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Effect Yellow corn and Soybean with Sorghum (*Sorghum bicolor* L.) and Peas (*Pisum sativum*) on Productive Performance and Physiological Traits of Broiler Chicks

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Abstract

This study was undertaken to investigate the effect of replacement of sorghum (white corn) instead of yellow corn and protein peas instead protein soybean meal on the productive performance and some blood traits of broilers. A total of 72 unsexed one day old chicks. Chicks were randomly all treated into three groups in three replicates of 8 chicks/ replicate. During the experimental period 49 day two diets were fed started and grower. The treatments were as follows: First treatment (T_1) was containing sorghum instead of yellow corn. Treatment (T_2) was containing protein peas instead of protein soybean meal. Treatment (T_3) was control diet. The results of this study indicated that: No significant difference ($p<0.05$) between control group and other treatment groups in body weight gain. Feed intake and feed conversion ratio were increased significantly in treatment (T_1 and T_2) comparing with control group.

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The hematological and serum biochemical parameters show highly significant increase ($P<0.05$) in T_1 and T_2 than compared with control group.

Keywords: Yellow corn, Soybean, sorghum, Peas, Broiler Chicks.

Introduction

Animals provide over 33 percent of protein consumed in human diets and about 16 percent of food energy (Martin, 2001). Despite considerable progress in food production in the last 30 years, 800 million people in the world are still undernourished (FAO, 1982).

Research on vegetable-based protein sources has grown as a result of the European Union ban on the inclusion of meat and bone meal in diets of agricultural livestock. This together with recent concern over genetically modified soybeans, the protein source for monogastric diets, has sparked research into the identification of some alternative protein sources. The concern over antinutritional factors (protease inhibitors, lectins, phenolic compounds, saponins, etc.) in some protein sources, like pea seeds (*Pisum sativum*) faba beans (*Vicia faba* var. *minor*) and lupin seeds (*Lupinus albus* var. *multitalia*), is genetic improvements of these ingredients make for products with minimal risk (Castell *et al.*, 1996; Rubio *et al.*,2003). The primary concern with these vegetablebase protein sources are related to their content of non-starch-polysacharides (NSP). The alfa-galactoside linkages in these polysaccharides are not broken down for digestion in the gut of monogastric animals (Gdala and Buraczewska, 1996, 1997; Perez-Maldonado *et al.*, 1999; Kocher *et al.*, 2000). These negative effects of high NSP containing protein sources can however be minimized by several methods. One of the most utilized and most studied is the utilization of specific enzymes (Gilbert *et al.*, 1999; Kocher *et al.*, 2000; Steenfeldt *et al.*, 2003; Cowieson *et al.*, 2003).

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The nutritional importance of sorghum grain in human food, animal and poultry feed is well established worldwide. This is reflected fact that in terms of cultivated area on a global scale, sorghum grain ranks the fifth among cereals and in Asia it ranks the third only after rice and corn (Ravidran and Blair, 1991).

The objective of this study was to evaluate of replacing raw peas seeds or Sorghum Grain instead of soybean meal and corn in broiler diets.

Materials and Methods:

The experiment was conducted in the premises of the poultry research unit, Faculty of Veterinary Medicine, University of Basra, during the period between (28 November 2011 to 16January 2012). The experiment was carried-out in controlled environment rooms (24°C).

Seventy-two in one day old chicks unsexed commercial broiler chicks (Ross) were used. The birds were fed the control diet for two days. Then chicks were weighted and allotted randomly into 3 groups of eight chicks as replicate (3 replicate / treatment). The chicks were housed in floor deep litter pens (1.00 m^2/bird), *ad libitum* fed energetic and nitrogenous diets and had free access to water. Artificial light was provided 24 h/d for the experiment according breeder's requirements for starter (1-28day-old) and finishing (29-49d-old) periods.

Basic nutrient composition of sorghum grain and peas are shown in (Table1). There is energetic and is nitrogenous starter and finisher diets were formulated (NRC, 1998) (Table 2).

Table (1): Composition sorghum and pea seed (% DM Basis) (Ravindran and Blair 1992; NRC, 1994).

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COMPOSITION	SORGHUM GRAIN	FIELD PEAS	MAIZE	SOYABEAN MEAL
Crude protein (%)	9	25	9	42
Crude fibre (%)	6.3	15	2.7	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)	1419	1436	1528	1067

Table (2): Composition and analyze of poultry diet (NRC, 1998):

Ingredients	T3 (Control) Starter fed	T3 (Control) growth fed	T1 (sorghum) Starter fed	T1(sorghum) growth fed	T2 (peas) Starter fed	T2 (peas) Growth fed
Yellow corn (maize)	46.8	48.8	------	------	34.8	36.8
Soybean meal	22	20	21	17	------	-----
Wheat	20	20	20	20	15	15
Sorghum grain	------	------	47.8	51.8	------	----
Peas seed	-----	------	-----	-----	38	37

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Protein premix	10	10	10	10	11	10
$CaCo_3$	0.7	0.7	0.7	0.7	0.7	0.7
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	22.2	20.2	21.8	20.8	21.3	20.4
Crud fiber	3.48	3.48	3.80	3.8	3.24	3.2
Cross energy	3051.5	3075.9	2925.6	3023.5	2919.4	3965

Take the parameters determined studied each two week were body weight gain, feed intake, feed conversion ratio, biochemical measurements and hematological parameters. These birds were selected randomly from each replicate of each treatment. Blood samples were drawn from the wing vein and collected from birds into clean dry test tubes. The serum was separated and collected for frozen and later analyzed.

