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The Effects of Feeding Watermelon Seed Meal and Full Fat Seed on Broiler Chicks Growth

Research Article

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ABSTRACT

Watermelon seed full-fat (WMSF) and watermelon seed meal (WMSM) samples were analyzed for proximate composition and then incorporated in broiler chicks diets at increasing levels up to 20%. Feeding increasing levels of WMSF to broiler chicks for up to 20% increased weight gain ($P<0.05$), feed intake, protein consumed, protein efficiency ratio and improved feed conversion ratio. A positive linear effect was observed for weight gain, protein consumed and protein efficiency ratio in birds fed WMSF. Feed intake was linearly increased with increasing the level of WMSM. However, no similar response was noted for weight gain, protein consumed, protein efficiency ratio and feed gain ratio in chicks given increasing levels of WMSM. The study indicated that WMSF and WMSM may be used as feed ingredients in broiler chick diets at up to 20%.

KEY WORDS broiler chicks, feed conversion ratio, water melon seed.

INTRODUCTION

Watermelon (*Citrulus vulgaris*) is extensively cultivated throughout the Sudan. It is grown mainly for its fruit, which is used as a dessert. Water melon is extensively utilized especially in Darfur and Kordofan regions. The melon watery juice is considered in many dry areas as a water substitute for man and animals. Watermelon seeds are rich in oil and protein (Mustafa *et al.* 1972; Oyenuga and Fetuga, 1975; Al-Khalifa, 1996) and mechanically pressed for oil extraction (annual seed production is 156 ton). Investigation revealed watermelon seeds are rich source of protein. Feeding experiments with chicks showed normal growth with up to 15% whole watermelon seeds in the diet. Using of the unprocessed meal at the same level depressed growth and feed efficiency (Sawaya *et al.* 1986). The oil extracted from watermelon seeds has been shown to be suitable for human and animal consumption (Sawaya *et al.* 1983). The present study was conducted to investigate the effects of feeding levels of unprocessed watermelon seed meal and watermelon full-fat seeds on performance of broiler chicks.

MATERIALS AND METHODS

Two hundred unsexed broiler chicks (Lohmann) were randomized into 20 groups each containing 10 birds of approximately similar body weight. The group of chicks allocated to one of five dietary treatments each with four replicates. The birds were kept in pens (1 m²) in an open-sided deep litter poultry house and offered mash feed and water ad libitum. Individual body weight and feed consumption were recorded at weekly intervals up to 6 weeks of age. Mortality was recorded as it occurred. At the end of the experiments 3 birds were randomly selected from each pen.

They were killed by cervical dislocation and the abdominal fat was excised and weighed. The average house temperature during the experiment was 27.5 ˚C.

In both experiments, diets used were based on either full fat watermelon seed (WMSF) or watermelon seed meal (WMSM).

Five diets consisted of a control diet based on sesame and groundnut meals as a protein source and four other diets in which increasing levels (5, 10, 15 and 20%) of water seed meal were included.

The diets were calculated to be isonitrogenous and isoenergetic. One ton of watermelon seed (undicorticated) were purchased from the local market. Half the amount (full fat seed) was ground in a hammer mill. The corticated watermelon seeds were processed by continuous horizontal screw-pressing expelling. Oil was extracted mechanically from the other portion and both full fat seeds and the meal obtained were used in the study. Proximate analysis was performed on watermelon seed meal and the diets (AOAC, 1990).

Data were subjected to analysis of variance (Steel and Torrie, 1960). Treatment means were compared according to Duncan's new Multiple Range Test following a significant T-test ($P<0.05$).

RESULTS AND DISCUSSION

Chemical analysis of watermelon seed and meal obtained in the present study are presented in Table (1).

Table 1 Proximate analysis of watermelon full fat seed and watermelon seed meal on dry matter basis

Variable (%)	Watermelon full fat seed	Watermelon seed meal
Dry matter	97.3	96.3
Crude protein (N×6.25)	17.7	27.0
Ether extract	26.0	6.4
Crude fiber	22.8	32.2
Ash	4.3	5.2
Calcium	0.3	0.1
Total phosphorus	0.2	0.3
Calculated ME (kcal/kg)	3362	2215
Nitrogen free extract	29.2	29.2

The results indicated that watermelon seed and meal had a good protein quantity (17.7 *vs.* 27%).

Values obtained from the analysis were in line with values reported previously by Hayat (1994) and Rajab (2002). Madaan and Lal, (1984) found mean CP, fat and CF contents to be 16.4, 23.1 and 47.7% respectively, which was higher than the values of fat and CF of seeds and meal in the present results, while CP % obtained from the seeds was lower.

The variations from the analysis reported by Al-khalifa (1996); Yousuf (1992) and Ogunsua *et al.* (1984) might be due to the different varieties of watermelon seed used.

Ration formulation and calculated composition of WMSF and WMSM meal are shown in Tables (2 and 3).

