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Effect of Ajwain (*Trachyspermum ammi*) Supplementation on Production Indices, Cost of Production and Mortality Pattern of Broiler Chicken

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ABSTRACT

The present study attempts to analyze the effect of supplementation of Ajwain on the performance of broiler chicken. Two hundred and twenty five one-day old unsexed broiler chicks were used on a completely randomized design in 5 groups with 3 replicates, each consisting of 15 broilers. The treatments included the control group (basal diet) and four groups with basal diet + Ajwain powder @ 0.1% in feed, basal diet + Ajwain powder @ 0.2% in feed and basal diet + Ajwain seeds soaked in drinking water over nightly @ 0.1% and basal diet + Ajwain seeds soaked in drinking water over nightly @ 0.2%, respectively. Temperature and humidity of the shed were recorded daily to calculate Temperature Humidity Index (THI). Standard feeding and all other managemental practices were followed during the experimental period. Performance index (P.I), protein efficiency (P.E), energy efficiency (E.E) and production number (P.N) was found to be significantly different among the treatment groups. No mortality was recorded in the experiment and there was no detrimental effect of Ajwain supplementation on health and performance of broilers. The cost of production calculated at the end of experiment revealed that net profit on live body weight (`/kg) were 0.33 (basal diet + Ajwain powder @ 0.1% in feed) as compared to control group having only standard broiler diet. Through this experimentation it can be concluded that Ajwain can be promoted as a NAGP in broiler industry for producing quality meat without antibiotics in a very cost effective way.

Key words: *Broiler, Ajwain, Production indices, Cost of production, Mortality*

INTRODUCTION

Ajwain (*Trachyspermum ammi*) is an aromatic, grassy and annual medicinal plant belonging to Apiaceae (Umbelliferae) family. It is mostly grown in areas like in Egypt, Iran, Iraq, Pakistan and eastern India. In India mostly it is grown in Rajasthan, Gujarat and Madhya Pradesh. The name Ajwain originated from Sanskrit word Yavanaka or Ajomoda. It is known by various vernacular names such as Bishop's weed (Sanskrit), Carom or Thyme seed (English name) and Ajowan or Ajwain or Omum (Indian name). Ajwain is highly esteemed as a remedial digestive agent for flatulence, flatulent colic, atonic dyspepsia, diarrhoea etc. and also as an antiseptic[3].

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The phytochemical studies on Ajwain have revealed the presence of alkaloids, steroids, fixed oils glycosides, tannins, saponin and flavonoids, cumene, thymene, amino-acids and dietary fiber essential oils like thymol, carvacrol, c-terpinene, p-cymene, etc.

Thymol, the major phenolic compound present in Ajwain, has been reported to be germicide, antispasmodic and antifungal agent[15]. Oil of Ajwain contains thymol and its specific gravity and odour resembles the volatile oil. The oil contains a liquid hydrocarbon, 1-methyl-4-isopropylbenzol, and another hydrocarbon which is isomeric with oil of turpentine[3].

Ajwain is reported to have platelet aggregation inhibitory action[19], antifungal potency[7] and blood pressure lowering action[1]. Recently, it was assessed that Ajwain powder at dose rate of 2 g/kg body weight and its equivalent methanol extract were effective lipid lowering agents[12]. It was also assessed that antithyperlipidaemic effect of Ajwain seed extracts in chloroform, methanol, petroleum ether and water is found in albino rabbits[11]. Aflatoxicosis can be treated using Ajwain in diet[17]. Jandaghi *et al.*[10], observed that respiratory problems in guinea pigs were cured when Ajwain was supplemented. Zahin *et al*.[24], showed that Ajwain has antioxidant activities which play an important role in biological systems by suppressing the formation of active oxygen species like hydrogen peroxide. Ajwain seed extract has flavonoids which has antioxidant activity[16]. Ajwain supplementation could improve blood cholesterol profile and gastrointestinal microbial population on broiler chicken[21]. Khan *et al*.[14], studied the anti-inflammatory and antioxidant activity of *Trachyspermum ammi* seeds in collagen induced arthritis (CIA) in rats. The intestinal epithelium acts as a natural barrier against pathogenic bacteria and toxic substances that are present in the intestinal lumen. The efficiency of utilization of dietary protein in poultry depends partly on the features of the gastrointestinal tract[20]. The small intestine, especially crypts and villi of the absorptive epithelium, plays a significant role in the final phase of nutrient digestion and assimilation[22]. Intestinal development can be accessed through measurements of the crypt, a region in which new intestinal cells are formed, as well as villus height and surface area, to determine the area available for digestion and absorption[20,9]. According to Yamauchi[23], the morphological changes of the intestinal villi in broilers are dependent on the presence of digested nutrients in the small intestinal lumen. Therefore, the present study was planned to observe the effect of Ajwain on the production indices, cost of production and mortality pattern of broilers.

