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Effect of Dietary Levels of Processed *Leucaena leucocephala* Seeds on Broiler Performance and Blood Parameters

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Abstract: In the current experiment, *Leucaena leucocephala* seeds were subjected to three treatments (soaking, roasting and supplementation with 40mg/Kg ferrous oxide). Then treated and untreated leucaena seeds were incorporated in boiler diets at 0, 6 and 12%. Soaking and roasting of the seeds reduced phytate, whereas tannin was not significantly affected. Feed intake and weight gain were significantly ($p \leq 0.05$) reduced with the inclusion of 12% untreated leucaena seed, 12% soaked or 12% roasted leucaena seeds. However, feeding diets that supplemented with ferrous had no negative effect on feed intake and weight gain compared with control. Dietary treatments did not affect haematological parameters, plasma GOT ALP, K, inorganic phosphorus (Pi), total protein, albumin, globulin, cholesterol, uric acid and tibia P. Plasma glucose for birds fed leucaena seed diets was not significantly different as compared with those fed the control diet.

Key words: *Leucaena leucocephala*, soaking, roasting, broiler, tannin, phytate

Introduction

Utilization of seed legumes as a source of protein for poultry is limited by the uncertainty of their nutritional quality. This may be due to variation of protein quality and amount of antinutritional factors (Wiryawan, 1997). Various methods for food processing and preparations, such as soaking (Ologhobo, 1989) and germination (Alonso *et al*., 2000) activate intrinsic phytase in legumes, which reduces the content of phytate. Price *et al*. (1980) claimed that soaking of *Cajanus cajan* seeds reduced trypsin inhibitory effect and improved *in vitro* protein and starch digestibility. A wide range of methods for thermal inactivation of antinutritional factors of seed legumes has been studied (Wiryawan, 1997). Ernest (1984) reported that the weight gain of chicks fed diets containing 75% autoclaved faba bean or autoclaved field peas increased by 4 or 8% compared with that fed raw beans or raw peas. Moreover, Wee and wang (1987) found that autoclaving leucaena leaves and seeds reduce mimosine more than dry heating. Ter Meulen *et al*. (1979) reported that supplementing leucaena with mineral (iron, zinc) salts reduced mimosine toxicity in rats and chicks. Therefore, the only objective of this experiment was to study the effect of soaking and roasting of leucaena seeds on tannin and phytic content and the influence of soaking, roasting and ferrous supplementation of leucaena seeds on broiler performance.

Materials and Methods

Seeds analysis and diets formulation: *Leucaena leucocephala* seeds were subjected to three processing methods (soaking, roasting and supplementation with 40mg/Kg ferrous oxide) and added at (0, 6 and 12%). Nine isocaloric and isonitrogenous starter and finisher diets (Table 1 and Table 2.) were formulated according to nutrient specifications of the standards recommended by National Research Council (NRC, 1994). Diet (A) was the control with 0% of leucaena seeds, diet (B) 6% of untreated leucaena seeds, diet (C) 6% of leucaena seeds supplemented with 40 mg/kg ferrous oxide, diet (D) 6% of soaked leucaena seeds, diet (E) 6% of roasted leucaena seeds, diet (F) 12% of untreated leucaena seeds, diet (G) 12% of leucaena seeds supplemented with 40 mg/kg ferrous oxide, diet (H) 12% of soaked leucaena seeds and diet (I) 12% of roasted leucaena seeds. Samples of leucaena were analyzed for proximate composition according to the methods outlined in the AOAC methods of analysis (1990).

Tannin content of untreated, soaked and roasted leucaena seeds was determined using modified vanillin HCl in methanol methods described by Price and Butler (1977). Phytic acid content of *Leucaena leucocephala* seeds, soaked and roasted was carried out according to the method described by Wheeler and Ferrel (1971).

