after washing with detergent and water. Litter materials made of old newspapers were used for the first two weeks of chicks. Clean and disinfected feeders and waterers were set in a place accessible to the birds. Each pen was properly labeled for easy identification of each treatment groups. In addition, a 25-watt electric bulb was placed at the center of each pen, one foot above the floor. The distance of the bulb was adjusted by pulling it away from the floor based on the response of chicks, weather condition and feather growth. The bulb was removed during the third week or when feathers are fully grown. In terms of feeding, booster mash was given during the first two weeks and full grower mash during third week. Full Finisher mash was given during fourth week of age or one week before the harvest of broilers. Feeds were given *ad libitum* and shifting from one form of feeds to another was done gradually to avoid digestive disorder. During feeding, a predetermined amount of feeds as well as the leftover has been weighed and recorded.

Malunggay Leaf Extraction

Mature leaves of Malunggay were selected and used in this experiment. The leaves were gathered in one area and were subjected to air-drying so that 20% of moisture was left. Air-dried mature green leaves of Malunggay were pounded using mortar and pestle prior to extraction. Infusion technique was applied in extracting bioactive substances present in Malunggay leaves. The leaves were soaked in distilled water for 24 hours using 1:2 ratio (weight/volume) (Fernandez, 1990). The preparation was then filtered to separate the debris and filtrate. The filtrate was processed in Rotary Evaporator (60^{0}C) until become concentrated into 20mL. The concentrated extract was placed in a sealed, clean container and then refrigerated (4^{0}C) until needed. The concentrated extract was diluted using distilled water (volume/volume) into 30mL/1000mL, 60mL/1000mL and 90mL/1000mL H_2O.

Experimental Design

The experiment was laid out in a Completely Randomized Design (CRD). There were 400 broilers randomly distributed into four treatment groups and were replicated four times, with 25 birds per replicate. Sexing was conducted on day 1, such that each treatment contained 50% male and 50% female samples of birds. Control group (T_0) was given with Dan Way Inc. Medication Program; T_1, T_2, and T_3 were treated with 30 ml, 60 ml and 90 ml of Malunggay aqueous leaf extract per 1000mL of water, respectively.

Statistical Design

The data on the feed consumption, actual live weight, feed conversion ratio and return of investment were analyzed using One-way Analysis of Variance (ANOVA). Significant differences among treatment means was analyzed using Tukey Honestly Significant Difference (Tukey HSD).

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RESULTS

MoALE (*Moringa Oleifera* Aqueous Leaf Extract)

There was an observable voluntary intake of broilers given their respective treatments of MoALE from day one to harvest. The physical characteristics of MoALE can be described as an extract with remarkable dark greenish brown color, slightly sticky in consistency, moderately bitter and a distinctive smell.

Feed Consumption (FC)

Results during harvest showed that feed consumption (FC) of T_1 (30 ml MoALE) and T_2 (60 ml MoALE) were higher than T_0 (control group) (Table 1). But the FC of T_0 was higher than T_3 (90 ml MoALE). The highest feed consumption was observed in Cobb broilers treated with 30 ml MoALE while the lowest FC was observed in broilers treated with 90mL MoALE.

Actual Live Weight (LW)

Results during harvest revealed that MoALE treated birds (T_1-T_3) have better LW than T_0 (Control group). But there was no significant difference observed among LWs of MoALE treated groups (T_1-T_3) (Table 1). The highest LW numerically was seen in 90 ml MoALE treated broilers.

Feed Conversion Ratio (FCR)

The feed conversion ratios (FCR) of MoALE treated birds (T_1-T_3) were better than T_0 (Control group). But there was no significant difference observed among FCRs of MoALE treated groups (T_1-T_3) (Table 1). The best FCR numerically was observed in broilers treated with 90 ml MoALE.

Table 1 - Weekly feed consumption, actual live weight and feed conversion ratio of Cobb broiler given with varying concentrations of MoALE (*Moringa oleifera* Aqeous Leaf Extract) from day 1 to harvest

Treatment Groups	Week	Feed Consumption	Actual Live Weight	Feed Conversion Ratio
T_0 (DWMP)	1	3650.00^{d}	4012.50^{a}	0.911^{b}
T_1 (30 ml MoALE)		3550.00^{b}	4100.00^{a}	0.866^{ab}
T_2 (60 ml MoALE)		3525.00^{a}	4200.00^{a}	0.8340^{a}
T_3 (90 ml MoALE)		3637.50^{c}	4225.00^{a}	0.861^{ab}
T_0 (DWMP)		12337.50^{b}	9725.00^{a}	1.269^{b}
T_1 (30 ml MoALE)	2	12450.00^{d}	10375.00^{b}	1.202^{ab}
T_2 (60 ml MoALE)		12300.00^{a}	10600.00^{b}	1.161^{a}
T_3 (90 ml MoALE)		12400.00^{c}	10562.50^{b}	1.174^{a}
T_0 (DWMP)		26025.00^{b}	18858.75^{a}	1.381^{b}
T_1 (30 ml MoALE)	3	26187.50^{d}	20650.00^{b}	1.269^{a}
T_2 (60 ml MoALE)		26100.00^{c}	20662.50^{b}	1.264^{a}
T_3 (90 ml MoALE)		25950.00^{a}	21738.50^{b}	1.194^{a}
T_0 (DWMP)		44900.00^{b}	29216.25^{a}	1.537^{b}
T_1 (30 ml MoALE)	4	45062.50^{d}	31217.50^{b}	1.444^{a}
T_2 (60 ml MoALE)		44975.00^{c}	31662.50^{b}	1.422^{a}
T_3 (90 ml MoALE)		44825.00^{a}	31445.00^{b}	1.426^{a}
T_0 (DWMP)	33rd	59900.00^{b}	39332.50^{a}	1.524^{b}
T_1 (30 ml MoALE)	Day	60062.50^{d}	42135.00^{b}	1.426^{a}
T_2 (60 ml MoALE)	(Harvest)	59975.00^{c}	41945.00^{b}	1.430^{a}
T_3 (90 ml MoALE)		59825.00^{a}	42420.00^{b}	1.412^{a}

Means with different letters are statistically significant ($P<0.01$)

DISCUSSION

On the average, the feed consumption (FC) of MoALE treated broilers decreases as the concentration given increases. This pattern could be due to the considerable amount of Vitamin C in MoALE, which is in agreement with Rajput et al. (2009) who reported the significant lower FC with broilers supplemented with Vitamin C. On the other hand, it appears that lower feed consumption did not affect the live weight (LW) of broilers though LW is dependent in FC. Thus, MoALE treated broilers are heavier compared to control. This could be attributed to complete amino acids, considerable amount of vitamins, minerals, antioxidants, immunostimulants and antibacterial compounds such as pterygospermin (Anwar et al., 2007; Fahey, 2005; Makkar and Becker, 1997). The complete nutritional components and some growth stimulating compounds of *Moringa oleifera* probably compensated to the enhancement of the live weight. In addition, the few amount of anti-nutritional factors that affect palatability of feeds (Kakengi et al., 2007) were not implicated to compromise the bioavailability of nutrients and growth stimulating compounds present in *Moringa oleifera* leaves (Foidl et al., 2001). Consequently, lower FC but higher

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LW resulted to better feed conversion ratio. This suggests that MoALE treated groups were efficient converter of feeds into meat. Thus, better return of investment was achieved by MoALE treated groups.

The crude extract of *Moringa oleifera* like other herbal drug may contain digestion enhancing properties and stimulates favorable growth of good bacteria while decreasing bad microorganisms. But the mechanism by which this herbal product influences the growth performance and gut microflora of poultry are poorly understood (Hernandez et al., 2004). Meanwhile, base on the result of the present study, MoALE could be a potential cheap source water supplement for broilers. However, further research is needed to validate the potential of MoALE as a substitute to synthetic supplements such as antibiotics in improving broiler production. Moreover, *Moringa oleifera* aqueous leaf extracts have a promising outcome to the broiler industry in terms of achieving optimum growth performance and better return of investment. Hence, results of the study will provide additional contribution to the dynamic researches on the effect of *Moringa oleifera* on the performance of broilers.

CONCLUSION

Based on the results of the study, the supplementation of 30 ml and 60 ml concentrations of *Moringa oleifera* aqueous leaf extract had improved feed consumption of Cobb broilers. Likewise, supplementation of 30 ml, 60 ml and 90 ml concentrations of *Moringa oleifera* aqueous leaf extract had improved the actual live weight, feed conversion ratio (FCR) and return of investment (ROI) of Cobb broilers. In general, *Moringa oleifera* aqueous leaf extract given via drinking water significantly improved growth performance of Cobb broilers, regardless of the concentrations given.

RECOMMENDATIONS

It is recommended to study the immune system and general performance of broilers artificially or naturally infected with a particular disease. Furthermore, it is recommended to conduct field trial on MoALE as supplement to commercial poultry.

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THE EVALUATION OF DRY SEASON NUTRITIVE VALUE OF DOMINANT AND IMPROVED GRASSES IN FALLOWS IN CHIVI DISTRICT, ZIMBABWE

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ABSTRACT: *Five dominant (Cynodon dactylon, Perotis patens, Digitaria eriantha, Brachiaria brizantha, Hypethelia dissoluta) and two improved grasses (Pennisetum purpureum and Cynodon nlemfluensis) were compared for their nutritive value in Chivi district in terms of crude protein(CP), ash, dry matter(DM), neutral detergent fibre (NDF) and acid detergent fibre (ADF). The proximate analysis procedure was used to assess CP, ash and DM while NDF and ADF were estimated using the Van Soest et al. procedure. Significant differences were observed in the nutritive value of improved and dominant grasses. Cynodon nlemfluensis (5.54% CP, 39.04% ADF and 59.11% NDF) and P. Purpureum (5.35% CP, 39.17% ADF and 56.80% NDF) had significantly higher CP values and lower ADF values in comparison with dominant grasses, C. dactylon (3.75% CP, 44.13%ADF and 66.00% NDF), D. eriantha (2.21% CP, 48.78% ADF and 69.04 % NDF), P patens (3.51% CP, 47.51% ADF and 70.31% NDF), B. brizantha (2.37% CP, 50.95% ADF and 67.00% NDF) and H. dissoluta (2.10% CP, 44.49% ADF and 67.24% NDF). In terms of CP content comparisons, improved grasses have the potential to increase the carrying capacity of the fallows. It was concluded that the improved species have high nutritive value compared to the dominant grasses therefore have the potential to improve forage quality in terms nutritive value in fallow fields in Chivi.*

Key words: *Dominant grasses; Improved grasses; Nutritive value*

ORIGINAL ARTICLE

INTRODUCTION

In communal areas in Zimbabwe cattle play an important role as they are a source of income, draught power and, and organic fertilizer. However, productivity per animal is very low, and the contribution of the livestock sector to communal livelihoods is much lower than the expected potential (Ngongoni et al., 2006). A major constraint to the livestock industry is the inadequacy of feed. Communal livestock production depends on natural pastures whose dry season quality is too low. The result is low growth rates, poor fertility and high mortality rates of livestock in communal areas (Ngongoni et al., 2007; Gwaze et al., 2009; Nqeno et al., 2011).