Table 2 Ration formulation and calculated composition of water melon seed meal

Ingredients	Rations				
	0.0%	5.0%	10.0%	15.0%	20.0%
Sorghum	65.0	65.0	62.0	60.0	57.0
Wheat bran	2.0	-	-	-	-
WM meal	-	5.0	10.0	15.0	20.0
WM seed	-	-	-	-	-
Salt	0.3	0.3	0.3	0.3	0.3
Oyster shell	1.5	1.5	1.5	1.5	1.5
Concentrate (broilers)	5.0	5.0	5.0	5.0	5.0
Groundnut meal	12.3	13.3	12.3	15.3	14.3
Sesame meal	14.0	10.0	9.0	3.0	2.0
Lysine	0.6	0.6	0.6	0.6	0.6
Methionine	0.2	0.2	0.1	0.1	0.1
Calculated composition					
ME kcal/kg	3101	3090	3042	3000	2952
Crude protein %	22.1	21.9	22.0	21.9	22.0
Lysine %	1.2	1.2	1.2	1.2	1.2
Methionine %	0.6	0.6	0.6	0.6	0.6
Fat %	4.5	4.4	4.4	4.2	4.2
Crude fiber %	4.3	5.4	6.8	8.2	9.5
Ca %	1.4	1.3	1.3	1.2	1.3
P %	0.6	0.9	0.6	0.5	0.5

ME: metabolizable energy.

Table 3 Ration formulation and calculated composition of water melon full fat seed

Ingredients	Rations				
	0.0%	5.0%	10.0%	15.0%	20.0%
Sorghum	65.0	61.0	58.0	55.0	50.0
Wheat bran	2.0	2.0	-	-	-
WM meal	-	-	-	-	-
WM seed	-	5.0	10.0	15.0	20.0
Salt	0.3	0.3	0.3	0.3	0.3
Oyster shell	1.5	1.5	1.5	1.5	1.5
Concentrate (broilers)	5.0	5.0	5.0	5.0	5.0
Groundnut meal	12.3	11.3	12.3	12.3	11.3
Sesame meal	14.0	14.0	13.0	11.0	12.0
Lysine	0.6	0.6	0.6	0.5	0.5
Methionine	0.2	0.1	0.1	0.0	-
Calculated composition					
ME kcal/kg	3101	3104	3131	3140	3137
Crude protein %	22.1	22.0	22.2	21.8	22.0
Lysine %	1.2	1.2	1.2	1.2	1.2
Methionine %	0.6	0.6	0.6	0.6	0.6
Fat %	4.5	5.7	6.8	7.8	9.0
Crude fiber %	4.3	5.3	6.1	7.0	8.0
Ca %	1.4	1.4	1.4	1.4	1.4
P %	0.6	0.6	0.6	0.6	0.6

ME: metabolizable energy.

It was observed that WMSF contained high crude protein, ash and nitrogen free extract and low crude fiber compared to values reported by (Sawaya *et al.* 1986). Oil content was within the range reported for *C. colocynthesis* seed (Singh and Yadava, 1973; Sawaya *et al.* 1986), while,

WMSM contained high crude protein, ether extract, ash and nitrogen free and low crude fiber compared to values reported by Sawaya *et al*. (1986). This discrepancy might be resulted from differences due to variety, area of production or agronomic system of water melon seed.

Effects of WMSM on performance of broiler chicks

The effect of feeding graded levels of watermelon seed meal on performance of broiler chicks is shown in Table (4).

A positive effect was observed for weight gain, feed conversion ratio and protein efficiency ratio. Feed intake (g/bird/6 weeds) showed a significant increased between the control and the birds receiving 15% watermelon seed meal ($P<0.05$). Birds given 10% level of watermelon meal showed significantly higher final body weights ($P<0.05$) compared to the birds fed the control diet. The study revealed that the feed intake in the present experiment increased at 15% and 20% watermelon meal, which contested the results reported by Nwokolo and Sim (1987). Mortality rate was low (5%) and not influenced by the dietary treatment which could be due to heat stress.

To our knowledge no sufficient information on the use of watermelon seed meal in the poultry diets. A similar response was reported for growing calves and lactating cows fed 20% WMSM. Feeding WMSM at 15% was shown to depress growth and feed efficiency whereas chicks feed WMSF at the same level showed normal growth (Sawaya *et al*. 1986). The present study showed that inclusion of watermelon seed meal up to 10% significantly induced better growth and feed efficiency; this is in line with the results obtained by Ahmed (1998) in an experiment in which watermelon seed meal was included at 2.5%, 5.0%, 7.5% and 10%. The results of the present investigation suggest that for practical broiler diets watermelon seed meal could be included up to 10%.

Effects of WMSF on performance of broiler chicks

The effects of feeding graded levels of watermelon full fat seed on performance of broiler chicks is shown in Table (5). Final bodyweight compared to the control, showed significant differences ($P<0.05$) were recorded among the dietary levels. Inclusion of 20% watermelon seed full fat recorded the highest final body weight (1705.0±24.0).