Birds and treatments: One hundred eighty one-day-old unsexed broiler chicks (Ross 308) were purchased from Arab Poultry Breeders Company-Egypt after being vaccinated against Marek's disease. The chicks were divided into nine treatment groups of twenty birds each and randomly allotted to the dietary treatments. Each group was further divided into four replicates of five birds each. The chicks were reared from one - day - old to six

Table 1: Composition of experimental broiler starter diets containing graded levels of Leucaena leucocephala with different treatments

	Dietary levels of Leucaena leucocephala%, with different treatments Ingredients, %								
	0 Control (A)	6 Untreated (B)	6 Ferrous[1] (C)	6 Soaked (D)	6 Roasted (E)	12 Untreated (F)	12 Ferrous (G)	12 Soaked (H)	12 Roasted (I)
Sorghum	59.00	58.00	58.00	58.00	58.00	56.00	56.00	56.00	56.00
Ground nut meal	19.00	12.00	12.00	12.00	12.00	8.00	8.00	8.00	8.00
Sesame meal	13.00	15.00	15.00	15.00	15.00	14.50	14.50	14.50	14.50
Super- concentrate[2]	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
Dicalcium phosphate	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40
NaCl	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
Methionine	0.10	0.10	0.10	0.10	0.10	0.20	0.20	0.20	0.20
Vegetable oil	2.20	2.20	2.20	2.20	2.20	2.60	2.60	2.60	2.60
Ferrous oxide	0.00	0.00	40. mg/kg	0.00	0.00	0.00	40. mg./kg	0.00	0.00
Calculated analysis									
ME (kcal/kg)	3202.82	3186.66	3186.52	3186.65	318665	3184.07	3183.93	3184.07	3184.07
CP	23.59	23.10	23.10	23.10	23.10	22.85	22.85	22.85	22.85
Crude fiber	4.52	4.77	4.77	4.77	4.77	5.09	5.09	5.09	5.09
Ca	1.12	1.14	1.14	1.14	1.14	1.12	1.12	1.12	1.12
Available Phosphorus	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45
Lysine	1.09	1.10	1.10	1.10	1.10	1.12	1.12	1.12	1.12
Methionine	0.58	0.60	0.60	0.60	0.60	0.69	0.69	0.69	0.69
Methionine ± Cystine	0.86	0.88	0.88	0.88	0.88	0.96	0.96	0.96	0.96
Determined analysis									
CP	24.77	23.69	23.71	23.64	24.12	23.55	23.45	23.64	23.88
Crude fiber	4.75	4.95	4.91	4.92	4.93	5.21	5.22	5.30	5.27
EE	2.90	3.75	5.50	4.45	5.35	5.35	4.20	5.55	4.85
Ash	9.20	8.20	8.15	8.65	7.95	7.40	8.65	8.05	8.45
NFE	53.06	53.30	51.64	52.23	52.07	52.34	51.23	51.90	53.38
Ca	1.14	1.18	1.17	1.18	1.19	1.15	1.14	1.16	1.15
Total phosphorous	1.55	1.60	1.57	1.55	1.58	1.52	1.54	1.56	1.56

[1]Ferrous oxide added at 40 mg/kg diet. *Cp 40%, ME 2000 kcal/kg, C. fiber 3%, EE 3%, Ash 34%, Ca 8%, Av. P 1.38%, Lysine 12%, Methionine 3%, Methionine±Cystine 3.5%. Vitamin A 250000 IU/Kg, Vitamin D3 50000 IU/Kg, Vitamin E 500Mg/Kg, Vitamin K3 60 Mg/Kg, Vitamin B1/ Thiamin 20 Mg/Kg, Vitamin B2/ Riboflavin 100 Mg/Kg, Niacin Vitamin PP 600 Mg/Kg, Pantothenic acid/ Vitamin B3 160 Mg/Kg, Vitamin B6/ Pyridoxine 40 Mg/Kg, Vitamin B12 300 Mcg/Kg, Biotin/ Vitamin H 2000 Mcg/Kg, Choline 10000 Mg/Kg, Vitamin C 4000 Mg/Kg, Folic Acid 30 Mg/Kg, Iron 800 Mg/Kg, Manganese 1400 Mg/Kg, Copper 120 Mg/Kg, Zinc 1000 Mg/Kg, Iodine 6 Mg/Kg, Cobalt 12 Mg/Kg, Selenium 3 Mg/Kg.

weeks of age in 36 pens (1x1x1 m) with wood shavings litter. For the first 3 weeks, the chicks were fed starter diets and then they were placed on finisher experimental diets. The birds in each pen had continuous access to water and were fed *ad libitum*. Feed intake and body weight gain were determined weekly while mortality was recorded daily as it occurred.