Blood samples were centrifuged (5000rmp/ min.) to isolate blood serum. The serum total cholesterol was determined by using commercial kits (Spinreact/CHO-POD,Spain). The serum glucose was measured by using

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glucose-oxidase method (Trinder, 1969), (Biomaghreb / GOD – PAP, Tunisia).

Red blood cell count (RBC) and total white blood cell count (WBC) were in blood sample obtained by Schalm *et al.* (1975).

Completely randomize design was used in the experiment. The data generated from the experiment was subjected to Analysis of variance according to the SPSS using computer program. Duncan's multiple tests were used to assess significance of differences between treatment means (Gomes and Gomes, 1984).

Results and Discussion:

Performance results are presented in Table 3.Up to 38% peas feed had no significant effect in (T2) on body weight ($p<0.05$) comparison of control group. Either sorghum grain did not significant affect when maize grain was replaced by sorghum at 47.8% level in(T1) because the maize and sorghum grains have nearly similar chemical composition.

The finding recorded in present study is in agreement with that recorded by Duarte D.*et al* (2006) who also reported high levels of peas (350g/kg) and faba bean (500g/kg) did not show negative effects on body weight gain compared to control groups.

The result in this study agreement with Subramamnian V. and Metta V.C.(2000) when use (15,45)% white and yellow sorghum replace maize in poultry feed ,The final bird weight did not vary among the feed that had varied levels of maize and white and yellow sorghum. The data suggest that sorghum can replace maize grain up to 45%without adverse on broilers.

The Feed intake and feed conversion ratio performance data of the broilers are presented in table (4 and 5). Feed intake and feed conversion ratio were

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increased (P<0.05) in treatments (T1 and T2) comparison with control groups.

Sorghum is a potential substitutes for yellow corn because of the similarity in their amino acids and energy profiles, also contain over 60% carbohydrates (mainly starch) (Reddy *et al*., 1984).

The result in this study agreed with the result of Fidelis F.N. *et al*. (2007) who detect increase levels of field peas to 500g/kg did have highly significant effects on feed consumption ratio during the growing period (2-7)week. And also agreed with Prandini *et al*. (2005) show positive effect of pea on growth performance and feed consumption ratio.

On the other hand, the result in this study disagreement with Subramamnian V. and Metta V.C.(2000) when use (15,45)% white and yellow sorghum replace maize in poultry feed these levels had no significant differences in feed consumption ratio compared with control group.

These results also disagreed with result of Cramer *et al*. (2003) and Travis *et al*. (2006) for broiler chicks , the feed intake decrease for birds fed sorghum–based diets and reared in environmentally- controlled house.

Table (3): Effect replacement sorghum and peas instead of yellow corn and soybean on body weights of broiler chicks (gram):

Groups	2 w	4 w	6 w	7 w
T1	333.500 ± 17.590 ^{A}	600.000 ± 30.983 ^{A}	1178.833 ± 33.054 ^{A}	1426.666 ± 59.888 ^{A}

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T2	333.666± A 17.002	647.500± B 33.128	1153.666± A 34.760	1456.666± A 33.266
T3	341.666 ± A 9.309	703.833 ± C 19.374	1192.166 ± A 55.159	1488.333± A 49.734

T1= sorghum replacement T2 =peas replacement T3= control

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

Table (4): Effect replacement sorghum and peas instead of yellow corn and soybean on feed consumption of broiler chicks (gram):

Groups	2 w	4 w	6 w	0-7 w
T1	311.666± A 1.211	676.200± A 35.820	1590.166± A 54.038	3252.333± A 54.410
T2	310.166 ± A 2.041	667.283± A 14.849	1673.666± A 75.404	3373.00± A 79.884
T3	307.833± B 3.710	660.666± A 31.513	1466.666± B 29.964	3199.466± B 31.913

T1= sorghum replacement T2 =peas replacement T3= control

A, B = denote to the different between groups

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Table (5): Effect replacement sorghum and peas instead of yellow corn and soybean on feed conversion ratio of broiler chicks:

