USING SORGHUM (*SORGHUM BICOLOR* L.) AND PEAS (*PISUM SATIVUM*) AS REPLACEMENT FOR YELLOW CORN AND SOY BEAN AND THEIR EFFECTS ON GROWTH , HEMATOLOGY AND SERUM BIOCHEMICAL PARAMETERS OF BROILER CHICKS [(A)]

Nawras A. Alwan

Department of Physiology ,Pharmacological and chemistry /College of Veterinary Medicine/ Basrah University, Basrah-Iraq.

(Received 3 June 2012,Accepted 25 June 2012)

Keywords; yellow corn**,** sorghum**,** serum**.**

ABSTRACT

This work was done to investigate the effect of replacing the yellow corn (maize) with sorghum (white corn) and soy bean with peas on body weight, food intake, some hematological (PCV. And Hb) and also on some biochemical parameters (protein and urea).

72 one day old unsexed broiler chicks of average body weight 40-45 gm; they were divided into 3 equal groups of 24 chicks with 3 replicates. The first group were fed a diet containing sorghum ; the second group were fed a diet containing peas while third group fed normal diet. All groups fed on a starter diet for the first 28 days and then fed on growth diet till 49 days of age. Results showed significant increase in food intake, body weight in all experimental groups. Also significant increase were obtained in hematological parameters increased (Hb and PCV)as well as in serum biochemical parameters studied ($P<0.05$)for protein and urea in first and second groups compared to control group (Group 3).

INTRODUCTION

sorghum has a higher protein content than corn (1& 2) . Amino acid contents in sorghum specially cystine, tryptophan are higher than in corn but lower than in wheat (3 & 4) which are considered to be the first limiting amino acid in sorghum. Workers had reported reduced nitrogen and protein retention due to consumption of low tannic

acid sorghum. The effects of tannins on nutritive value of sorghum for poultry were reviewed by Gualtieri and Rapaccini (1) and Nyachoti *et al.* (5); they concluded that low tannin sorghum was comparable to maize in nutritive value whereas Nyachoti *et al.* (5) that there were a great deal of variation in nutritive values of different varieties of sorghum. In Australian sorghum, tannins are not a limiting factor for its use (6).

The use of maize grain as a staple food for human and several industrial uses, this situation has called for investigation into the potentials of other readily available cereal for poultry feeding which are cheaper and are not used for human consumption widely like maize such as white corn (sorghum). Sorghum is a drought tolerant crop which has little industrial uses. The use of sorghum grains as energy sources in poultry diets has been documented (7). It has been ascertained that sorghum grains is a suitable substitute for maize in poultry diets (8 &9). Nayannor *et al* (10) and Medugo *et al* (11) replaced maize with sorghum grain in broiler chickens diet and reported no significant difference in performance.

Peas (*Pisum sativum*) has a high potential in yield, energy and protein (12). The crude protein content of ripe seeds of peas ranges from 24 to 34% on dry matter basis and the protein has relatively good amino acids profile (13& 14).

So this study was conducted to compare the performance of broiler chicks fed diets based on sorghum instead of corn and peas instead of soy bean compared with chicks fed on diet containing corn in Basrah environments.

MATERIALS AND METHOD

Housing and Experimental animals :

Feeding trial of The experiment was conducted in the premises of the poultry research unit, Faculty of Veterinary Medicine , University of Basra , during the period between November 2011 to January 2012. The experiment was carried-out under controlled environment rooms (24°C) and conditions.

Seventy-two (one day old) unsexed commercial broiler chicks (Ross) were used. All birds were fed on the control diet for two days. After weighted the chicks divided randomly into 3 groups of 8 chicks as replicate (3 replicate / treatment). The chicks were housed in floor deep litter pens (1.00 m2/bird). *ad libitum* fed energetic and is nitrogenous diets and had free access to water. Artificial light was provided 24 h/d for

the experiment according breeder's requirements for starter (1-28d-old) and finishing (29-49d-old) periods.

composition of grain types and experimental diets:

Basic nutrient composition of sorghum grain and peas are shown in (Table1) Three is energetic and is nitrogenous starter and finisher diets were formulated (Table 2).