Blood and tibia analysis: Blood samples were taken from jugular vein during slaughtering of two birds/ replicate/treatment. The blood was received in 10 ml test tube, which contained ETDA. Packed cell volume (PCV) was assessed by a microhaematocrit centrifuge (Hawksgley-England). Hemoglobin concentration (Hb) was determined using Haemoglobin -Drabkin kit. Red blood cells (RBCs) were determined by using an improved Neubauer haemocytometer (Hawksgley and Sons, Ltd., England). Plasma total protein was determined as shown by (King and Wooton, 1965). Plasma albumin, plasma globulin, plasma Na and plasma K were determined by calorimetric method of (Baratholmew and Delaney, 1966). Plasma calcium was determined by calorimetric method described by (Trinder, 1967). Inorganic plasma phosphorus was determined by the method described by (Gomori, 1942). Plasma glucose and plasma cholesterol were determined by enzymatic calorimetric methods using kit GOD-PAP (Randox laboratory Ltd. Lordon). Plasma uric acid was measured by an enzymatic method using a kit (Plasmetec Laboratory Products Ltd., U.K). Plasma GOT was assayed by the method described by Reitman and Frankel (1957).

Right tibiae were taken from slaughtered birds and cleaned from adhesive tissues. Thereafter, tibia bones were oven dried, ground and ashed for overnight at 550^{o}C in a muffle furnace. Tibia ash, Ca and P were determined according to AOAC methods of analysis (1990).

Statistical analysis: The design adopted was a Completely Randomized Design (CRD). Data were subjected to analysis of variance and treatment means compared using the Duncan's multiple range tests (Steel and Torrie, 1980) in SAS version 6.12.

Table 2: Composition of experimental broiler finisher diets containing graded levels of Leucaena leucocephala with different treatments

	Dietary levels of Leucaena leucocephala%, with different treatments Ingredients, %								
	0 control (A)	6 Untreated (B)	6 Ferrous1 (C)	6 Soaked (D)	6 Roasted (E)	12 Untreated (F)	12 Ferrous (G)	12 Soaked (H)	12 Roasted (I)
Sorghum	67.70	64.80	64.80	64.80	64.80	66.10	66.10	66.10	66.10
Ground nut meal	5.00	5.40	5.40	5.40	5.40	4.00	4.00	4.00	4.00
Sesame meal	7.00	7.40	7.40	7.40	7.40	7.40	7.40	7.40	7.40
Wheat bran	11.50	7.60	7.60	7.60	7.60	2.20	2.20	2.20	2.20
Super-concentrate[2]	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
Dicalcium phosphate	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
NaCl	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
Vegetable oil	2.50	2.50	2.50	2.50	2.50	2.00	2.00	2.00	2.00
Ferrous oxide	0.00	0.00	40. mg/kg	0.00	0.00	0.00	40. mg/kg	0.00	0.00
Calculated analysis									
ME (kcal/kg)	3195.54	3198.60	3198.47	3198.60	3198.60	3213.25	3213.11	3213.25	3213.25
CP	17.98	19.15	19.15	19.15	19.15	19.67	19.67	19.67	19.67
Crude fiber	4.38	4.67	4.67	4.67	4.67	4.65	4.65	4.65	4.65
Ca	0.85	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87
Available Phosphorus	0.37	0.37	0.37	0.37	0.37	0.36	0.36	0.36	0.36
Lysine	0.95	1.01	1.01	1.01	1.01	1.04	1.04	1.04	1.04
Methionine	0.39	0.40	0.40	0.40	0.40	0.41	0.41	0.41	0.41
Methionine ± Cystine	0.60	0.62	0.62	0.62	0.62	0.63	0.63	0.63	0.63
Determined analysis									
CP	18.75	19.66	19.85	20.10	20.04	20.41	20.51	19.96	20.71
Crude fiber	4.56	4.71	4.75	4.80	4.74	4.81	4.73	4.69	4.70
EE	4.30	4.85	4.30	4.75	4.15	3.65	4.05	5.15	3.95
Ash	7.55	9.05	8.05	7.85	7.90	6.00	8.05	6.40	8.80
NFE	58.96	55.59	57.15	56.65	56.71	57.72	56.40	59.14	55.63
Ca	0.90	0.91	0.93	0.94	0.95	1.00	0.98	0.97	0.97
Total phosphorous	1.26	1.25	1.28	1.30	1.31	1.29	1.29	1.29	1.28

