

EFFECT OF DIETARY INCLUSION OF GUM ARABIC (*Acacia senegal*) ON PERFORMANCE AND BLOOD CHEMISTRY OF BROILER CHICKS

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The aim of this study was to investigate the effect of feeding graded levels of gum arabic (0%, 2.5%, 5% and 7.5%) on the performance and blood chemistry of broiler chicks. A total of 192 unsexed broiler chicks (Cobb strain) were randomly assigned in four dietary treatments. Each treatment contained six replicates (8 birds/replicate). Feed and water were offered *ad libitum* throughout the experimental period (42 days). Feed intake, weight gain and feed conversion ratio were not influenced by the dietary inclusion of gum arabic. The results also revealed that the different levels of gum Arabic had no effect on serum constituents, except total protein which increased significantly. Cholesterol, creatinine and triglyceride levels were decreased significantly in birds fed 5% and 7.5% gum arabic. It is concluded that the incorporation of gum Arabic in broiler chickens diets has a positive effect on broiler chicks performance and reduced serum cholesterol levels, creatinine and triglyceride.

Key words: serum, Cholesterol, creatinine, triglyceride

Gum Arabic is the dried exudates obtained from stems and branches of *Acacia Senegal* or *Acacia Seyal*. These plants are cultivated in Sudan as a cash crop in agro-forestry systems (Duke, 1981). In Sudan gum arabic production covers a wide area as it is considered as a principle national product. Gum arabic has been used in many industries such as processed food, dairy products and pharmaceutical preparation e.g. emulsion and pills (Leung 1980). It was

used in folk medicine to treat different diseases. Gum arabic contains high molecular weight lipoprotein and low molecular weight heterogeneous gum polysaccharides (Nasir, 2008). It is indicated that the supplementation with gum arabic increased nitrogen concentration in renal failure patients consuming a low protein diet (Bliss et al., 1996). In birds soluble dietary fiber such as oligofructose and inulin were fermented in the cecum (Cehen et al., 2005). However, there are no limitations to the effect of supplementing gum arabic in layers diet on serum and yolk albumin level. The use of gum Arabic as a feed additive met the safety demand suggested by the international food safety (Androsen, 1986). The objective of the present study was to determine and to assess the effect of dietary supplementation of gum arabic on broiler growth performance on some blood constituents and metabolites (protein, glucose, cholesterol, creatinine, albumin, calcium, phosphorus and triglyceride).

MATERIALS AND METHODS

Experimental birds and management:

One hundred and ninety two one day old unsexed commercial strain (Cobb) broiler chicks were randomly assigned to four experimental diets. Forty eight birds were used per treatment in a completely randomized design; each treatment was further subdivided into six replicates (8 birds/ pen). The initial weight of the chicks in each pen was approximately equal. The chicks were reared in deep litter with feed and water offered *ad-libitum*. The experimental birds were vaccinated against

Table 1. Chemical composition of gum Arabic

Component	Percentage
Dry mater	87
Crude protein %	2.5
Ash %	3.6
Crude fiber %	0
Arabinose	25
Lactose	14
Methyl glucogonic acid	1.5
pH	4.4
ME kcal/kg diet	3000

Table 2. Composition of experimental broiler starter diets containing different levels of gum Arabic

Levels of gum arabic				
Feed Ingredient %	0.00	2.50	5.00	7.50
Sorghum	60	56.95	53.56	49.95
Groundnut meal	24.2	17.55	15.91	23
Sesame meal	5.5	14	16.33	10
Wheat bran	1.56	0.4	0.4	0.4
Super concentrate*	5.00	5.00	5.00	5.00
Gum Arabic	0.00	2.5	5.00	7.5
Di-calcium phosphate	0.74	0.7	0.69	0.74
Oyster shell	0.24	0.24	0.24	0.24
Salt	0.20	0.20	0.20	0.20
Premix**	0.25	0.25	0.25	0.25
Lysine	0.12	0.12	0.12	0.06
Methionine	0.09	0.09	0.02	0.06
Vegetable oil	2.1	2	2.28	2.6
Calculated analysis				
ME kcal/kg diet	3197.02	3190.38	3193.3	3190.71
Crude protein %	23.037	23.13	23.00	23.04
Crude fiber %	4.59	4.42	4.36	4.44
Calcium %	1.04	1.16	1.19	1.12
Total phosphorus %	0.45	0.45	0.45	0.45
Lysine %	1.22	1.20	1.19	1.15
Methionine %	0.51	0.58	0.52	0.51

*contains (%): CP 32, CF 2, Ca 7, P 5, Lysine 11, Methionine 3.7, and ME 1900 kcal/kg,

**provided per kg of diets: vitamin A 8000 IU, vitamin D3 1400 IU, vitamin E 2IU, vitamin K3 2 mg, vitamin B2 4 mg, vitamin B1 2 mg, Ca – d – pantothenate 5 mg, Nicotin amide 15 mg, Choline choride 100 mg, Folic acid 0.5 mg, vitamin B12 5mcg, Iron 22 mg, Manganese 33 mg, Copper 2.2 mg, Cobalt 0.5 mg, Zinc 25 mg, Iodine 1.1mg.