One way to achieve increased communal livestock production is through the introduction of high-quality forages. Such forages must be adapted to biotic and abiotic factors such as soil fertility, climatic conditions and resilience to continuous defoliation. The reinforcement of grass-legume species into indefinite fallows which, according to a study by Manzungu and Mtali (2011) form more than 50% of land which was under cultivation in the early eighties, in Chivi district, is one approach which have been successfully used in other countries (Mnene, 2006; Mganga, 2009), for improving quality of forage in communal areas.

Among the promising forage grass species promoted as suitable in the semiarid region of Zimbabwe in which Chivi district is located, *P. purpuruem* and *C. nlemfluensis* could play an important role in providing a significant amount of high quality forage to livestock (Jingura, 2000 and Mapiye et al., 2006). Bana grass (*P. purpuruem* variety schumm) is vigorous and highly productive forage, which can withstand long periods of drought (Mhere et al., 2002). Star grass (*C. nlemfluensis* variety robustus) is a spreading perennial with stout rapidly growing stolons. It is highly persistent and resilient. Although little or no growth takes place during the drought periods, the grass rapidly recovers with the onset of rains (Mapiye et al., 2006 and Taliaferro et al., 2004). However,

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it is essential to evaluate the nutritive potential of recommended reinforcement forages as a means of providing high quality (nutritive value) dry season feed supply for smallholder livestock production systems before promoting them. This can be achieved through conducting a comparative evaluation of the nutritive value of dominant and improved/introduced grass species to check if the nutritive value of the grasses identified for reinforcement is superior to that of the grasses dominant in communal areas under local conditions. Previous studies have given more importance to introduced/improved species than dominant vegetation without characterizing the seasonal dynamics in the nutritive value of the forages in communal areas where no fertilizer application is done at reinforcement due to affordability. Mapiye et al. (2006) recommended selection of improved grass species that retain their nutritive value for the major part of the dry season to ensure sustainable livestock production in Zimbabwe communal areas. The objective of the study was to compare the nutritive value of dominant grass species with those of *Pennisetum purpureum* and *Cynodon nlemfluensis* cultivated under inherent soil fertility.

MATERIALS AND METHODS

Study Site

The study was conducted in Ward 28, in Chivi district, which is located in south central Zimbabwe. The district extends from 20° 14' S to 20° 24' S and lies between 30° 13' E and 30° 57' E. The area receives low and unreliable rainfall ranging from 450-600mm (Mapanda and Muvengahama, 2011; Nemarundwe and Kozanayi, 2003) and is generally characterized by poor crop productivity and food insecurity (Mtali and Manzungu, 2011). Major soils in Chivi were derived from coarse-grained granite and include the chromic luvisols, ferric luvisols and eutric regosols (Anderson and Ingram, 1993).

Samples preparation

An open environment (in situ) pot experiment was used to grow two improved grasses, *C nlemfluensis* and *P purpureum* at the onset of the rain season. The soil used in the pots experiment was from the fallows where dominant grasses grew and collected from a depth of 20cm. Each grass species was replicated 15 times (15 pots per grass species). The grass species were harvested (whole plant) at 5cm above ground at the onset of the dry season for nutritive analysis. On the other hand, samples of five dominant grass species (*Cynodon dactylon, Perotis patens, Digitaria eriantha, Brachiaria brizantha* and *Hyperthelia dissoluta*) growing in fallows in Chivi district were also collected at onset of the dry season. Fifteen samples per species (whole plant) were cut at 5cm above ground using shears. All the samples were packaged in khaki bags and stored in a shade until transported to the University of Zimbabwe Animal Science laboratory for analysis. All the samples were oven dried at 60^{o}C for 72 hours and ground in a Willey Mill to pass through 1mm sieve. The ground samples were kept in airtight containers before they were subjected to analysis for nutritive value.

Analytical procedures for chemical composition

The AOAC (1990) method was used for proximate analysis of the samples. Fibre analyses (Neutral detergent fibre (NDF) and acid detergent fibre (ADF)) were done according to the procedure developed by Van Soest et al., (1991).

Statistical Analysis

A one-way analysis of variance (ANOVA) was used to test the effect of grass species on nutritive quality, using PROC GLM of Statistical Analysis Systems (SAS, 2004) in a completely randomized design (CRD). Mean separation was by Predicted error differences were used as a mean separation technique at 5% alpha error level. The model was as follows:

$Y = \mu + A_i + E_{ij}$

Where:

Y is herbage quality (ADF; NDF; CP; ash; DM)

μ is overall mean

A_i is effect of plant species on nutritive quality (i = 1; 2; 3; 4; 5; 6; 7)

E_{ij} is residual error

RESULTS

Table 1 presents data on chemical composition of dominant and improved grass species in fallows in Chivi district. Dry matter (DM) content of the five dominant grass species (*Cynodon dactylon, Perotis patens, Digitaria eriantha, Brachiaria brizantha* and *Hyperthelia dissoluta*) evaluated were higher ($P<0.05$) than DM content of the improved *P. purpureum* and *C. nlemfluensis* species. The highest DM content of 94.92% was observed in *C. dactylon* followed by *Perotis patens, Digitaria eriantha,* and *Hyperthelia dissoluta* which had very similar DM levels ($P>0.05$). For the improved species DM levels was 90.27% and 90.18% for *P. purpureum* and *C nlemfluensis* respectively, and these were not significantly different ($P > 0.05$).

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Ash values of *Cynodon dactylon* (7.39%), *Perotis patens* (8.27%), *Digitaria eriantha* (7.94%), and *Brachiaria brizantha* (7.07%) and the improved *C. nlemfluensis* (8.60%), were similar (P>0.05) but below ash content of *P purpureum* (P<0.05) which was 10.27%. The lowest ash values were observed in *Hyperthelia dissoluta* (4.40%)

There were no significant (P>0.05) differences in CP content of *C. nlemfluensis* (5.54%) and *P purpureum* (5.35%) which was significantly higher (P<0.05) than CP content observed in *Cynodon dactylon, Perotis patens, Digitaria eriantha, Brachiaria brizantha* and *Hyperthelia dissoluta* which were 3.75%, 3.51%, 2.21%, 2.37% and 2.10% respectively. Among the dominant grasses species the crude protein values of *H. dissoluta* and *D. eriantha* were similar (P>0.05) but lower (P<0.05) than those of *B brizantha*, *C. dactylon* and *P. patens*.

Chemical analysis for acid detergent fibre (ADF) indicated that *C. nlemfluensis* and *P. purpuruem* had similar (P> 0.05) ADF levels of 39.04% and 39.17% respectively. The ADF values were significantly lower (P < 0.05) than those of the dominant grass species. Among the dominant grass species, the highest ADF value was observed in *B.brizantha* (50.95%) and was significantly different (P< 0.05) to values observed in *D. eriantha* (48.78%) and *P. patens* (47.51%). *Cynodon dactylon* (44.13%) and *Hyperthelia dissoluta* (44.49%) had the lowest ADF values among the dominant grass species.

There were significant differences in neutral detergent fibre (NDF) between *C. nlemfluensis* and *P. purpuruem* (P<0.05), however, NDF values for the two grasses were significantly lower (P<0.05) than those of *P. patens, B. brizantha, H. dissoluta, C. dactylon* and *D. eriantha.*

Table 1 - Mean dry matter (DM), ash crude protein (CP), neutral detergent fibre (NDF) and acid detergent fibre (ADF) of native and improved forage species in fallows in Chivi district

Fallow age	DM	Ash	CP	ADF	NDF
B. brizantha	92.92^{c}	7.07^{b}	2.37^{c}	50.95^{a}	67.91^{b}
C. dactylon	94.92^{a}	7.39^{b}	3.75^{b}	44.13^{c}	66.00^{b}
D. eriantha	93.20^{b}	7.94^{b}	2.21^{d}	48.78^{b}	69.04^{ab}
H. dissoluta	93.20^{b}	4.40^{c}	2.10^{d}	44.49^{a}	67.24^{b}
P. patens	93.41^{b}	8.27^{b}	3.51^{b}	47.51^{b}	70.31^{a}
C nlemfluensis	90.27^{d}	8.60^{b}	5.54^{a}	39.04^{d}	59.11^{c}
P. purpureum	90.18^{d}	10.27^{a}	5.35^{a}	39.17^{d}	56.80^{d}
± SEM	0.51	0.32	0.10	0.64	0.57

^{abcd} Within column values with different superscripts differs significantly (P<0.05)

DISCUSSION

Crude protein content of the *C. dactylon, D. eriantha, P. patens, B. brizantha and H. dissoluta* and the introduced *P. purpureum* and *C. nlemfluensis* grass species ranged from 2.10% to 5.54%, a range within values observed by Mtali (2011) for the dominant species (1.76 % to 6.14%). Jingura (2000) recorded CP values of 8 % for *P. purpureum* in a trial conducted in Gokwe South, which is slightly above the value observed in the current study. Mapiye et al. (2006a) noted that early part of the dry season (May or June) nutritive value of improved grasses in Zimbabwe range from 1% to 5%. In the current study, improved *P. purpureum* and *C. nlemfluensis* species had the highest CP content of 5.54% and 5.35% respectively, compared to dominant grasses, which ranged between 2.10% to 3.75% therefore, the grasses have the potential to improve the quality of grazing in Chivi fallow lands. However, the observed CP values of *P. purpureum* and *C. nlemfluensis* were low and not comparable to some values reported in literature. Gwayumba et al. (2002) and Islam et al. (2003) reported higher CP value for *P. purpureum* (14%). The differences observed may be due mainly to influence of genotype and growth environment.

Factors such as differences in stage of growth, inherent soil fertility could have contributed to low CP values observed (Lukhele and van Ryssen, 2003). Influence in agronomic and genotype of forage species, difference in tolerance to soil quality characterising an area in which grasses grow also affect nutritive value of grasses. In this study, the CP content of both the dominant grasses and the improved grasses, which ranged between 2.10% to 5.54%, was lower than the levels recommended to meet the minimum requirements for growth (11.3%) and lactation 12.0% in ruminants (Agricultural Research Council, 1984).

Fibre fractions (ADF and NDF) are important as they describe those forage components that have low solubility in a specific solvent systems and are relatively less digestible than starch. ADF values of *C. dactylon, D. eriantha, P patens, B brizantha* and *H. dissoluta* were in similar range to result obtained by Mtali (2011). The ADF values of improved *P. purpureum* and *C. nlemfluensis* were similar to findings of Jingura (2000). Also the results obtained in the current study were within the range reported by Mapiye et al. (2006) who reported that fibre content of improved grasses range from 25%-30% in early growing season to around 50% in late growing season. The low values of ADF for *P. purpureum* (39.17%) and *C. nlemfluensis* (39.04%) compared to the dominant grass species (44.13% to 50.95%) indicates the superiority of the two improved grasses since detergent fibre fractions are negatively correlated to voluntary DM intake by cattle. The high ADF and NDF content noted in the dominant grasses reduce intake and digestibility of forages as illustrated by Van Soest (1995) who showed that ADF and NDF were negatively and significantly correlated to intake and digestibility of forages.