[1]ferrous oxide added at 40 mg/kg diet. [2]As shown in Table 1.

Results and Discussion

The results of the effect of soaking and roasting on tannin and phytate content of leucaena are presented in Table 3. Although soaking and roasting reduced tannin of leucaena seeds by 54.67% and 30.67%, respectively, the effect did not reach significant level. Ogum *et al.* (1989) observed an increased loss in tannin when cowpea soaked and cooked. Slight decrease in tannin by roasting was reported by Vaishale *et al.* (1998). Loss of tannin as a result of soaking or roasting may be due to heat degradation of tannin molecule or formation of water soluble complexes between tannin and other tissues molecules of beans which could be leached out into cook liquor (Ogum *et al.*, 1989). On the other hand, both soaking and roasting significantly ($p \leq 0.01$) reduced phytate of leucaena seeds. Similar findings were reported by (Vaishale *et al.*, 1998), who found that roasting of legumes apparently reduced phytic acid.

Overall performance of broiler chick as affected by two levels of leucaena seeds with different treatments are given in Table 4. Feed intake was significantly ($p \leq 0.01$) influenced by the dietary treatments. Feed intake and body weight gain of birds fed 12% leucaena seed diets, except that supplemented with ferrous, were significantly ($p \leq 0.05$) depressed compared to the control. The depression in feed intake is in line with the findings of Abriam (1981), who reported that feed intake depressed with the increased levels of leucaena seeds. This reduction in feed intake may be due to wide range of factors such as appetite inhibiting effect of mimosine (El-Harith, *et al.*, 1979). Feed intake of birds fed 12% soaked and roasted leucaena seeds were not significantly different from that of 12% untreated leucaena i.e. soaking and roasting may fail to reduce all mimosine, tannin and trypsin and chymotrypsin inhibitors. Soaking and roasting were inefficient in decreasing the harmful effect of antnutritional factors.

Growth curve of broiler chicks as affected by leucaena seeds with different treatments is given in Fig. 1. It is clear that live body weight was higher for birds fed 12% ferrous supplemented leucaena and the control diet, while the lower live body weight was recorded for birds fed other 12% leucaena seed diets. Moreover, Sethi and Kulkarni (1995) reported a depressed weight gain with the increased of leucaena seeds in broiler diets. This depression in weight gain is in line with the findings of Scott *et al.* (1982), who ascribed the reduced weight gain to inadequate protein and essential amino acids, inhibiting effect of chelation of phosphorus and protein by phytate and to trypsin and chymotrypsin inhibitors. Overall FCR and PER of birds fed 12% roasted leucaena seeds were poorer than other dietary treatments. Similar

Table 3: Effect of soaking and roasting on tannin and phytate content of leucaena seeds

	Leucaena seeds with different treatments			
Antinutritional Factors	Untreated leucaena seeds	Soaked leucaena seeds	Roasted leucaena seeds	±SEM
Tannin %	0.75±0.21	0.34±0.10	0.52±0.33	0.134
Phytate mg/100g	697.50^{a}±66.66	538.75^{b}±47.48	345.00^{c}±84.44	39.20

Values are means (±SD) of 3 replicates per treatment. ^{abc}Means with different superscripts in the same row were significantly different ($P \leq 0.05$). SEM: Standard error of the means from ANOVA d.f 6.