Table (1): Composition pea seed and sorghum (% DM Basis) (15) (16).

COMPOSITION	SORGHUM GRAIN	FIELD PEAS	MAIZE	SOYABEAN MEAL
Crude protein (%)	9	25	9	42
Ether extract (%)	3.5	1.5	43	2.4
Crude fibre (%)	2.5	6.0	2	6.19
Crude ash (%)	2	4.0	2.3	6.47
Nitrogen free extract (%)	60	63.5	71.49	32.11
Gross Energy (kcalkg-1)	3288	2600	3340	2240

Experimental Design:

72 Broiler chicks aged 1day and average of body weight about 40-45gm., the chicks were divided into three equal groups, Group(G1):24 chicks were fed on diet contain sorghum. Group (G2): 24 chicks were fed on diet contain pea while group (G3): 24 chicks fed on normal diet. All groups fed on starter fed for 1-28days and then growth fed for 28-49days.

Blood samples were drawn from the wing vein , Blood samples were collected from birds into clean dry test tubes and allowed to clot, and serum was separated and collected for frozen and later analyzed.

Table (2): Composition of poultry diet for starter and growth:

Ingredients	Starter diets			Growth diets		
	G1 Sorghum	G2 Peas	G3 control	G1 Sorghum	G2 peas	G3 Control
Yellow corn (maize)	------	44.8	44.8	------	48.8	48.8
Soybean meal	21	------	24	17	-----	20
Wheat	20	20	20	20	18	20
Sorghum grain	47.8	------	------	51.8	----	------
Peas seed	-----	25	-----	-----	22	------
Protein premix	10	10	10	10	10	10
$CaCo_3$	0.7	0.7	0.7	0.7	0.7	0.2
Vit.	0.2	0.2	0.2	0.2	0.2	0.2
Salt	0.3	0.3	0.3	0.3	0.3	0.3
Total	100	100	100	100	100	100
Calculated composition						
Crud protein	21.8	21.3	22.2	20.8	20.4	20.2
Crud fiber	3.80	3.24	3.48	3.8	3.2	3.48

Metabolic energy	**2925.6**	**2919.4**	**3051.5**	**3023.5**	**2965**	**3075.9**

Hematological parameters

1- Hemoglobin concentration (Hb)

Sahli apparatus was used to measure the concentration of hemoglobin (gm / dl). Hydrochloric acid of 0.1 normality (N) was poured to mark (20) of Sahli tube and 10 µl of blood specimen were added and mixed together, then the mixture was left for 10 minutes. Later on, distilled water was added gradually until the color of the diluted acid hematin tenders similar to that of the standard tube color (17).

2-Packed cell volume (PCV)

The microhematocrit method was used to calculate the percentage of PCV by the use of heparinized capillary tubes, which contain heparin. One end of the capillary tube was closed by artificial clay after being filled to 3/4 of its length with blood, and it is put in microhematocrite centrifuge on velocity (12000 g/min) for 3.5 minutes then the hematocrit value was obtained by service device (18).

Biochemical measurements:

Blood samples were centrifuged (5000rmp/ min.) to isolate blood serum. The serum total protein was estimated by the photometric colorimetric test for total proteins / Biuret method by using special kit (Human / Total protein liquicolor, Germany). The serum urea measured by using special kit Urea/BNA-Liquizyme, Germany (modified Urease-Berthlot method).

Statistical Analysis:

The experiment was designed as a complete randomized design. Data obtained from the experiment was subjected to analysis of variance (ANOVA) according to SPSS using computer program for windows.

($P<0.05$) was considered to be significant Duncan's multiple test were used to assess significance of differences between treatment (19).