In terms of range improvement, the improved grasses have the potential to increase the current carrying capacity in fallows in Chivi district when compared to the assessed dominant grasses, as CP content in the

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improved grasses was double the level observed in most of the dominant grasses. This is especially so because cattle grazing *C. nlemfluensis* or *P. purpureum* require less quantities of forages per day to meet 7% and 12% for cattle maintenance and lactation requirements respectively compared to the dominant species studied.

CONCLUSION

The nutritive value (CP, ADF and NDF) of *P. purpureum* and *C. nlemfluensis* was significantly superior to that of the dominant grass species in Chivi district. It was thus concluded that *P. purpureum* and *C. nlemfluensis* have the potential to moderately improve the quality of grazing in fallows in Chivi district, which will increase the grazing capacity of fallows through decrease in quantity of forage, required to meet nutrient requirements for various physiological and production needs of cattle. Reinforcement of the fallows with P purpureum and C. nlefluensis is therefore recommended.

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OCCURRENCE OF *SALMONELLA SPP* FROM FRESH FISH (Tilapia Nilotica Linn) USING IMPROVED ISOLATION METHODS

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ABSTRACT: *Fresh fish (Tilapia Nilotica Linn) is a very important source of protein to the population in our country; this is of importance when other sources of animal protein are in short-supply. This freshwater fish may harbor salmonella spp. Which may be a source of pathogen to human hence, this study is important due to the public health implications. A total of 90 samples (30 whole freshwater fish, 30 intestines and 30 gills) were collected from different open market in Aba, South, Aba North and Osisioma Local Government Area all in Abia State, and examined. The objective of this study was to compare between non-pellet method and pellet method of isolation of salmonella spp. from different parts of freshwater fish. In this study, the pellet method was evaluated and compared with the non-pellet. Three selective agars used for the purpose of this study namely: Salmonella-shigella Agar (SSA) xylose Lysine Deoxycholate Agar (XLD) and Bismuth sulfite Agar (BSA). There was significance difference (P<0.05) with the pellet method on the 30 Tilapia sample. The frequency of occurrence in pellet method was 66.66%, 50.00% and 26.66% growth on SSA, XLD and BSA while non-pellet method presented occurrence of 33.33%, 23.33% and 13.30% for SSA, XLD and BSA respectively. It was observed that salmonella sp was found more on the whole body of Tilapia nilotica than the gill and intestine presenting 66.66%, 50.00% and 20.00% respectively. The result confirms that pellet method isolated higher number of salmonella sp than non – pellet method.*

Key words: *Tilapia nilotica, salmonella sp., Isolation, "pellet and non-pellet method"*

ORIGINAL ARTICLE

INTRODUCTION

Salmonella spp. is a pathogenic, nod shaped, gram negative pathogenic bacteria of water bodies in warm climate zones which pose a great risk on human health (Heinitz et al., 2000). Salmonella cause a wide range of human diseases such as enteric fever, bacteramia and gastroenteritis. Gastroenteritis has the greatest adverse effect on children's growth and development (Black et al., 1984). The majority of 1.3billion annual cases of salmonella cause human gastroenterities resulting from ingestion of contaminated food products such as undercooked beef, pork, eggs shell fish and fish (Esaki et al., 2004).

Thampuren et al. (2005) reported that the microbial quality of the tilapia indicated that all tissues were contaminated with salmonella and fecal coli form. Salmonella can be disseminated as a result of water currents, underground springs and rain runoff carrying contaminated material (Abdel-Monem et al., 1990). Human infections by these fish pathogen are usually through contact with infected fish while handing them, water or other constituents of fish life environment (Acha et al., 2003). This pathogenic organism has been isolated from freshwater fish such as Tilapia nilotica Linn (D'Aoust et al., 1992). Tilapia is an important aquaculture production for food supply. Since on a global scale, fish and fish products are the most important source of protein and it is estimated that more than 30% of fish for human consumption comes from aquaculture (Hastein et al., 2006). *Salmonella spp.* Infections can be life threatening, especially for the very young, the elderly, and for persons with impaired.

Systems (Morales et al., 2004) showed that the presence of *Listeria sp*. and *Salmonella sp*. from the external surface of tilapias were remarkable. It is clear that the contamination of *Salmonella sp.* with or without antimicrobial resistance become a food safety problem. Hence, it is very necessary to develop some alternative methods to isolate the bacteria. The aim of this study is to compare a pellet method to a non-pellet method of isolation of *salmonella sp.* from different part of tilapia fish (Tilapia nilotica Linn).

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MATERIAL AND METHOD

Sample

Tilapia nilotica Linn samples were obtained from three markets located in three different local government areas. The samples were obtained from July 2010 to January 2012. An average of 5 live fishes was bought and transported to Michael Okpara University of Agriculture, Veterinary Laboratory in well ventilated sterile plastic container within 4 hours. The Tilapia fish was thereafter examined.

Sample processing

With gloved hands and sterilized knife, the Tilapia fish was severed into parts (intestine, gill and whole body of the Tilapia fish). 20 grams of each part was grinded (stomacher 400) with 225ml Buffered Peptone Water (BPW) for 3min. pellet were obtained by centrifugation at 20^0C, 10,000 x g RPM, for 15minutes for fish sample. The pellet was then dissolved into 10ml of BPW and incubated at 37^0C for 24hr 1ml of BPW was later transferred onto salmonella enrichment Broth according to Rappaport and Vassiliadis (RV broth-Merck) and incubated at 42^0C for 24hrs.

The inoculum was later streaked onto *salmonella shigella Agar* (SSA Difco), Xylose-Lysine Deoxycholate (XLD Difico) and Bismuth sulfite Agar (BSA – Difco) and were incubated at 37^0C for 48hrs. In SSA *Salmonella spp.* were seen as white or yellow with black spot centrally, in XLD, *Salmonella spp.* grew as pink color with black centre while in BSA salmonella colony grew as grey black with metallic sheen color. Biochemical tests and Gram stain was carried out. These include. Oxidase, catalyze, phenol red, ducitol, indole, Simon's citrate, methyl-red-Voges Proskauer, motility tests. Others are serology using polyvalent H and somatic antigens as described in Bacteriological Analytical Manuel (FDA, 2007). The control was *Salmonella spp.* and *Esherichia Coli* obtain from Veterinary Microbiology Laboratory of Michael Okpara University of Agriculture, Umudike. Nigeria.

Statistical analysis

The experimental design used was that of factorial 3x2 to evaluate the effect of isolation method (chopped – pellet and chopped – non – pellet method) on SSA, XLD and BSA media for salmonella isolation. Random sampling which was repeated 4 times. The total sample run was 120 obtained from 3 different markets. 5 fish was used in each run. Turkey's test was carried out for multiple comparisons (Kirschner et al., 1999). Why analysis of variance. (ANOVA) was used to analyze the result obtained.

RESULT

This study showed that pellet methods presented 66.66% ($^{20}/_{30}$), 50.00% ($^{15}/_{30}$), 26.00% ($^{8}/_{30}$) of the whole fish sample on SSA, XLD and BSA respectively. The pellet method obtained higher isolates than non-pellet method.

Table 1 - Number of conformed *salmonella spp.* Isolated from Tilapia

Media	SSA		XLD		BSA	
Isolation method	Pellet	Non pellet	Pellet	Non pellet	Pellet	Non pellet
Intestine (N = 30)	6	4	2	4	0	0
Gills (N = 30)	12	4	8	6	4	2
Whole fish (N = 30)	20	10	15	07	08	4

Table 2 - The Number of conformed *Salmonella spp.* isolated from Tilapia in percentage

Media	SSA		XLD		BSA	
Isolation method	Pellet	Non pellet	Pellet	Non pellet	Pellet	Non pellet
Intestine (N = 30)	20.00%	13.30%	6.66%	13.30%	0.00%	0.00%
Gills (N = 30)	40.00%	13.30	26.66%	20.00%	13.30%	6.66%
Whole fish (N = 30)	66.66%	33.33%	50.00%	23.33%	26.00%	13.30%

SSA= (*Salmonella Shigella Agar*). XLD= (Xylose Lysine Deoxycholate Agar). BSA= (Bismuth Sulfite Agar).

Table 3 - The number of *Salmonella spp.* positive in Tilapia at different market

Sample	Aba South (Market) (n – 4)	Aba North (Market) (n – 4)	Osisioma (Market) (n – 4)
Intestine	$^{2}/_{4}$	$^{1}/_{4}$	$^{0}/_{4}$
Gills	$^{2}/_{4}$	$^{2}/_{4}$	$^{1}/_{4}$
Whole-fish	$^{4}/_{4}$	$^{3}/_{4}$	$^{2}/_{4}$

SSA (Salmonella shegella Agar), XLD (xylose lysine deoxycholate Agar), BSA (Bismuth Sulfite Agar)

The method of isolation and media used contributed to the effect of *Salmonella sp* significance. This proves that different media produce different results and performance. The result obtained of the intestine and whole body fish differ because of the sensitivity of different media that was used. From this study, SSA media was more

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sensitive than BSA. There was no significance difference between markets in the three Local Government Area as analyzed by ANOVA. This shows that the distribution of *Salmonella sp.* in the three market more about the same. Turkey's result shows all market were evident in the same subset. This means that occurrence of *Salmonella sp.* is similar when compared between market. *Salmonella spp.* was present in all parts of the Tilapia fish especially the whole body, gills and intestine represented by (66. %), (50%) and (26%) respectively.

DISCUSSION

In this study, larger number of isolates were obtained using the pellet method than the non pellet method of isolation. This was supported by (Kirschiner et al., 1999). He showed that the chance of isolating the bacteria cell by centrifugation is higher in pellet method than non – pellet method. The type of media used was seen to be significantly different for *Salmonella sp.* and this was reflected in the statistical analysis. The isolation of pathogenic bacteria from a sample requires the use of culture media. This is in agreement (Ruiz et al., 2004). In the above study, SSA gave more bacterial isolates than the other two XLD and BSA (Dutch et al., 1995). He reported that the sensitivity of SSA and BSA were 76.6% and 50.0% respectively. (Michael et al., 2003) showed that SSA presented better conditions for isolation of salmonella sp. colonies, hence eliminating the volume of false positives. As a result, the better selectivity of the media is responsible for the greater detection of *Salmonella sp:* majorly when streaked from a selective enrichment that eliminates overgrowth of competitors the method of isolation was largely responsible for the significant difference on *Salmonella sp.* isolated farm tilapia fish. This implies that the pellet method could equally serve as support method for non – pellet method as a standard method of US -FDA.

The pellet – methods presented an average range of 0 – 26.66% more sensitive in isolating compared to the non – pellet.

From this study, *Salmonella sp.* was found to contaminate different parts of the body. This was supported by the finding (Hatha et al., 1997). That these bacteria would exist on tilapia fish's skin, gills and intestine and the most potential reservoir of salmonella spp. was the intestine. Hence, it is highly recommended that cross – contamination of other tissue notably digestive tract during handling or preparation be avoided. The whole – body of tilapia fish recorded the highest incidence as found in Aba South Market (100%). This is important for future study in order to know the route of salmonella specie transmission from pond to the next food chain supply. Hence, the pellet method and making use of appropriate media (SSA) was used to obtain more salmonella isolates in tilapia fish.