Table 4: Overall performance of broiler chicks as affected by inclusion of levels of Leucaena leucocephala seeds subjected to different treatments

	Dietary levels of Leucaena leucocephala%, with different treatments				
Parameters	0 Control (A)	6 Untreated (B)	6 Ferrous (C)	6 Soaked (D)	6 Roasted (E)
Feed intake (g/bird)	2841.03^{a}±189.59	2966.75^{a}±479.31	2587.94^{ab}±319.64	2525.00^{ab}±241.60	2735.97^{a}±306.04
Body weight gain (g/bird)	1392.01^{a}±59.67	1377.70^{a}±135.48	1382.18^{a}±123.88	1309.25^{a}±64.27	1358.32^{a}±175.85
FCR (g feed/g weight gain)	2.04^{b}±0.06	2.14^{b}±0.15	1.87^{b}±0.18	1.93^{b}±0.10	2.02^{b}±0.04
PER (Body weight gain/ protein consumed)	2.52^{ab}±0.08	2.34^{b}±0.17	2.69^{a}±0.24	2.60^{ab}±0.14	2.48^{ab}±0.05

Table 4: (continued)

	Dietary levels of Leucaena leucocephala%, with different treatments				
Parameters	12 Untreated (F)	12 Ferrous (G)	12 Soaked (H)	12 Roasted (I)	±SEM
Feed intake (g/bird)	2114.44^{bc}±250.80	2864.19^{a}±124.87	1936.00^{c}±340.41	2022.75^{c}±425.66	157.71
Body weight gain (g/bird)	1033.13^{b}±208.09	1394.55^{a}±72.76	919.50^{bc}±74.69	829.05^{c}±43.88	59.72
FCR (g feed/g weight gain)	2.08^{b}±0.21	2.06^{b}±0.09	2.09^{b}±0.23	2.43^{a}±0.42	0.10
PER (Body weight gain/ protein consumed)	2.38^{ab}±0.24	2.38^{ab}±0.11	2.36^{b}±0.25	2.05^{c}±0.30	0.10

Values are means (±SD) of 4 replicates per treatment. ^{abcd}Means with different subscripts in the same row were significantly different ($P \leq 0.05$). SEM: Standard error of the means from ANOVA d.f 27.

Table 5: Some haematological parameters of broiler chicks as affected by inclusion of levels of Leucaena leucocephala seeds subjected to different treatments

	Dietary levels of Leucaena leucocephala with different treatments				
Parameters	0% (A)	6% Untreated (B)	6% Ferrous (C)	6% Soaked (D)	6% Roasted (E)
PCV%	22.67±0.58	23.33±2.52	24.33±5.51	22.33±3.79	21.00±1.73
Hb g/dL	10.48±0.25	13.46±0.78	15.56±0.48	10.56±2.81	13.29±2.05
RBC ($x10^{6}$ /mm^{3})	2.46±0.26	2.11±0.22	2.25±0.19	2.33±0.28	2.71±0.15
MCV (fl)[1]	92.68±7.75	111.56±17.59	107.89±22.70	95.48±6.27	77.42±5.39
MCH (pg)[2]	42.83±3.51	64.03±3.75	69.29±4.61	45.31±10.14	48.82±5.16
MCHC%[3]	46.22±0.59	58.27±8.83	66.71±18.45	47.27±8.48	63.08±5.75
	Dietary levels of Leucaena leucocephala with different treatments				
Parameters	12% Untreated (F)	12% Ferrous (G)	12% Soaked (H)	12% Roasted (I)	±SEM
PCV%	22.00±4.36	22.67±1.53	22.33±2.08	24.33±3.79	1.87
Hb g/dL	14.82±6.65	10.99±1.79	9.88±0.59	12.26±5.17	1.80
RBC ($x10^{6}$ /mm^{3})	2.43±0.19	2.22±0.47	2.06±0.17	2.62±0.01	0.14
MCV (fl)[1]	90.52±14.89	106.01±26.53	108.90±15.32	92.74±14.31	9.27
MCH (pg)[2]	60.73±25.08	52.27±19.18	47.94±1.09	46.73±19.75	7.61
MCHC%[3]	65.37±15.77	48.39±6.29	44.56±5.81	49.56±16.65	6.45