RESULTS AND DISCUSSION

1-Effects of sorghum and peas on body weight:

Body weights difference between experimental groups is shown in table (3 and 4). It is clear from the tables that sorghum and peas did not exert any negative effects on birds body weight during the first growing period (first 28 days) and during the finishing period till 49 days.

It is clear from the tables that mean body weight of group 2 which fed peas instead of soya bean increased significantly ($P<0.05$) when compared with groups 1 and 3. This results resembles that found by Prandim *et al*., (20) who found significant effect of feeding peas on body weight; in this study the significant increase of peas fed group may be attributed to the high crude protein content of peas and high energy as well as which contributed together to enhance the increase in body weight of this group as well as decrease body weight of sorghum group than peas group this may be due to the manifestation of astringent effect of tannin contents of sorghum but the final body weight at the birds of all diets groups were within the ranges of reports for broiler chicks in the tropics (21). Also result of this study agreed with that of Castell *et al*. (22) when the found significant increase of broiler chicks body weight when fed on peas based diet.

Other workers found same trends of body weight of broiler chicks when fed on sorghum and corn such as (23) when found aconsiderable mean body weight of chicks fed on sorghum based diet during winter. Also Jacob *et al.* (24) recorded body weight of chickens fed on sorghum based diet like what is found in this study.

Also our results of body weights of birds fed on peas resembles that found by Moschini *et al*. (25) when they fed the birds on diet based on peas. Reddy and Rao (26) showed the effect of sorghum on body weight increase significantly (P>0.05) (1304 gm.) when compared with other group feed on maize (1238 gm.).

2- Effect of sorghum and peas on feed intake:

Also feed intake recorded in table 4, it is clear that feed intake is markedly increased in group 2 than group 1 and group 3. the some what reduce in feed intake in group 1 may be attributed to the higher energy in the sorghum diet rather than in peas and corn based diets.

The higher protein content in peas based diet of group 2 may caused the birds of this group to consume more diet than the other two groups. Also results of this study agreed with those reported by Cramer *et al*. (27) when found that feed intake decreases in birds fed sorghum based diet.

3- Effect of Sorghum and peas on blood and biochemical parameters:

These results were represented in tables (5, 6, 7 and 8). It is clear that all the measured parameters were increased significantly (P<0.05) in group 1 fed on sorghum when compared with other groups, this result is corresponded with results found by Prandini *et al*. (20).

Result of increase total protein and urea of this study were in the same way of results found by Diaz *et al*. (29) when found significant increase of these two parameters in group of birds fed on peas when compared with other group fed on faba bean.

Table (3): Effect of sorghum and peas replace on body weights (gm.) of broiler chicks:

Groups	2w.	4w	6w	7w.
G1	$396.166 \pm {}^{Aa}$ 26.573	$709.416 \pm {}^{Ab}$ 22.968	$1219.500 \pm {}^{Ac}$ 31.190	$1466.583 \pm {}^{Ad}$ 67.689

G2	386.416± ^{Aa} 25.403	733.250± ^{Bb} 27.052	1233.583± ^{Bc} 49.162	1600.333± ^{Bd} 72.019
G3	405.500 ± ^{Aa} 29.956	652.166 ± ^{Aa} 27.924	1208.166 ± ^{Ac} 29.498	1470.000± ^{Ad} 51.874

G1= sorghum replacement G2 =peas replacement G3= control

A, B, C,D= denote to the different between groups

a, b, c, d= denote to the different within groups

Table (4): Effect of sorghum and peas replace on feed Intake (gm.) of broiler chicks:

Groups	1-2w.	2-4w	4-6w	6-7w.
G1	311.666± ^{Aa} 1.211	676.200± ^{Ab} 35.820	1590.166± ^{Ac} 54.038	3252.333± ^{Ac} 54.410
G2	310.166 ± ^{Aa} 2.041	667.283± ^{Ab} 14.849	1673.666± ^{Ac} 75.404	3373.00± ^{Ac} 79.884
G3	307.833± ^{Ba} 3.710	660.666± ^{Aa} 31.513	1466.666± ^{Bc} 29.964	3199.466± ^{Bc} 31.913