CONCLUSION

The pellet method of salmonella isolation recorded a better performance than the non-pellet method. The study showed that salmonella was more on the whole body of fish than the gills and intestine. *Salmonella shigella agar* proved to be a better selective media than the other the other two media.

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NUTRITIVE EVALUATION OF TWO FLOOD GRASSES IN WHITE NILE – SUDAN

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ABSTRACT: *Flood grasses (Echinochloa stagnina and Echinochloa pyramidalis) were evaluated as animal feed in term of chemical composition and in vitro digestibility. Crude protein (CP) content was significantly (P < 0.05) higher in Echinochloa stagnina (9.7%) than in Echinochloa pyramidalis (6.5%). Acid-detergent fibre (ADF) (51.6%), Nitrogen-free extractive (NFE) (31.4), Neutral-detergent fibre (NDF) (69.8) and Ether extract (EE) (0.69) in Echinochloa stagnina were lower than in Echinochloa pyramidalis (55.7%, 35%, 73%, 0.95%) for ADF, NFE, NDF and EE respectively. Sodium (Na) content (0.7%) was significantly (P > 0.05) higher in Echinochloa pyramidalis than in Echinochloa stagnina (0.3%) and Calcium (Ca), Phosphorus (P), Potassium (K) and Magnesium (Mg) were (0.30% and 0.40), (0.60% and 0.60%), (1.60% and 1.70%) and (0.20% and 0.40%) in Echinochloa stagnina and Echinochloa pyramidalis respectively. In vitro dry matter digestibility (IVDMD) of Echinochloa stagnina (63%) was significantly (P > 0.05) higher than in Echinochloa pyramidalis (56%) as well as the values of Digestible acid-detergent fibre (DADF) (69.8%: 54%), Digestible neutral-detergent fibre (DNDF) (71%: 58.5%), and Digestible crude fibre (DCF) (38.3%: 33%). From obtained results it can be concluded that the two species of Echinochloa contribute most of livestock nutrients requirement. Further research required to improve their nutritional value, digestibility and feed intake.*

Key words: *Flood grass, Echinochloa stagnina, Echinochloa pyramidalis, Animal nutrition*

ORIGINAL ARTICLE

INTRODUCTION

Rangelands in Sudan occupy an area of 110 million hectares and provide about 62 million ton of feed for livestock, varied from open grassland to seasonal water courses, flood plains, river bank and associated island wood lands, hills and mountain slopes Harrison and Jackson (1958) and Wickens (1991).

River sides in Sudan, flood region and seasonal water land are rich with many types of grasses. According to Abusuwar (2007), river sides and seasonal swamps grasses with permanent moisture are mainly of the genus *Echinochloa* including the species: *echinochloa stagnina* (burdi) and *echinochloa pyramidalis* (Om fola), therefore its evergreen and supplies animals with green forages.

Vegetation in the flood region, 14% of the country, is associated with *Echinochloa pyramidalis* and *Echinochloa stagnin*a Sutcliffe (1974) and Petersen (2007). The major food items selected by herbivores in Dinder National Park Sudan were echinochloa sp Abdel Hameed (1985).

These wild grasses may grazed directly in dry season or purchased from market in nearby towns. Its consumed by all domestic animal species especially donkeys which contribute significantly to economic and social development in towns and rural communities in Sudan; where they were used mainly for transport , riding , pack transport and as draught animal for pulling carts.

Serious problem of feed shortage in Sudan especially green fodder will constrain animal production particularly in dry summer and this will incite to seek for easy and available substitutes. Accordingly to estimate feed resources for animals, this study aimed to evaluate *Echinochloa* species which is considered as a part of a solution for forages shortage in dry summer.

MATERIALS AND METHODS

Samples of *Echinochloa stagnina* and *Echinochloa pyramidalis* were cut and collected from banks of White Nile River near Kosti city in Sudan from area equal approximately one kilometer in December 2009.

Samples were dried and kept for further analysis. Chemical analysis for organic matter (OM), crude protein (CP), crude fiber (CF), nitrogen-free extractive (NFE), ether extract (EE) , total ash, sodium and potassium contents of

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the two samples were carried out according to A.O.A.C. (1990). Neutral detergent fiber (NDF), acid detergent fiber (ADF) and ADL were determined according to Van Soest et al (1991) Cellulose and hemicelluloses were then calculated.

Calcium (Ca) and magnesium (Mg) determination was carried out according to the method of Chapman and Pratt (1961). Total phosphorus was determined according to the method described by Hanson (1973) using spectrophotometer.

Dry matter digestibility of the samples was determined using the procedure 'tow-stage *in vitro'* described by Tilly and Terry (1963). Residues remained were analyzed in the term of (ADF) (NDF), (CP), and (CF) to determine their digestibility.

Metabolizable energy values were calculated from chemical composition according to the following equation adopted by Ellis (1981). ME (MJ/Kg DM) = 0.012 CP + 0.031 EE + 0.005 CF + 0.014 NFE Where: CP (Crude Protein), EE (Ether Extract), CF (Crude fiber), NFE (Nitrogen-free extractive).

Statistical analysis: Data were analyzed by a Student's t test Snedecor and Cochran (1980).

RESULTS AND DISCUSSION

Chemical composition of *Echinochloa stagnina* and *Echinochloa pyramidalis* are shown in (Table 1). CP content in *Echinochloa pyramidalis* (9.7%) was almost higher than in *Echinochloa pyramidalis* (6.5%) and both of them were within the range of crude protein content in grasses that reported by Bogdan (1977) and McDonald et al (2002). Similar to the results of crude protein content were informed by Gohl (1981) who reported 11.3% in *Echinochloa stagnina* and 7% *Echinochloa pyramidalis*. CP content of tropical grasses falls below 6-8 percent, appetite will be depressed by CP deficiency. Animal and grazing cattle required a diet of 10 percent CP on dry matter basis and mature cattle required 7% CP for maintenance (Skerman and Riverose 1990). Therefore CP in both *Echinochloa stagnina* and *Echinochloa pyramidalis* will influence animal appetite. And they may provide grazing cattle with maintenance requirement only.

Table 1 - Chemical composition% of *Echinochloa stagnina* and *Echinochloa pyramidalis*

	E. stagnina	*E. pyramidalis*	SEM	Level of significance
Ash	11.4	10.8	0.01	NS
CP	9.7	6.5	0.04	*
CF	37.9	37	0.001	NS
NFE	31.4	35	0.07	*
EE	0.7	0.95	0.03	*
NDF	69.8	73	0.02	NS
ADF	51.6	55.7	2.1	*
Cellulose	29	31.6	2.13	NS
Hemicelluloses	18	17	2.1	NS
Lignin	11.8	9.6	0.03	*

SEM= Standard error of means, * = P<0.05 , NS = not significant

CP requirements of donkeys are low; falling between 3-8% of the diet (Eduardo valdes, 2007). Hence *Echinochloa* species would adequate donkey's performance. Crude fibre content in *Echinochloa stagnina* (38%) was not differ much than in *Echinochloa pyramidalis* (37%) and both of them were within the range of crude fibre content of grasses mentioned by Bogdan (1977) who found 22 to 46% and McDonald et al (2002) who reported 20 to 45%. While Gohl (1981) found lower values of crude fibre content in *Echinochloa stagnina* 32.5% and *Echinochloa pyramidalis* 31.4%, this may attributed to stage of growth.

ADF (51.6%), NFE (31.4%), NDF (69.8%) and EE (0.7%) in *Echinochloa stagnina* were significantly (P < 0.05) lower than in *Echinochloa pyramidalis* (55.6%, 35%, 73%, 0.95%) respectively. Cellulose and Hemi cellulose showed no differ in two species and the results were in consistent with the range mentioned by McDonald et al (2002) who reported 20 to 30% cellulose and 10 to 30% hemicelluloses.

Major mineral contents of *Echinochloa stagnina* and *Echinochloa pyramidalis* are shown in (Table 2). Phosphorus (0.60%), potassium (1.60%), calcium (0.30%) and magnesium (0.30%) content in *Echinochloa stagnina* were more or similar to that in *Echinochloa pyramidalis* (0.60%, 1.70%, 0.40%, and 0.40%) while sodium content was higher significantly (P < 0.05) in *pyramidalis* (0.70%) than in *stagnina* species (0.20%).

Table 2 - Major mineral composition and silica % of *Echinochloa stagnina* and *Echinochloa stagnina*

	P	K	Ca	Mg	Na	Silica
Echinochloa stagnina	0.60	1.60	0.30	0.30	0.20	10.8
Echinochloa pyramidalis	0.60	1.70	0.40	0.40	0.70	14.5
SEM ±	0.01	0.1	0.05	0.03	0.6	1.5
Level of significance	NS	NS	NS	NS	*	*

SEM= Standard error of means, * = P < 0.05 , NS = not significant

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These results were agreed with mineral range content of tropical grasses reported by Skerman and Riverose (1990). Major mineral content in *Echinochloa stagnina* and *Echinochloa pyramidalis* were meet requirement of dairy cow, beef cattle, growing and finishing steers and heifers which adopted by Reid and Jung (1974) and by Cohen (1980).

IVDMD, DNDF, DADF and DCF in *Echinochloa stagnina* were 63%, 71%, 69.8% and 38.3% respectively (Table 3). These were significantly ($P < 0.05$) higher compared with 56%, 58.5%, 54% and 33% in *Echinochloa pyramidalis* and this may be due to the high indigestible component of silica founded in *pyramidalis* (14.5%) which was significantly ($P < 0.05$) higher compared with (10.8%) in *stagnina* species.

These results were compared favourably with the range of DMD reported by Skerman and Riveros (1990) who found range from 30 to 75% and Crowder and Cheda (1982) who reported up to 80% for DCP and reported high range, from 50 to 70% for DCF in many grasses.

Feed with less than 50% DM digestibility failed to meet the requirement of cattle Coppock et al. (1987) and Salih (1986). Hence, *Echinochloa stagnina* and *Echinochloa pyramidalis* were capable to meet cattle nutrient requirement in term of DM digestibility.

Table 3 - Apparent digestibility (%) of MD, CP, CF, NDF and ADF and ME (MJ/KgDM) of *Echinochloa stagnina* and *Echinochloa stagnina*

	IVDMD	DCP	DCF	DNDF	DADF	ME (MJ/Kg DM)
Echinochloa stagnina	63	79.8	38.3	71.0	69.8	7.7
Echinochloa pyramidalis	56	81.6	33	58.5	54	7.8
SEM	1.7	2.14	1.8	2.18	1.9	0.002
Level of significance	*	NS	*	*	*	NS

SEM= Standard error of means, * = $P < 0.05$, NS = not significant

CONCLUSIONS

River banks in the Sudan, flood plains and seasonal water courses are rich with the fodder of *Echinochloa* species. Species of *Echinochloa* were adequately able to meet most of livestock nutrients requirements. Further research required to improve their nutritional value, digestibility and feed intake. It would be also interesting to evaluate it's anti nutritional and anti-herbaceous factors.