Values are means (±SD) of 3 replicates per treatment. SEM: Standard error of the means from ANOVA d.f 18. [1]Mean corpuscular volume. [2]Mean corpuscular haemglobi. [3]Mean corpuscular haemglobin concentration.

findings were observed by Greervani (1970) who related the negative response of FCR to the destruction of lysine and methionine in the roasting process of *Cajanus cajan*. Moreover, Wallis and Balnave (1984) claimed that heat processed proteins are more resistant to digestive processes than unheated ones, with lysine, glutamic acid, aspartic acid and threonine the most liable to be damaged by heat. Ferrous supplementation of 12% leucaena diet improved feed intake and body weight gain. This may be ascribed to reduction of mimosine effect; this is in line with findings of Ter Meulen *et al.* (1979) who found that supplementing leucaena with mineral (iron, zinc) salts reduced mimosine toxicity in rats and chicks. Likewise, reduction of mimosine toxicity by ferrous ions may be due to the formation of a ferric chelate of mimosine after oxidation

Table 6: Plasma constituents and tibia ash, Ca and P as affected by inclusion of levels of Leucaena leucocephala seeds subjected to different treatments

	Dietary levels of Leucaena leucocephala with different treatments				
Parameters	0% (A)	6% Untreated (B)	6% Ferrous (C)	6% Soaked (D)	6% Roasted (E)
GOT U/L	32.33±4.93	31.33±2.89	41.33±2.52	45.33±4.62	36.00±6.08
ALP U/L	85.00±1.00	84.67±3.06	85.67±1.53	82.00±3.46	85.67±1.15
Ca mg/dL	7.80^{a}±0.10	7.47^{bc}±0.06	7.57^{abc}±0.15	7.70^{ab}±0.10	7.50^{bc}±0.10
Na mEq/L	135.33^{bc}±2.08	140.33^{ab}±3.51	132.33^{c}±4.93	136.67^{abc}±3.51	135.67^{abc}±2.52
K mEq/L	4.20±0.10	4.17±0.15	4.17±0.21	4.20±0.10	4.17±0.15
Pi mg/100ml	3.80±0.10	3.70±0.10	3.60±0.10	3.67±0.15	3.80±0.10
Total protein g/dL	4.38±0.66	4.57±1.27	4.46±0.64	4.88±0.73	4.27±0.35
Albumin g/dL	2.67±0.23	2.53±0.31	2.53±0.23	2.33±0.61	2.47±0.31
Globulin g/dL	1.71±0.58	2.04±0.97	1.92±0.43	2.54±0.97	1.80±0.33
Cholesterol mg/dL	190.67±6.11	170.67±13.65	169.67±0.58	174.00±13.23	188.33±4.04
Uric acid mg/dL	1.80±0.10	1.73±0.45	1.93±0.06	1.93±0.23	1.60±0.10
Glucose mg/dL	198.67^{abc}±16.17	214.00^{abc}±39.34	193.33^{bc}±18.9	175.33^{c}±3.06	177.41_{c}±4.29
Tibia ash %	31.11^{b}±3.85	35.66^{ab}±4.04	33.33^{b}±0.00	40.00^{a}±0.00	40.00^{a}±0.00
Tibia Ca %	12.86^{e}±0.77	14.63^{de}±1.33	19.98^{a}±0.03	19.33^{ab}±1.15	14.00^{de}±0.00
Tibia P%	10.58±1.33	11.38±0.95	12.20±0.43	11.33±1.49	10.00±0.00