Newcastle disease at 14 day-old (IB) and at the 28 day (lasota). Gumboro disease vaccine was given at the 21 day. Vitamins were offered for three days after vaccination as supportive dose in drinking water.

Experimental diet

Four starter and four finisher diets were formulated according to nutrient requirement suggested by **NRC (1994)**. The control diet (A) contained 0% gum arabic while the other three diets B, C and D contained 2.5, 5 and 7.5% gum arabic respectively. Chicks

Table 3. Composition of experimental broiler finisher diets containing different levels of gum Arabic

Feed Ingredient %	Levels of Gum Arabic %			
	0.00	2.50	5.00	7.50
Sorghum	64.82	64.26	62.42	63.61
Groundnut meal	12	13.6	14	15
Sesame meal	7	7	7	7
Wheat bran	8.19	5	4	0
Super concentrate*	5.00	5.00	5.00	5.00
Gum Arabic	0.00	2.5	5.00	7.5
Di-calcium phosphate	0.35	0.4	0.4	0.45
Oyster shell	0.2	0.16	0.15	0.15
Salt	0.20	0.20	0.20	0.20
Premix**	0.20	0.20	0.20	0.20
Lysine	0	0.08	0.08	0.1
Methionine	0	0	0	0
Vegetable oil	2.04	1.6	1.55	0.79
anticoccidia	0.002	0.002	0.002	0.002
antifungal	0.1	0.1	0.1	0.1
Calculated analysis				
ME kcal/kg diet	3190.243	3190.7	3190.20	3190.9
Crude protein %	20.09	20.24	20.07	20.05
Crude fiber %	4.50	4.24	4.100	3.708
Calcium %	0.91	0.91	0.91	0.92
Total phosphorus %	0.38	0.39	0.38	0.39
Lysine %	1.01	1.09	1.08	1.09
Methionine %	0.41	0.40	0.40	0.40

were fed starter diets at the first three weeks and afterward they were placed on finisher experimental diets. The proximate analysis of gum arabic was shown in Table 1. The compositions and proximate analysis of gum arabic starter and finisher diets were shown in Table 2. And table 3.

Blood chemistry: Serum glucose was determined using GOD – POD method as described by (Trinder, 1969) and total serum protein was determined by Biuret method as described by King and Wooton, (1965). Cholesterol concentration was determined according to the methods described by Naito (1984). Serum triglycerides were determined using GPO–POD methods as described by Bucolo et al, (1973) and serum calcium was determined by calorimetric method as described by Trinder (1967). Inorganic phosphorus was obtained by the colorimetric method using a kit (Randox laboratory - London) and creatinine was determined

using commercial kits (Biosystem reagents Reagent and Instruments).

Data collection

At the end of the experimental period two birds from each replicate of each dietary treatment were randomly selected and weighed individually then slaughtered and allowed to bleed. Samples of blood were collected from two birds/replicate (12 birds/treatment) into clean dry test tubes and allowed to clot and serum was separated, collected and analyzed.

Experimental design and statistical analysis

The statistical analysis for recorded data was carried out using analysis of variance for completely randomized design by general linear model using Statistix program version 8. Means separation were done by LSD and the values were expressed as means and standard error. The means considered significantly different when ($P < 0.05$).

RESULTS AND DISCUSSION

The performance of broiler chicks fed graded levels of powder gum Arabic (0, 2.5, 5 and 7.5%) are presented in Table 4. The results showed that there were no significant differences between dietary treatments in feed intake, body weight gain and feed conversion ratio. Feed intake recorded the lowest value for birds fed control diet (3269.3 g) and the highest value (3628.2 g) for the group received 7.5 % gum Arabic diets. Reported feed intake is lower than the results reported by Ali et al (2013) and Kur et al (2013). The best results of weight gain were obtained in birds fed 7.5% gum Arabic (1741.3 g). Results for weight gain were higher than the results reported by Ali et al (2013) and Kur et al (2013). Feed conversion ratio recorded high results for birds received control diet and 2.5% gum Arabic (1.93 and 1.96 Vs 2.17 and 2.08 for diet 5 % and 7.5% gum Arabic). The findings of the present study were in agreement with the result reported by El-kheir (2009) who found that bird fed high level of gum Arabic recorded increased feed

intake. He suggested that increased gum level may enhance the palatability of the diet.