MATERIAL AND METHODS

Two hundred and twenty five day-old broiler chicks were obtained from a local commercial hatchery and were weighed; wing banded and randomly allotted to five treatment groups viz. T_1, T_2, T_3, T_4 & T_5, with three replications having fifteen chicks in each. The control group T_1 was fed a basal diet[5] while the birds in group T_2: control + Ajwain powder in feed @ 0.1 %; T_3: control + Ajwain powder in feed @ 0.2 %; T_4: control + soaked seeds of Ajwain in drinking water over nightly @ 0.1 % and T_5: control + soaked seeds of Ajwain in drinking water over nightly @ 0.2 % were supplemented. Before formulation of experimental rations (pre-starter, starter and finisher) the feed ingredients were analyzed for proximate composition[2] and experimental diet offered is presented in Table 1. Ajwain seeds were grinded in a grinder-mixer to make fine powder. Ajwain seeds were soaked in drinking water over nightly and aqueous solution was prepared after sieving through muslin cloth twice.

The chicks were routinely vaccinated and reared under strict hygienic conditions on deep litter system maintaining all standard managemental practices including brooding, lighting, raking of litter, cleaning of feeders, drinkers etc.

Table 1: Quantity of ingredients and chemical composition (% DM basis) of experimental diet (kg/100 kg feed)

Name of Ingredients	Quantity		
	Pre-starter (0-1 week)	**Starter (2-3 weeks)**	**Finisher (4-6 weeks)**
Maize	51	53	57
Soyabean meal	23	19	16
Ground nut cake	10	12	11
Rice polish	3	3	4
Fish meal	8	7	5
*Mineral mixture	2	2	2
Vegetable oil	3	4	5
****Feed additives (g/100kg of ration)**	**0-1 week**	**2-3 weeks**	**4-6 weeks**
Spectromix (g)	10	10	10
Spectro BE (g)	20	20	20
Cocciwin (g)	50	50	50
Choline chloride (g)	50	50	50
Lysine (g)	50	50	50
DL - methionine (g)	80	80	80
Antibiotic (chlortetracycline)	150	150	150
Chemical composition	**Pre-starter**	**Starter**	**Finisher**
Moisture %	10.34	10.84	10.88
Crude protein %	23.28	21.96	19.76
Crude fibre %	3.64	3.61	3.32
Ether extract %	6.98	8.38	8.98
Total ash %	6.30	6.18	5.86
Nitrogen free extract %	49.53	48.97	50.88
Methionine %	0.45	0.40	0.35
Lysine %	1.26	1.15	0.94
Metabolizable energy (Kcal/Kg)	2960	3050	3162

*Mineral mixture (salt free): Ca (32%), P (6%), Mn (0.27%), Zn (0.26%), Iodine (0.01%), Fe (1000 ppm), Cu (100 ppm), and Co (50 ppm).

**Spectromix Powder: Each gm contained Vitamin A-82,500 IU, Vit. B2-50 mg, Vit. D3-12,000 IU, and Vit. K-10mg, Spectro BE Powder: Each gm contained Vit.B1-8 mg, Vit.B6-16 mg, Vit.B12-80 mg, Niacin- 120mg, Vit. E-160 mg, Lysine hydrochloride-10 mg, DL-methionine- 10 mg, Calcium pentothenate - 80mg, and Calcium – 260mg., Cocciwin: Dinitro- O –Toluamide, Lysine: Contained 98 per cent lysine, DL- methionine: Contained 98 per cent methionine, Choline chloride: Contain 60 percent choline, Antibiotic chlortetracycline: Control group only

Chicks were individually weighed at arrival and after that at weekly interval. Feed intake was also measured at weekly interval during the experiment and feed conversion ratio (FCR= feed intake/weight gain) was calculated for the same interval. Protein efficiency (P.E) and energy efficiency (E.E) were calculated as suggested by Kamran *et al*.[13], Performance Index (P.I) as per Bird[4] and Production number (P. N) as advocated by Euribrid[8].