	Dietary levels of Leucaena leucocephala with different treatments				
Parameters	12% Untreated (F)	12% Ferrous (G)	12% Soaked (H)	12% Roasted (I)	±SEM
GOT U/L	33.00±6.08	41.00±8.54	36.33±6.66	33.67±5.03	3.20
ALP U/L	82.00±2.00	83.67±2.08	84.33±2.52	85.00±1.00	1.24
Ca mg/dL	7.80a±0.10	7.53^{bc}±0.15	7.40^{c}±0.20	7.60^{abc}±0.20	0.08
Na mEq/L	133.00^{c}±3.46	141.33^{ab}±3.06	139.00^{ab}±1.00	141.67 a±	1.81
K mEq/L	4.20±0.10	4.17±0.15	4.20±0.10	4.20±0.10	0.08
Pi mg/100ml	3.60±0.10	3.63±0.06	3.63±0.12	3.60±0.10	0.06
Total protein g/dL	4.65±0.56	4.04±0.07	4.46±0.20	4.69±1.16	0.42
Albumin g/dL	2.60±0.53	2.07±0.12	2.53±0.31	2.77±0.25	0.20
Globulin g/dL	2.05±0.16	1.97±0.05	1.92±0.39	1.75±1.25	0.40
Cholesterol mg/dL	185.33±6.43	184.00±12.49	182.67±9.45	175.00±20.42	6.44
Uric acid mg/dL	1.57±0.15	1.97±0.25	1.90±0.10	1.77±0.15	0.12
Glucose mg/dL	190.00^{bc}±26.15	236.59^{ab}±47.98	253.48^{a}±27.86	242.96^{ab}±41.06	16.82
Tibia ash %	30.00^{b}±0.00	33.33^{b}±5.77	40.00a±0.00	33.33^{b}±5.77	1.90
Tibia Ca %	15.67^{de}±3.51	16.00^{cde}±2.00	19.00^{abc}±0.00	16.67^{bcd}±2.31	0.97
Tibia P%	9.67±0.08	11.43±1.66	11.16±0.00	11.11±1.18	0.58

Values are means (±SD) of 3 replicates per treatment. ^{abcd}Means with different subscripts in the same row were significantly different ($P \leq 0.05$). SEM: Standard error of the means from ANOVA d.f 18.

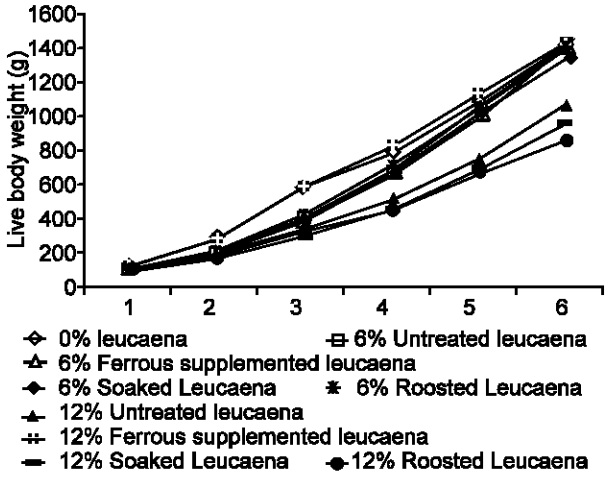

Fig.1: Growth curve of broiler chicks and fed different levels of processed Leucaena *leucocephala* seeds.

of ferrous ions to ferric ions (Sethi and Kulkarni, 1995). However, in the present study no clinical signs of toxicity were observed.

The effect of dietary treatments on some haematological parameters and tibia ash, Ca and P content is presented in Table 5. There was no significant ($p \geq 0.05$) effect of the dietary treatments on any of haematological parameters as well as tibia P. Mean values of plasma constituents as affected by two levels of leucaena seeds with different treatments are summarized in Table 6. There was no significant ($p \geq 0.05$) effect of dietary treatments on plasma GOT ALP, K, P, total protein, albumin, globulin, cholesterol and uric acid. It is clear that tibia ash and Ca results were not consistent with the dietary treatments.

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