The effects of gum arabic on broilers blood chemistry are shown in Table 5. Birds fed 5% and 7.5 % gum arabic obtained lowest level of serum cholesterol compared to control and 2.5% groups (50.74 and 57.76 Versus 68.15 and 67.08 mg/dl) this result in line with El-kheir (2009) who reported that gum arabic reduced serum cholesterol may be due to its effect by interference with dietary cholesterol absorption. Moreover, Alothman (1998) reported that gum arabic was observed to be effective in lowering the total plasma cholesterol level compared with insoluble fiber. In the current study diet contained 5% gum arabic recorded the lowest levels of serum glucose (129.6mg/dl) compared with other groups 57.76-68.15 mg/dl). This result is in agreement with Wadood et al., (1989) who reported that gum arabic significantly reduces glucose concentration. In the present study serum albumin (2.28 - 2.63 g/L), phosphorus (5.03 -5.18 mg/dl), calcium (8.03 – 8.43 mg/dl) and creatinine (

Table 4. Effect of dietary gum Arabic levels on overall performance of broiler chicks

Item	Treatment				
	Gum Arabic level %				
	0	2.5	5	7.5	±SEM
Feed intake (g)	3269.3 ^b	3336.3 ^b	3478.2 ^{ab}	3628.2 ^a	134.32
Weight gain(g)	1698.3 ^a	1703.9 ^a	1615.3 ^a	1741.3 ^a	89.31
F.C.R	1.93 ^b	1.96 ^b	2.17 ^a	2.08 ^{ab}	0.091

^{a-b} = Means with different superscripts in the same row were significantly different ($P \leq 0.05$).
SEM = Standard error of treatment means

Table 5. Effect of dietary gum Arabic levels on serum constituents of broiler chicks

Item	Treatment				
	Gum Arabic level %				
	0	2.5	5	7.5	±SEM
Cholesterol(mg/dl)	68.15 ^a	67.08 ^a	50.74 ^b	57.76 ^{ab}	3.93
Albumin (g/l)	2.37 ^a	2.28 ^a	2.63 ^a	2.38 ^a	0.19
Glucose (mg/dl)	158.8 ^a	138.08 ^{ab}	129.6 ^b	139 ^{ab}	8.48
Triglyceride (mg/dl)	57.73 ^a	39.88 ^b	44.58 ^{ab}	40.38 ^b	5.45
Total protein (g/l)	3.12 ^a	2.72 ^b	3.13 ^a	3.14 ^a	0.21
Phosphorus (mg/dl)	5.18 ^a	5.03 ^a	5.12 ^a	5.03 ^a	0.28
Calcium (mg/dl)	8.6 ^a	8.03 ^b	8.43 ^{ab}	8.38 ^{ab}	0.37
Creatinine (mg/dl)	1.35 ^a	1.33 ^a	0.92 ^{ab}	0.83 ^b	0.32

^{a-b} = Means with different superscripts in the same row were significantly different ($P \leq 0.05$).
SEM = Standard error of treatment means. Values are means of 6 replicates per treatment (2 birds/replicate)

0.83-1.35 mg/ dl) levels were not significantly affected by dietary treatments. However Kawase et al, (2007) revealed that the efficiency of Ca absorption in rats was improved by using gum Arabic. In the present study creatinine level numerically decreased for birds fed 5% and 7.5% gum arabic. These results were in line with the findings of Suliman (2000) who reported that supplemented of gum arabic orally to patient with chronic renal failure, and it was claimed that it helps to reduce urea and creatinine plasma concentration. Serum triglyceride was decreased by inclusion of gum Arabic 39.88 – 44.58 Vs 57.73 mg/dl in the control group). This result is in line with results obtained by Abdel Wahed (2010), Topping et al, (1985) who observed that supplemented dietary level of gum Arabic resulted significant decrease in serum triglyceride. In present study birds fed 2.5% gum Arabic recorded the lowest result for total proteins (2.72 g/l) while the other groups were not significantly different for the trait (3.12-3.14 g/l).

CONCLUSION

It is concluded that the incorporation of gum arabic in broiler chickens diets has a positive effects on broiler chick performance and on the reduction of serum cholesterol levels, creatinine and triglyceride.

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