Groups	2 w	4 w	6 w	7 w
T1	1.013 ± 0.096 ^{A}	1.641 ± 0.045 ^{A}	2.017 ± 0.413 ^{A}	2.278 ± 0.112 ^{A}
T2	0.915± 0.042 ^{B}	1.510± 0.072 ^{B}	2.216± 0.024 ^{B}	2.318 ± 0.082 ^{B}
T3	0.891 ± 0.017 ^{C}	1.371± 0.004 ^{C}	2.038 ± 0.105 ^{A}	2.150± 0.085 ^{A}

T1 = sorghum replacement T2 =peas replacement T3 = control

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

Blood Parameters:

The results of hematological and serum biochemical study are presented in table (6,7,8 & 9). All these parameters (glucose, cholesterol, WBC and RBC count) increased significant ($P<0.05$) in treatment (T_1 contain sorghum grain) comparison with control group. On the other hand treatment (T2 contain peas) recorded no significant ($P<0.05$) in level of blood cholesterol and WBC comparing with control group. The immune system to identify harmful toxic substance, with tannin substance content in sorghum but in this experiment the maximum desire level of tannin increase the activity of immunity system by increase the WBC and RBC count. The values for all

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hematological parameters observed were within the normal range reported by Merck Veterinary M., (1986) and Awoniyi *et al*.,(2000) for broiler chickens although most of the values assumed the upper limits of these ranges. The presence of anti-nutrition factors such as tannins. Sorghum is a good source of B-complex vitamins and contain β-carotene which can be converted to vit.A by the human body contain some fat-soluble vitamins D, E and K (Paterson *et al*., 2009). These entire components enhance the blood and biochemical parameters.

Sorghum and peas gains are used in poultry feed in small quantities. The results growth performance and blood parameter did not adversely effect on these parameters. This holds good for both sorghum and peas.

The experiment in this study holding gave encouraging results to use these plants in poultry feed.

Table (6): Effect replacement sorghum and peas instead of yellow corn and soybean on WBC of broiler chicks:

Groups	1-2w	2-4w	4-6w	6-7w.
T1	4600.000± ^{A} 334.664	7166.666± ^{A} 983.192	9666.667± ^{A} 605.530	15750.00± ^{A} 758.287
T2	3975.000± ^{B} 582.880	4750.000± ^{B} 273.861	5416.667± ^{B} 491.506	7116.666± ^{B} 694.027
T3	4008.333± ^{B} 602.010	4500.000± ^{B} 447.213	5083.333± ^{B} 487.510	6666.667± ^{B} 535.412

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T1= sorghum replacement T2 =peas replacement T3= control A, B = denote to the different between groups

Table (7): Effect replacement sorghum and peas instead of yellow corn and soybean on RBC of broiler chicks:

Groups	1-2w	2-4w	4-6w	6-7w
T1	391000± ^{A} 10315.037	450000± ^{A} 26832.815	465833.3± ^{A} 14288.690	475083.3± ^{A} 13821.782
T2	395083.3± ^{A} 8581.472	453333.3± ^{A} 5163.977	455000± ^{A} 5477.225	464666.7± ^{A} 13366.625
T3	389833.3± ^{A} 11703.275	392666.7± ^{B} 11360.751	408333.3± ^{B} 7527.760	413333.3± ^{B} 12110.601

T1= sorghum replacement T2 =peas replacement T3= control A, B = denote to the different between groups

Table (8): Effect replacement sorghum and peas instead of yellow corn and soybean on cholesterol of broiler chicks:

Groups	1-2w	2-4w	4-6w	6-7w
T1	112.153± ^{A} 6.097	123.006± ^{A} 2.333	152.518± ^{A} 8.956	167.948± ^{A} 12.966
T2	108.546± ^{A}	115.748± ^{B}	118.565± ^{B}	127.166± ^{B}

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	7.350	4.164	1.756	3.262
T3	108.156± 7.170 [A]	109.315± 7.915 [B]	112.681± 4.938 [B]	120.915± 1.454 [B]

T1= sorghum replacement T2 =peas replacement T3= control

A, B = denote to the different between groups

Table (9): Effect replacement sorghum and peas instead of yellow corn and soybean on glucose of broiler chicks:

Groups	2 w	4 w	6 w	7 w
T1	107.916± 8.523 [A]	123.051± 4.909 [A]	146.750± 2.925 [A]	172.003± 10.151 [A]
T2	108.624± 5.306 [A]	119.398± 1.070 [B]	133.445± 4.608 [B]	145.672± 12.740 [B]
T3	108.761± 4.505 [A]	114.990± 3.453 [B]	121.908± 2.901 [C]	124.906± 2.829 [C]

T1= sorghum replacement T2 =peas replacement T3= control

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

Conclusion:

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Sorghum can replace yellow corn and peas replace soy bean meal in poultry feed. sorghum can replace maize about 47.8% without any effect on broilers. Sorghum and maize grains have nearly similar chemical composition. The sorghum contain tannins but within maximum levels to exception as replacement from results of these study, there are no effect of tannins to reduce the growth and average increasing in the body weight of broiler chicks. Thus, sorghum grain and also peas have high potential for use in poultry feed.

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