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SEROPREVALENCE AND ISOLATION OF CHICKEN INFECTED WITH SALMONELLA HAEMATOLOGICAL AND PATHOGICAL EVALUATION

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ABSTRACT: *The research was conducted to study seroprevalence of bird infected with salmonella and to evaluate the pathology of the affected cockerel chicken in Abia and Umudike both in Aba north and Ikwuano local government area of Abia State, as well as isolate salmonella. This study was carried out from February to June, 2010. Samples used were blood cloaca and liver swabs. Other organs like intestine, ovary, spleen and lungs were also used. The serum plate agglutination method was used. Others are gross, histopathology, morphological, cultural and biochemical tests. The total percentage of seroprevalence was 45.0%. Gross lesion showed congestion, enlargement of the liver and petechial hemorrhages in the intestine. Hematological features showed that there were decreased red blood cells on hemoglobin while the white blood cells increased. And there was no significance difference. (P<0.05). At history, congestion, massive lymphocytes infiltrates in the liver paranchyma. The sum of 54 seropositive salmonella samples from birds were isolated. Further study would also be carried out to investigate the pathogenesis, serotyping and sensitivity test.*

ORIGINAL ARTICLE

Key words: *Isolation and Seroprevalence, chicken, salmonella, heamatology, histology*

INTRODUCTION

Salmonella is one of the major beneficial agents that cause food borne infection in human worldwide (Herickstad et al., 2002). In studies that have examined the prevalence of salmonella on chicken farms, there has also been large interstock variability. The percentage of salmonella positive birds and feaces samples on farms has ranged from 5 – 100% (Carriminana et al., 1997).

Infections with bacteria of the genus salmonella are responsible for a variety of acute and chronic absence of poultry has been reported (Bhattacherjee et al., 1996). With great expansion of poultry rearing and farming, pollurum disease and fowl typhoid have become wide spread problem in (Rahman et al., 1979).

Salmonella is often attributed to the consumption of contaminated food, such as poultry, eggs and fresh produce. Direct contact with infected animals may also serve as a source of salmonella infection as (Tauxe, 1991; Beneson et al., 1995). The shift towards global economy, microbial adaptation, changes in travel and commerce, and lack of knowledge on food safety and handling practices among consumers (Knabel, 1995; Alternese et al., 1997) has contributed to the dynamics of salmonella infection. The study is aimed at evaluating the seroprevalence, heamatological and pathological effect of chicken infected with salmonella and its isolation.

Clinical observation and blood samples were obtained at varying days, after inoculation and red blood cell (RBC), white blood cells (WBC), haemoglobin (HB) and phagocytosis were determined as described Todovora (1987) and Kokosharove (1998).

MATERIAL AND METHODS

This study was conducted in department of veterinary microbiology and parasitology, Michael Okpara University of Agriculture, Umudike, Abia State, Nigeria. Samples were obtained from poultry farms located in Aba and Umudike respectively from February to June, 2010.

Sample Collection and Processing

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Samples were collected from cockerel from different farms. The farms had no history of being vaccinated for salmonella. However, they were still screen for salmonella. The samples were collected from birds of varying ages; starter (3 – 6 wks), grower (10 – 16wks), and adult cock (18 – 40wks). Aseptically, 1ml of blood was collected from the jugular vein using 23 gauge needle. The sera were later separated by centrifugation at 1000 rpm for 5 minutes.

Serm Plate Agglutination Test

All isolates were serologically confirmed using commercially available anti-sera Kit (Remel Europe Ltd. UK), specific for all group and type factor antigens. Isolates were sub-cultured on salmonella overnight, serological evaluations were carried out by slide agglutination test. (El-Geridy et al., 1999). The anti sera kit contains salmonella polyvalent O (A-G), salmonella polyvalent O (A-S) and salmonella polyvalent O (A-S) and salmonella polyvalent 09 (A-H). Antigen 0.02ml was pieced on ceramic tiles and 0.02ml of chicken sera was placed on it with the aid of micropipette and mixed properly followed by rocking. Dumping on mixing indicates positive result.

Isolation and Identification of Salmonella

One hundred faecal samples (from the cloaca) were collected using sterile swab sticks. The method of Ewings (1986) was adopted. The culture swab sample was inoculated into selenite -F- and incubated at 37^0C for 24 hours and then plated on salmonella-Shegella agar (SSA) and Triple Sugar iron (TSI) agar to get a pure culture. This was later incubated overnight. The presence of (white or yellow) colony with black centered spot was observed.

Biochemical Test

Besides Gram's stain described by merchant and Packer (1967) other rest carried out were indole test, voges proskuaer (VP) test, methy red test (MR), TSI, agar slant reaction and sugar fermentation test according to (OIE, 2004).

Experimental Chicken

Firstly, the feacal samples of fourteen birds of four weeks old were screened for the presence of salmonella and those found to be negative were grouped into A and B. Group B was infected with salmonella while Group A was the control.

Exactly 0.2ml of 3.3 x 10^8 efu/ml of the salmonella was infected orally to the crop of the chicken with the aid of catheter and monitored for 21 days – (3 weeks). The birds were fed with Animal poultry feed adequately. Blood samples 1ml was collected from the jugular vein using 23 gauge needle at 1, 2, 3, 4, 7, 14 and 21 days after infection (Kokosharov, 1998). The birds were later sacrificed while the control was screened.

Estimation of Haemoglobin (Hb), Red Blood Cell (RBB) White Blood Cell (WBC) of Chicken

HB estimation was determined by adding phosphate buffer saline to the 20mark sahlis apparatus followed by addition of blood sample with pipette. The tube was typed intermittently while distill water was added drop by drop until it assume the consistency recorded. The experiment was repeated thrice. Red blood cell and white blood cell were determined using Neubaur hemocymeter counting chamber (Westhpal et al., 1952). The cover was well fixed to the counting chamber hemocymeter such that there is perfect bridging of the middle line. The suspension was prepared by adding 20ml of chicken of blood with pipette to 4ml of the already prepared red blood cell diluting fluid and 0.4ml white blood cell diluting fluid. A drop of the solution was applied to the tip against the edge of the cover slip. Caution was taken to avoid the fluid from over-flowing into the channels. Focus the objective onto each four corner square and count all the cells contained in them. The WBC and RBC were differently counted and recorded.

Historical examination of infected chickens

The infected birds were sacrificed using surgical blade and forceps and the intestine, liver and lungs tissue were preserved in 10% formalin for histological examination. Each sample was appropriately placed in sample bottle and labeled. The tissues were trimmed, washed, processed in ascending grades of alcohol, cleared in chloroform, embedded in paraffin, sectioned using a microtome and stained with hematoxylin and eosin (Luna, 1968). Photomicrography was taken using photomicrograhic camera (Olympus Pm –C35 model).

Statistical Analysis

All the results were expressed as means of three parallel determinations and the statistical significance was assessed by analysis of variance. The significance was expressed as ($P < 0.05$).

RESULTS AND DISCUSSION

It was found that salmonella increased with the increase of age of birds, table 1. This findings was supported by Sikder et al, (2005) and Young and Teiuquang (2003). A total of 16 isolates (28.5%) was found from 56 seropositive birds and 3 isolates (6.6%) was found from 44 seronegative birds as reflected in Table 2. The isolation rate of seronegative birds was lower than that of seropositve. This finding was also reported Hoque et al, (1996). The birds infected with isolate infection showed that WBC of infected differ significantly from the uninfected

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controls (P<0.05). However, from day 14 to 21 WBC decreased significantly (P<0.05) compared to control. WBC of uninfected was significantly (P<0.05) than that of infected birds on day 1 with mean WBC of 2.18 ±0.06 and 2.22± 0.25 respectively. There was s decrease in the red blood cell from 3.42 ± 0.24 in day 1 to 1.06 ± 0.18 in day 7, as well as heamoglobin from 9.32 ± 0.32 in day 1 to 5.86 ± in day 7. This could be attributed to the infective salmonella which destroys the red blood cell and heamoglobin. The white blood cell increased progressively up to day 7 and the reason is to fight the infective organism, similar report was presented by Kokosharov (1998).

Table 1 - Seroprevalence of chicken infected Salmonella of different ages

Group	No. of Sample Tested	No. of Sample Seropositive	Percentage Seropositive
Starter (3 - wks)	16	2	12.5%
Grower (10 - wks)	34	8	20.6%
Adult (18 - wks)	70	44	62.8%
TOTAL	120	54	45.0%

Table 2 - Relationship between Salmonella Isolate in percentage and Seroprevalence

Agglutination Test	Feacal Swab	Salmonella Isolated
Seropositive	56	16 (28.5%)
Seronegative	44	3 (6.6%)
TOTAL	100	19 (35.1%)

Table 3 - Red and white blood cells of birds orally infected with Salmonella Organism

Parameter	Control	Day after infection						
	0	1	2	3	4	7	14	21
WBC	2.18±0.60	2.22±0.25	2.4±1.0	2.86±1.8	5.42±1.8	5.42±0.10	2.12±0.42	1.86±0.14
RBC	3.64±0.11	3.42±0.24	2.88±.22	2.74±.20	1.66±0.18	1.66±0.18	2.04±1.4	1.66±0.16
HB	9.52±0.42	9.32±0.32	8.98±.54	8.26±.58	6.28±.60	5.86±0.56	5.80±0.54	5.86±0.56
Bandnuclei	2.86	3.16	4.80	4.82	7.12	8.20	9.32	6.82
Lymphocytes	73.10	66.40	58.84	56.40	54.10	56.00	55.00	70.00

Values were calculated from seven individual birds per group and expressed as mean ± SEM. Difference (P<0.05) from control and post infected treated groups. Wbc = White blood cell. Rbc=Red blood cell. Hb=Hemoglobin concentration

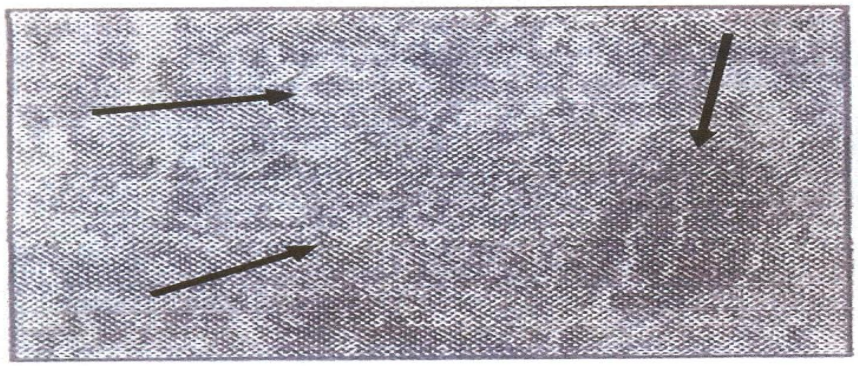

Plate 1. Histopathology of Salmonella sp. infected liver showing congested blood vessels, infiltration of lymphocytes, heterophils around the blood vessel.