G1= sorghum replacement G2 =peas replacement G3= control

A, B, C,D= denote to the different between groups

a, b, c, d= denote to the different within groups

Table(5):Effect of sorghum and peas replace on PCV (%) of broiler chicks:

Groups	2w.	4w	6w	7w.
G1	30.000± ^{Aa}	31.666± ^{Ab}	34.333± ^{Ac}	34.666± ^{Ad}

	0.894	0.516	0.816	0.516
G2	30.166± ^{Aa} 0.752	30.000 ± ^{Ab} 0.894	32.000± ^{Bc} 0.894	33.000± ^{Bd} 0.894
G3	30.000± ^{Aa} 0.894	30.666± ^{Ab} 0.516	30.666± ^{Bc} 0.516	31.000± ^{Bd} 0.894

G1= sorghum replacement G2 =peas replacement G3= control

A, B, C,D= denote to the different between groups

a, b, c, d= denote to the different within groups

Table (6): Effect of sorghum and peas replace on Hb (%) of broiler chicks:

Groups	2w.	4w	6w	7w.
G1	7.333± ^{Aa} 0.816	9.000± ^{Ab} 0.632	10.000± ^{Ac} 0.894	11.000± ^{Ad} 0.836
G2	6 ± ^{Ba} 0.894	7.666 ± ^{Bb} 0.516	9.166± ^{Ac} 0.752	9.500± ^{Bc} 0.547
G3	7.333± ^{Aa} 0.516	7.666± ^{Ba} 0.516	8.000± ^{Bb} 0.894	8.500± ^{Cb} 0.547

G1= sorghum replacement G2 =peas replacement G3= control

A, B, C, D= denote to the different between groups

a, b, c, d= denote to the different within groups

Table(7):Effect of sorghum and peas replace on total protein (gm/dl) of broiler chicks:

Groups	2w.	4w	6w	7w.

G1	3.695± ^{Aa} 0.320	4.450± ^{Aa} 0.301	5.041± ^{Ab} 0.547	6.543± ^{Ac} 0.670
G2	4.545± ^{Aa} 0.777	4.991± ^{Bb} 0.588	5.857± ^{Ac} 0.668	6.450± ^{Ad} 0.594
G3	3.796± ^{Aa} 0.303	4.418± ^{Ba} 0.390	4.603± ^{Ba} 0.407	5.403± ^{Bb} 0.480

G1= sorghum replacement G2 =peas replacement G3= control

A, B, C,D= denote to the different between groups

a, b, c, d= denote to the different within groups

Table(8):Effect of sorghum and peas replace on Urea (mg./dl) of broiler chicks:

Groups	2w.	4w	6w	7w.
G1	15.833± ^{Aa} 2.137	21.166± ^{Ab} 2.562	38.000± ^{Ac} 7.042	48.833± ^{Ad} 8.010
G2	16.000± ^{Aa} 2.190	20.666 ± ^{Ab} 2.065	27.500± ^{Bc} 2.738	35.000± ^{Bd} 5.433
G3	15.000± ^{Aa} 1.780	21.333± ^{Ab} 2.732	27.500± ^{Bc} 2.258	37.500± ^{Bd} 5.244

G1= sorghum replacement G2 =peas replacement G3= control

A, B, C,D= denote to the different between groups

a, b, c, d= denote to the different within groups

استخدام الذرة البيضاء والبازلاء كبدائل عن الذرة الصفراء وفول الصويا وتأثيرها على النمو والمعايير الدموية والبايوكيميائية المصلية في فروج اللحم

نورس عبدالاله علوان

فرع الفسلجة والادوية والكيمياء، كلية الطب البيطري-جامعة البصرة ، البصرة-العراق.