Table 4 Effects of feeding watermelon seed meal on performance of broiler chicks

Parameters response variable	Level of watermelon seed meal				
	0%	5%	10%	15%	20%
Initial body weight(g/bird/week 0)	46.3^{a}±2.39	43.8^{a}±2.39	47.5^{a}±1.44	42.5^{a}±1.44	43.8^{a}±1.25
Final body weight (g/bird/week 6)	1635.0^{a}±54.5	1532.5^{a}±81.6	1657.5^{b}±10.3	1637.5^{a}±49.4	1540.0^{a}±35.6
Weight gain (g/bird/6 weeks)	1588.8^{a}±67.87	1487.5^{a}±79.7	1611.3^{b}±8.26	1595.0^{a}±50.1	1496.3^{a}±34.9
Feed intake (g/bird/6 weeks)	2630.0^{bc}±31.8	2600.4^{c}±35.3	2680.4^{bc}±27.2	2799.0^{a}±10.2	2712.4^{b}±28.0
Feed conversion ratio (g feed/g body weight gain/bird)	1.52^{b}±0.05	1.63^{ab}±0.07	1.53^{b}±0.01	1.61^{a}±0.05	1.69^{a}±0.04
Protein consumed (g/bird/6 weeks)	581.2^{bc}±7.03	569.5^{c}±7.74	589.7^{b}±5.99	613.0^{a}±2.23	596.7^{ab}±6.17
Protein efficiency ratio (g weight gain/g protein consumed/bird)	3.13^{a}±0.11	3.02^{ab}±0.07	3.10^{a}±0.44	2.96^{ab}±0.08	2.80^{b}±0.05
Dressing %	68.8^{a}±0.35	69.3^{a}±0.76	68.3^{a}±0.22	69.0^{a}±0.58	69.2^{a}±0.28
Abdominal fat %	0.91^{ab}±0.04	0.74^{b}±0.03	0.73^{b}±0.12	0.95^{ab}±0.07	1.02^{a}±0.13
Mortality %	0.00^{a}±0.00	5.00^{a}±2.89	2.50^{a}±2.50	2.50^{a}±2.50	5.00^{a}±5.00

The means within the same column with at least one common letter, do not have significant difference ($P>0.05$).

Table 5 Effects of feeding watermelon full fat seed on performance of broiler chicks

Parameters response variable	Level of watermelon full fat seed				
	0%	5%	10%	15%	20%
Initial body weight (g/bird/week 0)	45.0±0.00	42.5±1.44	45.0±2.04	43.8±1.25	47.5±1.44
Final body weight (g/bird/week 6)	1540.0^{b}±40.8	1687.5^{a}±29.3	1682.5^{a}±24.6	1685.0^{a}±49.2	1705.0^{a}±24.0
Weight gain (g/bird/6 weeks)	1495.0^{b}±40.8	1645.0^{a}±29.8	1637.5^{a}±24.9	1618.5^{a}±33.9	1657.5^{a}±24.2
Feed intake (g/bird/6 weeks)	2595.4±50.5	2713.1±31.7	2620.0±54.4	2728.9±56.6	2706.5±80.8
Feed conversion ratio (g feed/g body weight gain/bird)	1.62^{a}±0.02	1.51^{a}±0.02	1.52^{b}±0.02	1.54^{ab}±0.03	1.57^{ab}±0.05
Protein consumed (g/bird/6 weeks)	573.6^{a}±11.2	596.9^{a}±6.98	581.7^{a}±12.1	600.3^{a}±15.3	598.73^{a}±15.6
Protein efficiency ratio (g weight gain/g protein consumed/bird)	2.95^{b}±0.05	3.24^{a}±0.09	3.07^{ab}±0.05	3.20^{a}±0.11	3.08^{ab}±0.08
Dressing %	67.9^{b}±0.80	71.0^{a}±0.53	70.4^{a}±0.59	70.1^{a}±0.29	69.4^{ab}±1.11
Abdominal fat %	0.94^{ab}±0.02	0.79^{b}±0.06	0.97^{a}±0.05	0.82^{ab}±0.04	0.92^{ab}±0.08
Mortality %	7.50^{ab}±4.79	2.50^{ab}±2.50	0.00^{b}±0.00	10.0^{ab}±7.07	15.00^{a}±6.45

The means within the same column with at least one common letter, do not have significant difference ($P>0.05$).

The highest and significant weight gain (P<0.05) was recorded in birds receiving 20% watermelon full fat in their ration, compared to the birds fed with the control diet (1657.5 *vs.* 1495 g/bird/6 weeks).

Inclusion of up to 20% watermelon full fat seed did not affect feed intake (P>0.05), because the level of fiber in watermelon full fat seed based diet was less than the level known to reduce feed intake (>10%), (NRC, 1994). This agrees with the findings of Sawaya *et al*. (1986) who recommended that watermelon seed should not be included at levels higher than 20%, because these levels brings up the fiber content of the ration to be over 10%, which reduce feed intake. Significant differences (P<0.05) observed in protein efficiency ratio between the control and birds receiving 5% and 15% watermelon full fat. However, birds receiving 5% watermelon full fat seed showed a significant reduction in the protein efficiency ratio in their diet, which agreed with the results obtained by Rajab (2002). Dressing % was significantly higher (P<0.05) in birds receiving the graded levels of (5% 10% and 15%) watermelon full fat compared to the control diet. No differences observed among feeding groups regarding mortality rate, however, the mortality occurred during the experimental period could be attributed to heat stress.

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