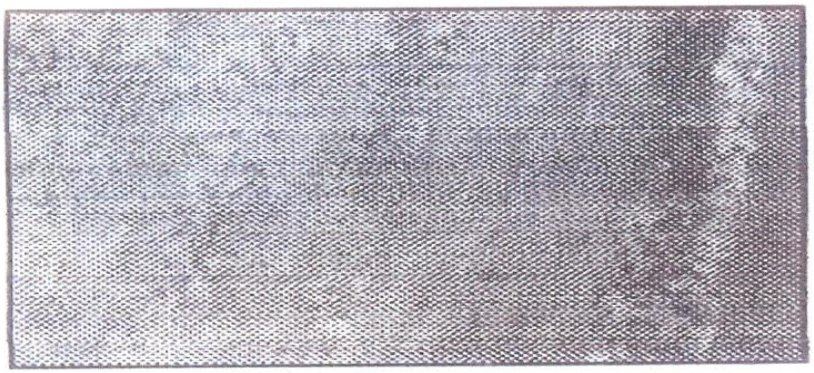

Plate 2: Histopathology of normal liver of a chicken

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Plate 3: The Lesions in the ovary of salmonella infected bird (Pullorum Diesease)

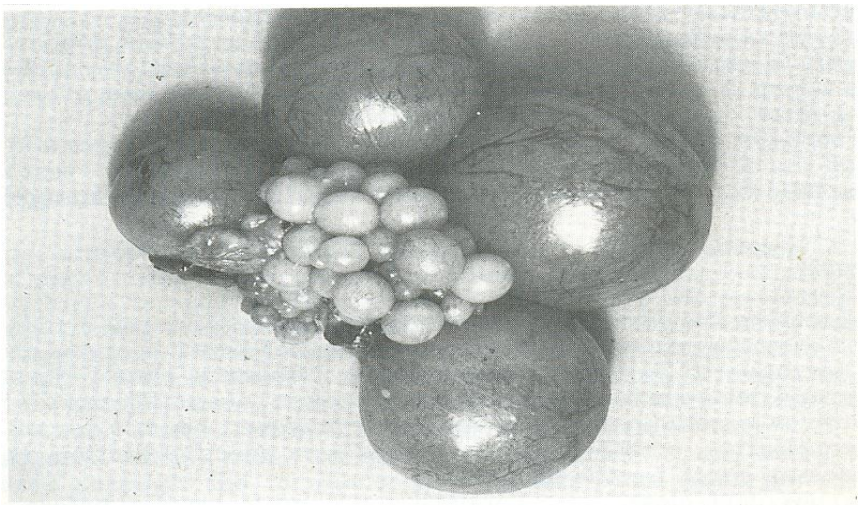

Plate 4. Normal ovary of birds

Similarly, there was a decrease in the lymophocytes from day 1 to 7. The noticeable increase in the white blood cell from day 14 to 21 is suggestive of the inability of the white blood cell to overcome the infective salmonella. The red blood cell, heamoglobin level and hymphocytes of post infection varied. The red blood cell and heamoglobin showed marked progressive decrease as low as 1.66 and 5.86 respectively. The analysis of variance showed no significance difference ($P<0.05$).

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NUTRITIVE VALUE OF MAIZE (*Zea Mays*) AND DOLECOUS (*Lablab Purpureus*) AS AFFECTED BY PHOSPHOROUS FERTILIZATION AND INTERCROPPING

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ABSTRACT: *A field experiment was conducted at the Demonstration Farm of University of Khartoum to determine the effect of phosphorous fertilization and intercropping on the nutritive value of* Zea mays *and Lablab purpureus. The field experiment was arranged as Split Plot Design with four replications. The main plots were (Lablab purpureus as sole crop,* Zea mays *as sole crop, Lablab purpureus and* Zea mays in the *mixture). The sub plot treatments were phosphorous fertilization at the rate of (0, 50 and 75 kg P_2O_5 / ha) which were then referred to as P_0, P_1 and P_2 respectively. The plants measured were Lablab purepureus as pure stand, Lablab purepureus in the mixture, Zea mays as the pure stand and the Zea mays in the mixture. Samples of 45 days cut from sowing were used to assess the ash, crude protein (CP), ether extracts (EE), crude fiber (CF), neutral detergent fibre (NDF) and dry matter digestibility. The data were statistically analyzed using complete randomized design. The results revealed that intercropping and phosphorous fertilization caused a significant (P<0.05) increased on the CP content and dry matter digestibility of all forages under estimation. Intercropping and phosphorous fertilization caused slight increase on the Ash content for all crops in this study. Moreover, Intercropping and phosphorous fertilization caused a decrease on the CF and NDF content of all forages under estimation but with no significant difference. However, Intercropping caused non–significant effect (P<0.05) on the EE content of* Zea mays *while, intercropping had a positive influence (P<0.05) on the EE content of Lablab purpureus. The data obtained indicated that phosphorous fertilization caused non–significant effect on the EE content of all crops in this study (P<0.05) except Lablab purpureus in the mixture with Zea mays which increased significantly (P<0.05) by increasing phosphorous level. It can be concluded that intercropping and phosphorous fertilization improved the nutritive value of both maize and lablab bean.*

Key words: *Nutritive Value, Digestibility, Forage Corn, Dolecous, Intercropping, Phosphorous Fertilization*

ORIGINAL ARTICLE

INTRODUCTION

The nutritive value of the tropical grasses and legumes is characterized by low quality in term of crude protein and digestibility. Around cities in the Sudan milk and meat production depends on crossbred animals which require high quality feed for maximum production potential. The major problems faced the producers is how to supplement their animals with protein source which is very expensive. So the improvement of these tropical grasses is one of most important issue so as to provide livestock with an affordable source of protein. Recently intercropping grasses with legumes gained an increasing interest in an attempt to substantiate functionalable biodiversity agricultural production (Baumann, 2004), through improving soil fertility and hence plant quality. Moreover, a unique approach in enhancing plant quality and quantity is through integration of fertilization program. The objective of the current study is to examine the effect of intercropping and phosphorous fertilization on nutritive value of maize and lablab bean.

MATERIAL AND METHODS

Site of the study

The study was conducted at the University of Khartoum Demonstration Farm of the Faculty of Agriculture at Shambat, Khartoum North, Sudan.

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Land preparation

The treatment(s) were arranged in split plot design with four replications. The main plots were (*Lablab purpureus* as sole crop, *Zea mays* as sole crop, *Lablab purpureus* mixture, *Zea mays* mixture), while the sub plot treatments were phosphorous fertilization. The application of super phosphate was in the levels of 0, 50 and 75 kg P_2O_5 / ha., which were denoted as P_0, P_1 and P_2 respectively.

Chemical analysis

Proximate analysis: Samples of 45 days cut from sowing were analyzed, for determination of crude protein, (CP), ether extract (EE), crude fibre (CF) and ash (AOAC, 1980). Neutral detergent fiber (NDF) was determined using procedures of Van Soest et al. (1991).

***In vitro* digestibility:** *In vitro* DM digestibility of samples was determined using methods of Tilly and Terry (1963). Rumen fluid was collected from local breed calves at the morning before feeding.

Statistical Analysis

The data collected were subjected to analysis of variance (ANOVA) using statistical analysis system, followed by Duncan's multiple range test and differences were considered significant at $P<0.05$.

RESULTS

Table 1 shows the effect of intercropping on the nutritive values of *Lablab purepureus* as pure stand, *Lablab purepureus* in the mixture, *Zea mays* in the pure stand and *Zea mays* in the mixture. The data showed that intercropping for both maize and lablab bean improved significantly ($P<0.05$) the CP, ash and EE content and DM digestibility with slight decrease in CF and NDF. Table 2 illustrates the effect of phosphorous fertilization on the nutritive values of *Lablab purpureus.* CP content and DM digestibility were found to be positively affected by phosphorous fertilization ($P<0.05$). The rank was found to be as follows $P_2 > P_1 > P_0$ for both in pure stand and the mixture.

In respect to the effect of phosphorous fertilization on the CF content and the NDF content for *Lablab purpureus* in the pure stand and the mixture, there were non-significant differences ($P>0.05$) among all phosphorus levels, with the least value attained for the plots applied with P_2 level of fertilization.

Table 1 - Effect of intercropping on chemical composition (%) and *in vitro* DM Digestibility of *Lablab purpureus* and *Zea mays*

Crop type	Ash	CP	EE	CF	NDF	DM dig.
Lablab purpureus Pure stand	14.5^a	18.5^b	2.20^b	21.0^b	38.8^b	59.40^b
Lablab purpureus in the mixture	16.8^a	26.5^a	6.03^a	20.2^b	35.3^b	66.80^a
Zea mays Pure stand	13.1^a	15.7^b	2.9^b	27.1^a	49.1^a	55.01^b
Zea mays in the mixture	14.5^a	22.2^a	3^b	26.5^a	47.5^a	64.70^a
SEM	8.19	5.11	1.02	1.80	8.06	3.73

^{a,b,c} values within columns with different superscript differ significantly ($P< 0.05$). CP = crude protein; EE = ether extract; CF = crude fiber; NDF = neutral detergent fibre; SEM = standard error of means; Dig. = digestibility.

Table 2 - Effect of phosphorous fertilization and intercropping on chemical composition (%) and *in vitro* DM digestibility of *Lablab purpureus*

Crop type	Fertilizer	Ash	CP	EE	CF	NDF	DM dig.
Lablab purpureus in pure stand	P_0	13.4^a	13.7^c	1.6^d	23.5^a	49.9^a	67.42^b
	P_1	13.9^a	18.9^c	2.3^d	23^a	46.9^a	68.16^b
	P_2	15.5^a	23.2^b	2.6^d	22.3^a	46^a	75.65^a
Lablab purpureus in the mixture	P_0	14.6^a	23.1^b	3.7^c	22.3^a	48.9^a	68.67^b
	P_1	16^a	25.6^b	5.8^b	22^a	47.9^a	69.70^b
	P_2	16.9^a	30.7^a	8.8^a	21^a	47.7^a	77.15^a
	SEM	14.18	8.85	1.77	3.13	13.97	6.46

^{a,b,c} Values with in columns with different superscript differ significantly ($P< 0.05$). CP = crude protein; EE = ether extract; CF = crude fiber; NDF = neutral detergent fibre; SEM = standard error of means; Dig. = digestibility. P_0= 0 kg /ha P_2O_5; P_1= 50 kg /ha P_2O_5; P_2=75 kg /ha P_2O_5.

Table 3 - Effect of phosphorous fertilization and intercropping on chemical composition (%) and *in vitro* DM digestibility of *Zea mays*

Crop type	Fertilizer	Ash	CP	EE	CF	NDF	DM dig.
Zea mays in pure stand	P_0	12.2^a	14^c	1.2^a	33.7^a	54.1^a	60.11^b
	P_1	12.9^a	14.2^c	1.6^a	31.5^a	52.4^a	62.45^b
	P_2	13.2^a	19.1^b	2.2^a	30.2^a	51.8^a	70.51^a
Zea mays in the mixture	P_0	13.1^a	14.9^c	1.6^a	31.4^a	53.1^a	62.68^b
	P_1	15.1^a	15.8^c	2^a	30^a	52.4^a	63.06^b
	P_2	16^a	24.9^a	2.2^a	29^a	52^a	72.52^a
	SEM	10.2	6.8	1.1	5.1	11.9	4.46

^{a,b,c} Values with in columns with different superscript differ significantly ($P< 0.05$). CP = crude protein; EE = ether extract; CF = crude fiber; NDF = neutral detergent fibre; SEM = standard error of means; Dig. = digestibility. P_0= 0 kg /ha P_2O_5; P_1= 50 kg /ha P_2O_5; P_2=75 kg /ha P_2O_5.