الخلاصة

أجريت التجربة لمعرفة تأثير استبدال الذرة الصفراء (الذرة) مع الذرة البيضاء وفول الصويا مع البازلاء على وزن الجسم، ومعدل استهلاك العلف، وبعض معايير الدم (حجم كريات الدم الحمر المرصوصة و نسبة هيموغلوبين الدم)، وكذلك على بعض المعايير الكيموحيوية (البروتين واليوريا) . 72.من دجاج اللحم بعمر يوم واحد غير مجنسة وبمتوسط وزن جسم من 40- 45 غرام ، تم تقسيم الافراخ إلى ثلاث مجموعات 24 طير وثلاث مكررات لكل مجموعة، مجموعة الاولى(G1): غذيت الافراخ على عليقة تحتوي على الذرة البيضاء.المجموعة الثانية (G2) : تم تغذية الافراخ على عليقة تحتوي على البازلاء بينما على عليقة بادئة لمدة 28 يوم ثم غذيت على عليقة نمو حتى 49 يوم من العمر، النتائج تظهر زيادة في استهلاك الغذاء و وزن الجسم في جميع مجاميع التجربة، ايضا زيادة مجموعة (G3): غذيت الافراخ على نظام غذائي طبيعي. كل هذه المجموعات غذيت في المعايير الدموية (حجم كريات الدم الحمر المرصوصة و نسبة هيموغلوبين الدم) وكذلك المعايير الكيمو حيوية ($P>0.05$) (البروتين واليوريا) في المجموعة الاولى والثانية بالمقارنة مع مجموعة السيطرة G3.

EFERENCES

1- Gualtieri, M. and Rapaccini, S. (1990). Sorghum grain in poultry feeding. World's Poult. Sci. J., 46: 246-254.

2- Diygkas, J.H., Sullivan, T.W.; Abdul-kadir, R. and Rupnow, H. (1991). Influence of infrared (Micronization) treatment on the nutritional value of corn and low and high tannin sorghum. Poult. Sci., 70: 1534-1539.

3- Hullan, H.W. and Proudfoot, F.G. (1982). Nutritive value of sorghum grain for broiler chickens. Can. J. Anim.Sci., 62: 869-875.

4- Deyoe, C.W. and Shellenberger, S.A. (1965). Amino acids and protein in sorghum grain. Agri. Food Chem., 13:446-450.

5- Nyachoti, C. M., Atkinson, J. L. and Leeson, S. (1997). Sorghum tannins: a review. *World's Poultry Science Journal* 53: 5-21.

6- Kondas, A. C. and Foale, M. A. (1986). Variation in sorghum grain composition and its utilisation by pigs. In: *'Proceedings of the First Australian Sorghum Conference'*, Gatton, Queensland. (Eds M. A. Foale and R. G. Henzell, R.G).

7- Reddy, V.R. and Rao, A.N. (2000). Sorghum in poultry feeds. International Crops Research Institute for the semi-Arid Tropics. Pp.: 248-257.

8- Dowling, L.F.; Arndt, C. and Hamaker, B.R. (2002). Economic viability of high digestibility sorghum as feed for market broilers. Agron, J., 94:1050-1058

9- Travis, D.K.; Tuinstra, M.R. and Hancock, J.D.(2006). Variation in nutrition value of sorghum hybrids with contrasting seed weight characteristics and comparisons with maize in broiler chicks. Crop Sci., 46: 695-699.

10-Nyannor, E.K.D.; Adedokum, S.A.; Hamaker, B.R.; Ejeta, G. and Adeola, O. (2007). Nutritional evaluation of high- digestible sorghum for pigs and broiler chicks. J.anim. Sci., 8:196-203.

11- Ijaduwa, M.C.; Kwari, I.D.; Igwebuike, J.; Nkama, I.; Mohammed, I.D. and Hamaker, B. (2010). Carcass and blood components of broiler chickens fed sorghum or millet as replacement for maize in the semi-arid zone of Nigeria. Agric. Biol. J. North Am., 1:326- 329.