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The effect of phosphorous fertilization on the nutritive value of *Zea mays* is illustrated in Table 3. The data revealed that plots applied with P2 had a significant influence (P>0.05) on the CP content with the highest value recorded for P2 level of fertilization for *Zea mays* in pure stand and in the mixture. On the other hand, the effect of phosphorous fertilization on the CF content and the NDF content, was found to be non significant (P>0.05) among all various levels of phosphorous fertilization. DM digestibility for *Zea mays* in pure stand was increased significantly by increasing the level of phosphorous fertilization with the following trend: P2>P1>P0.

DISCUSSION

CP content

The CP content of *Zea mays* in the mixture (22.2%) *was* significantly (P<0.05) higher than CP *Zea mays* in pure stand (15.7%). It could be concluded that lablab bean as leguminous plant has supplied the grasses with nitrogen in the grass -legume mixtures. This results in the line of Mehdi Dahmarden et al (2009) who stated that *Zea mays* when sown in mixture with cow pea secured a higher CP than *Zea mays* when sown alone. Moreover, this results were in the harmony with Fujita *et al*. (1992) who reported that protein concentration was increased from 69-81 g.kg-1 for Maize sole cropping to 88-108 g.kg-1 for various intercropping pattern.

In this study *Lablab purpureus* in the mixture had recorded the highest value of CP 26.5%. In USA Armstrong *et al.,* (2008) found that CP was higher for lablab bean when sown in intercropping with *Zea mays* (13%) than sole cropping (6.1%). Contradicting results were found by Ibrahim et al. (2006) who noted that the Cowpea sown alone produced more crude protein (18.10%).

Phosphorous fertilization was found to have a positive effect on CP of *Zea mays*. This result may be attributed to the fact that Phosphorous fertilization often increases nodulation and hence increase nitrogen or CP content in grasses (Hauque and Mohammed, 1985). This result was not in the line of Eltelib *et al*. (2006) who found none significant effect of phosphorous fertilization of *Zea mays* fodder. More over in Nigeria, Kombiok, and Elemo (2004) found non consistent effect of phosphorous fertilization on *Zea mays*. Based on the results, phosphorous fertilization significantly increased the CP content of lablab bean. Increasing the proportion of the legume particulary the leaves as affected by phosphorous fertilization may increase the CP concentration of the legume. In Turkey Tahir *et. al*. (2007) stated that When P fertilization was applied alone, crude protein concentration increased. In contrast Mullenr *et.al* (2000) observed no change in yield or protein for alfalfa when applied with 30 kg P/ ha.

DM digestibility

Inter-seeding grasses with legumes has a significant effect on DM digestibility of *Zea mays* ranging from 55.01 % for sole seeding to 64.70 % for mixed seeding. The positive effect of intercropping on DM digestibility may be attributed to the higher protein concentration for *Zea mays* when sown in the mixture with *Lablab purpureus*. These results were in the line with Javanmard *et al.,* (2009) who found that intercropping of legumes with *Zea mays* significantly increased digestibility of the forages. With the increase of phosphorous fertilization level DM digestibility increased for *Zea mays.* This indicated that phosphorus fertilization has raised the nutritive value of *Zea mays*. These results were in conformity with Rathore and Kumar (1977) who noted that phosphorous fertilization increased digestibility of sorghum in the pure stand and sorghum in the mixture. Moreover, as it was obvious from this study phosphorous fertilization had a positive impact of DM digestibility of lablab bean. This result was in the consistency of Colomb *et al*., (2002) who noted that phosphorous fertilization increased digestibility for alfalfa in the pure stand and in the mixture.

NDF and CF content

Intercropping grasses with legumes reduced both NDF and CF. These results were consistent with the results stated by Eskandari (2012), Dahmardeh (2009) and Lauriault *et al*. (2004). On the other hand Armstrong *et al*., (2008) reported that intercropping climbing beans with corn increased neutral detergent fiber concentration and decreased digestibility compared to monoculture corn. Phosphorous fertilization caused little reduction on CF and NDF of both *Zea mays* and lablab bean. Same results were obtained by Dianati Tilaki *et al.,* (2010).

Ash content

Although intercropping caused non-significant influence on the ash content for *Lablab purpureus* and *Zea mays* however, slight increase was recorded on the ash content in the mixtures. These were contradicting with many researchers who reviewed that intercropping can raise the Ash content of the crops. These findings were not similar to Ibrahim *et al*. (2006) who noted that the Cowpea sown alone produced the lowest ash content. In addition, these results not confirmed the observation reported by Javanmard *et al.,* (2009) in which they found that ash content of Maize forage increased by intercropping as compared with Maize sole crop. The effect of phosphorous fertilization and intercropping on the ash content was non-significant for all forages under estimation. These results were not confirmed the earlier reports by Habib *et al*., (1971); Colomb *et al*., (2002); Ayub *et al*., (2002), in which they found that application of phosphate increased the percentage of ash in legumes. In addition to that Colomb *et al*., (2002) stated that phosphorus fertilization increase the ash content in alfalfa when intercropped with *Zea maize*.

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EE content

The EE content was found to be higher in *Lablab purpureus* in the mixture when compared to *Lablab purpureus* in pure stand. These results were not supported by Boufaied *et al*. (2003) who noted that intercropping had no effect on concentration of the EE content for legumes. On the other hand, non-significant effect was observed between *Zea mays* in pure stand and *Zea mays* in the mixture in respect to the influence of intercropping. These results however, were in the line with Boufaied *et al*. (2003) who noted that intercropping had no effect on concentration of EE content for grasses. Phosphorous fertilization had non-significant effect on concentration of EE content of all crops under estimation except for *Lablab purpureus* in the mixture. These results were not in the line of the earlier report by (Ibrahim, 1996) in which he found that increased application of phosphorous up to 200 kg P_2O_5 / ha resulted in a significant decrease in the EE content of Clitoria when intercropped with *Zea maize*. While these results were in conformity with Boufaied *et al*., (2003) who noted that phosphorous fertilizer had non-significant effect on concentration of total and individual fatty acids in grasses and legumes.

CONCLUSION

The results indicated that phosphorous fertilization and intercropping contributed significantly to improve the nutritive values for both Zea mays and lablab bean.

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IMMUNE RESPONSES OF BROILER CHICKS SUPPLEMENTED WITH HIGH LEVELS OF ZINC

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ABSTRACT: *The objective of this study was to evaluate if the high levels of zinc can improve different aspects of broilers' immune system. One hundred and forty-four 1-d old broiler chicks were used in the current study with three dietary zinc (40, 120 and 200 mg/kg). At 2, 22, 32, 42 days of age, the blood serums were tested for antibody titer against Newcastle disease vaccination, using the standard Haemagglutination Inhibition test. On day 42 the sum of nitrite and nitrate (based on the reduction of nitrate to nitrite by cadmium) were measured and the weights of spleen and bursa of fabricius were recorded on a relative live weight basis. At 42 d, antibody response of level 200 mg/kg diet was significantly higher than control. Adding levels of 120 and 200 mg Zn/kg diet significantly increased the weight of bursa and spleen respectively (P< 0.05) compared with the control. Also level of 200 mg Zn/kg diet showed the highest amount of nitrite and nitrate in compare with other levels. The use of 200 mg Zn/kg diet in broilers diet could be considered as a natural promoter of cell-mediated immunity.*

ORIGINAL ARTICLE

Key words: *Antibody titer, Broiler, Immune organs, Newcastle disease, Nitrite and nitrate, Zinc*

INTRODUCTION

Nowadays the use of specific dietary supplements to boost the intrinsic potential of poultry to perform better immunologically is so important. Trace elements are involved in the metabolic activities via metalloenzymes which are essential for the antioxidant protection of cells in poultry (Petrovic et al., 2010).

Zinc is essential for highly proliferating cells, especially in the immune system and is an essential cofactor for thymulin which modulates cytokine release and induces proliferation (Maggini et al., 2007). Some studies indicate that supplementing the diet of broilers above 40 ppm recommended by the National Research Council (1994) enhances antibody production (Kidd et al., 2004).

Bartlett and Smith (2003) reported the broilers receiving 68 and 181 mg Zn had a higher response for total, IgM, and IgG antibodies.

The objective of this study was to evaluate if the high levels of zinc can improve different aspects of broilers' immune system like macrophages activity and immune organs.

MATERIALS AND METHODS

One hundred and forty-four 1-d old Ross 308 broiler chicks were used in this experiment. The study was carried out according to a completely randomized design, with three dietary Zn-So_4 (Merck Art, number 10888331000) levels and four replicates of 12 birds. The experimental diets were manufactured from a basal diet (Table 1), which was formulated to meet the nutrient requirements of broiler chickens (NRC, 1994). Three zinc levels (40, 120 and 200mg/kg) were added to the basal diet to establish the treatments. Zinc contents in starting, finishing basal diets and potable water were 72, 70 and 5 mg/kg respectively, as measured by atomic absorption analysis. Birds were kept in floor pens, and diets and fresh water were provided *ad libitum* from day one.

The lighting program used was 24 hours of artificial light during the entire experimental period, which Lasted 42 days. At 42 day of age, eight birds from each treatment were chosen at random, weighed and then slaughtered. The weights of carcass, spleen and bursa of fabricius were recorded. Organ weights were expressed on a relative

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carcass weight basis. Birds of all groups were intramuscularly injected with 0.1 ml of killed Newcastle disease (ND) vaccine (Cevac®Broiler NDK) at eight days of age. Blood samples from each replicate were collected at 2, 22, 32, 42 days of age. All the blood samples obtained from wing vein and serums were separated by 3000 rpm centrifuging for 15 min. The serums were tested for antibody against NDV, using the standard Haemagglutination Inhibition (HI) test (Allan and Gough, 1974) and the results were expressed as the logarithm base 2. Also at 42 d serum samples were prepared from eight chicks per each treatment and sum nitrite and nitrate was measured based on the reduction of nitrate to nitrite by cadmium. The nitrite produced was determined by Griess reaction. The serum sample was deproteinized by adding ZnSO (75 mmol/l) and NaOH (55 mmol/l) solutions. After centrifuging, the supernatant was recovered and diluted in glycine buffer (45 g/l, pH 9.7). Cadmium granules (2 - 2.5 g) were rinsed three times with deionized distilled water and swirled in a CuSO4 solution (5 mmol/l) in glycine-NaOH buffer (15 g/l, pH 9.7) for five min to become activated. Freshly activated cadmium granules were added to pretreated deproteinized serum. After continuous stirring for 10 min, the samples were transferred to appropriately labeled tube for nitrite determination by Griess reaction. Griess reagent 1 (1% sulfanilamide in 5% phosphoric acid) was added to the sample tubes and then incubated for 10 minutes at room temperature, protected from light. Griess reagent 2 was added (0.1% N-napthylethylenediamine dihydrochloride in water) to all samples and absorbance was measured within 10 minutes in a spectrophotometer at a wavelength of 540 nm (Pirali-Kheirabadi et al., 2011). At the final stage, the sum of the nitrite and nitrate was measured.