12- Emenalom, O.O.; Udedibie, B.I.; Esonu, B.O. and Etuk, E.B. (2005). Evaluation of processed vevet bean (Mucuna pruriens) as a feed ingredient in starter diets for broiler chickens. The Journal of poultry Science, 42:301-307.

13-Emenalom, O.O.; Udedibie, A.B.; Esonu, B.O. and Agowuike, U.B. (2002). Comparative performance of broiler chicks fed diets containing differently processed. *Mucuna pruriens* seed meals. Proc. 27th Ann. Conf. Nig. Soc. For Anim. Prod. (NSAP). Pp.: 139-140.

14-Udedibie, A.B.; Emenalom, O.O. and Obikaonu, H.O. (2001). Comparative evaluation of Nigerian and Brazilian *Mucuna pruriens* (velvet bean) as feed ingredients in broiler diets. International Journal of Agriculture and Rural Development. 2: 9-13.

15- Ravindran, V. and Blair, R. (1992). Feed resources for poultry production in Asia and the Pacific II. Plant protein sources. *World's Poultry Science Journal* 48: 205- 231.

16- NRC (National Research Council). (1994). *Nutrient Requirements of Poultry 9th Rev. Edn.* National Academy Press. Washington, D.C.

17- Coles, E. H. (1986). Veterinary clinical physiology. 4th ed., W.B. Saunders company, Philadelphia, London. Pp: 16.

18- Dasic, J. V. and Lewis, S. M. (1984). Practical hematology 6th ed. Edinburgh, Churchill., Pp: 40-55.

19- Gomes, K.A. and Gomes, A.A. (1984). Statistical procedures for the Agriculture Research. 2 nd.

20- Prandini, A.; Morlacchini, M.; Moschini, M.; Fusconi, G.; Masoero, F. and Piva, G. (2005). Raw and extruded pea (Pisum sativum) and lupin (Lupinus albus var. Multitalia) seeds as protein sources in weaned piglets diets: effect on growth rate and blood parameters. Ital. J. Sci. 4:385-394.

21- Jadhav, N.V. and Siddiqui, M.F. (2010) hand book poultry production and management. 2nd edn., published by Jaypee Brothers Medical Publishers Ltd, New Delhi, India. Pp.: 388.

22- Castell, A.G., Guenter, W., Igbasan, F.A. (1996). Nutritive value of peas for nonruminant diets. Anim. Feed Sci. Tech. 60:209-227.

23- Stephenson, E.L.; York, J.O.; Bragg, D.B. and IVY, C.A. (1970). The amino acid content and availability of different strains of grain sorghum to the chick. Poult. Sci., 67: 108-112.

24- Jakob, J.P.; Mitaru, B. N.; Mbugua, P.N. and Blair, R. (2004). The feeling value of Kenyan sorghum, sunflower, seeds cake and sesame seeds cake for broiler and layers. Anim.Feed.Tech. 61:41-46.

25- Morlacchini, M.; Moschini, M.; Fusconi, G.; Masoero, F. and Piva, G. (2005). Raw and extruded pea (Pisum sativum) and lupin (Lupinus albus var. Multitalia) seeds as protein sources in weaned piglets diets: effect on growth rate and blood parameters. Ital.J.Sci. 4:385-394.

26- Reddy, V.R. and Rao, A.N. (2000). Sorghum in poultry feeds. International Crops Research Institute for the semi-Arid Tropics. Pp.: 248-257.

27- Cramer, K.R.; Wilson, K.J.; Moritz, J.S. and Beyer, R.S. (2003). Effect of sorghum-based diets subject of various manufacturing procedures on broiler performance. J. Appl.Poult.Re., 12:404-410.

28- Diazd.; Morlacchini,M.; Masoero, F.; Oschini, M.; Fusconi, G. and Piva, G. (2006). Pea seeds (*pisum sativum*), faba beans (Vicia faba var. minor) and Lpin

seeds (Lupinus albus var. multitalia) as protein source in broiler diets. Ital.J.Anim.Sci. (5):43-53.