Table 1 - Ingredients and calculated composition of the starter and finisher diets

Ingredients	Starter (g/kg)	Finisher (g/kg)
Corn	535.5	595.7
Soybean meal 44%CP	389.3	333.4
Monodibasic Phosphate	14.3	12.1
Limestone	13.5	13.8
Vegetable oil	38.4	35.1
Salt	4.1	4.3
DL-methionine	2.07	2.14
L-Lysine HCl	1.29	1.97
Choline HCl 60%	0.6	0.5
Mineral-vitamin premix[1]	1	1
Total	1,000	1,000
Calculated Nutrients		
Crude protein	220	200
ME, kcal/kg	3,050	3,100
Calcium	9	8.5
Available phosphorus	4	3.5
Digestible Lys	11.5	10.7
Digestible Met	4.9	4.8
Digestible Met+Cys	8.1	7.7

[1]Composition (per kg): Mn (from MnSO4·H2O), 40,000 mg; Fe (from FeSO4·7H2O), 20,000 mg; Cu (from CuSO4·5H2O), 40,000 mg; I (from Ca (IO3) 2·H2O), 400 mg; vitamin A (from vitamin A acetate), 3,600,000 IU; cholecalciferol, 800,000 IU; vitamin E (from DL-α-tocopheryl acetate), 7,200 IU; menadione, 800 mg; thiamine; 720 mg; riboflavin, 2,640 mg; niacin, 4,000 mg; calcium pantothenate, 12,000 mg; pyridoxine, 1,200 mg; folic acid, 400 mg; cyanocobalamin, 6 mg; biotin, 40 mg; choline, 100,000 mg.

Statistical analysis

Statistical analyses were conducted using the ANOVA general linear models procedure of SAS software (SAS Institute, 1997). When ANOVA revealed significant effects, means were separated by Duncan's multiple range tests. The values were considered significant at $P< 0.05$.

RESULTS

Immune organs (spleen and bursa of fabrecius) weight were measured on a relative carcass weight basis (Table 2). Adding levels of 120 and 200 mg Zn/kg diet significantly increased the weight of bursa and spleen respectively ($P< 0.05$) compared with the control.

Table 2 - The Immune organ weights of broilers fed different levels of zinc

Zn level (mg/kg)	Bursa (%)	Spleen (%)
40	0.066b±0.008[b]	0.12±0.011[b]
120	0.084±0.006[a]	0.139±0.002[ab]
200	0.078±0.009[ab]	0.165±0.026[a]
SEM	0.008	0.016

[a,b] Means within a column with no common superscript are significantly different ($p<0.05$)

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Fig 1 shows the effects of graded levels of Zn on antibody titer against NDV of broiler chicks. Although at 2, 22, 32 d there was no significant difference in antibody titer, but at 42 d, antibody response of level 200 mg/kg diet was significantly (P< 0.05) higher than control, however the difference between 120 and 200 mg/kg diet was not significant.

Fig 2 shows the sum of nitrite and nitrate in serum after using different treatments. Results showed that adding additional Zn significantly (P< 0.05) increased the sum of nitrite and nitrate in the serum of broilers. Also level of 200 mg Zn/kg diet showed the higher amount of nitrite and nitrate in compare with the level of 120 mg Zn/kg diet; however this difference was not significant.

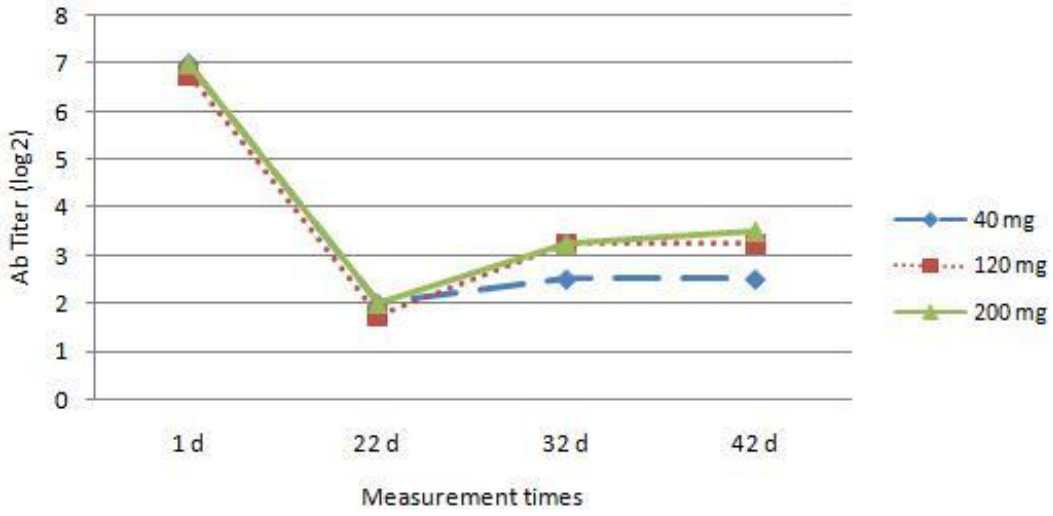

Figure 1 - Antibody responses of broilers fed different levels of zinc

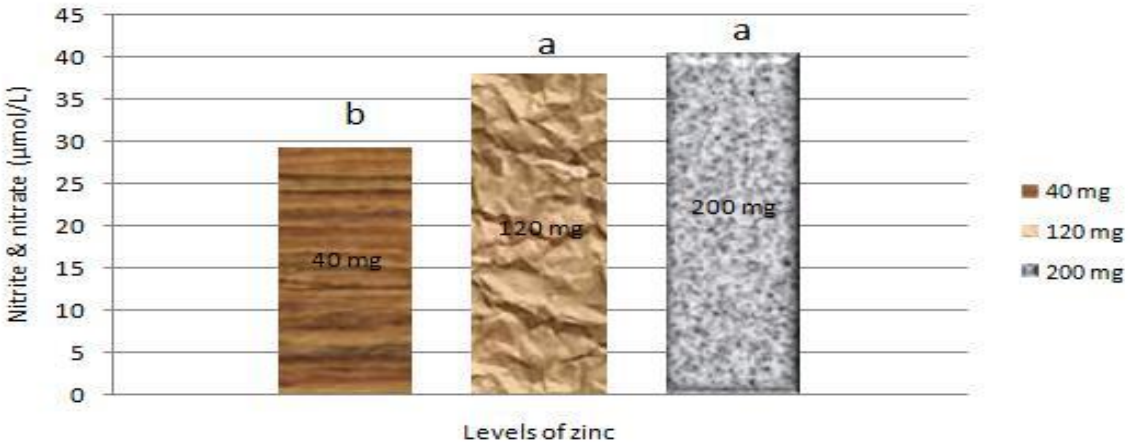

Figure 2 - Effects of Zn supplementation on sum of nitrite & nitrate in the serum of broilers.
[a,b] Columns that do not share the same letters differ significantly (P< 0.05).

DISCUSSION

Increase of the weight of bursa and spleen in this study was similar with result of Bartlett and Smith (2003) that showed a slight increase in lymphoid organs weight. Also Feng et al. (2011) reported that thymus, spleen, and bursa of fabricius indexes increased linearly with increasing dietary Zn. These finding could be due to role of Zn in growth and function of lymphocytes. Our results showed that antibody response at the level 200 mg/kg diet was significantly higher than control. Bartlett and Smith (2003) reported the broilers receiving 68 and 181 mg Zn had a higher response for total, IgM, and IgG antibodies. Also Hosseini et al. (2010) demonstrated that the graded Zn increased IgM and IgY titer against SRBC. Zinc is essential for thymulin, a thymic hormone that regulates T-lymphocyte maturation. Birds provided diets supplemented with a more available zinc source might have induced thymulin activity, and therefore promoted immune responses through increased maturation of T-lymphocytes and activation of B-lymphocytes by T-helper cells (Nassiri-Moghadam and Jahanian, 2009). Increase of sum of nitrite and nitrate has been caused by increase in production of macrophages. Zinc has effect on some aspects of

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macrophage function. It was proposed that resistance to some diseases after supplementation with Zn, may be due to role it in nitric oxide–mediated microbicidal activity of macrophages (Shankar and Prasad, 1998). This result was in agreement with finding of Bartlett and Smith (2003) that birds fed the 181 mg Zn/kg diet had more activated macrophages for opsonized and unopsonized sheep red blood cell (SRBC) than those fed the lower Zn. There is much speculation regarding the role of zinc in the killing of pathogens by oxygen radicals produced by macrophages. Rapid therapeutic effects of zinc supplementation on diarrhea or the common cold may involve some aspects of macrophage function.

CONCLUSION

The overall results of this study showed that supplementation of diet of broilers above 40 mg Zn/kg increased different aspects of immunity. Level of 120 mg Zn/kg diet was enough to achieve the maximum weight of bursa of fabrecius, while level of 200 mg Zn/kg diet was more efficient to increase spleen weight, antibody titer against NDV and sum of nitrite and nitrate in serum. Then the use of 200 mg Zn/kg diet in broilers diet could be more considered as a natural promoter of immunity in broiler chicks.

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	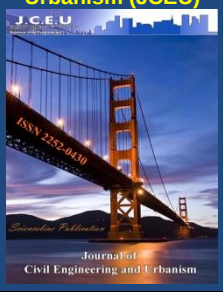	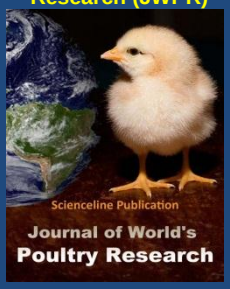	
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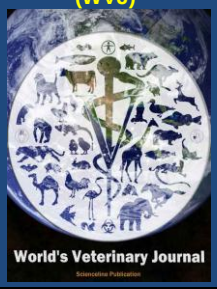		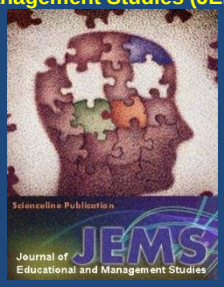	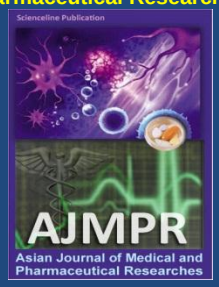
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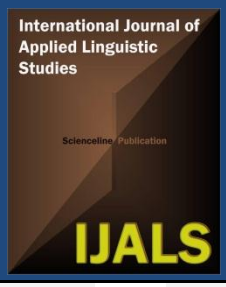	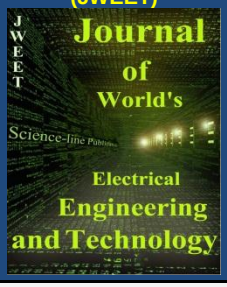		

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