P.E =Body weight gain (g)/ Protein intake (g)

E.E =Body weight gain (g)/ Total ME intake (Kcal) x 100

P.I = (Body weight Gain) ^{2}/ Feed consumed

P.N = Average weight gain (g) x percentage livability/ Days of fattening x FCR x 10

All the pens were checked for mortality twice a day. Relative cost of production was calculated at the end of sixth week. The cost of production included the cost of chick survived and the cost of feed consumed among the treatments to know which dietary supplementation was more profitable. The data pertaining to various parameters were analyzed statistically[18]. All the data were subjected to ANOVA using the General Linear Models procedure of SAS software. The significant mean differences were tested as per Duncan's multiple range test and significance was declared at $P<0.05$.

RESULTS AND DISCUSSION

PRODUCTION INDICES

The mean P.I values of T_4 (soaked Ajwain seeds in drinking water @ 0.1%) was significantly lower ($P<0.05$) as compared to control group (T_1) at 14 and 21 days of experiment (**Table 2**). Significant ($P<0.05$) differences were observed in the values of protein efficiency and energy efficiency during 5th week of experiment for Ajwain groups as compared to the control group (**Table 3 & 4**). The average values of protein efficiency (body weight gain, g/ protein intake, g) of experimental broilers under different dietary treatments have been presented in Table 3. The data recorded ranged from 2.95 (T_5) to 3.35 (T_1), 2.72 (T_4) to 3.02 (T_1), 2.58 (T_4) to 2.82 (T_1), 2.71 (T_4) to 2.93 (T_5), 2.69 (T_4) to 2.88 (T_5) and 2.62 (T_4) to 2.71 (T_5) during 7, 14, 21, 28, 35 and 42 days of experiment, respectively. The different level of P.E at different age intervals attributes to pre-starter (CP= 23.28 %), starter (CP= 21.96 %) and finisher ration (CP= 19.76 %) fed at 0-1, 2-3 and 4-6 weeks of age, respectively. The mean values of E.E ranged from 23.17 (T_5) to 26.38 (T_1), 19.56 (T_4) to 21.74 (T_1), 18.56 (T_4) to 20.30 (T_1), 16.95 (T_4) to 18.31 (T_5), 16.80 (T_4) to 18.02 (T_5) and 16.388 (T_4) to 16.91 (T_5) during 7, 14, 21, 28, 35 and 42 days, respectively (Table 4). The different level of E.E at different age intervals attributes to pre-starter (ME= 2960 Kcal/kg), starter (ME= 3050 Kcal/kg) and finisher ration (ME= 3162 Kcal/kg) fed at 0-1, 2-3 and 4-6 weeks of age, respectively. Results for production number (P.N.) were statistically similar to P.I. Significant ($P<0.05$) difference was observed in production number (P.N.) of broilers at 14, 21 and 35 day age intervals; however values are numerically different among 7, 28 and 42 day age interval but statistically there is no difference (**Table 5**).

These values although, calculated indirectly but are in accordance with the facts that Ajwain supplementation improves feed utilization, facilitate better nutrient absorption, improves gut health and strengthen the immune system[24,16,14,21].

Table 2: Effect of Ajwain on mean performance index (P.I) of broiler chicken

Time period (days)	Treatments				
	T_1	T_2	T_3	T_4	T_5
0-7	61.62 ± 2.54	53.42 ± 1.09	54.88 ± 2.82	56.10 ± 3.30	53.31 ± 4.38
0-14	188.16^{a} ± 5.91	180.99^{ab} ±6.52	184.48^{a} ± 8.06	164.01^{b} ± 4.02	183.27^{a} ± 5.08
0-21	366.97^{a} ±10.34	341.0^{ab} ±10.75	362.9^{ab} ±16.19	327.96^{b} ±14.06	350.7^{ab} ± 7.08
0-28	570.94 ±18.78	561.29 ±12.49	573.38 ±22.84	536.74 ±13.46	615.69 ± 55.30
0-35	855.4^{ab} ±19.77	858.6^{ab} ±24.20	847.5^{ab} ±20.38	814.9^{b} ±20.52	937.0^{a} ± 57.01
0-42	1107.67±34.12	1107.59±26.28	1116.59±44.41	1060.68±17.12	1134.24 ± 14.12

Each value is a mean of three replicates. (n=45)

Means bearing different superscripts differ significantly ($P<0.05$) row wise.

Table 3: Effect of Ajwain on mean protein efficiency (P.E.) of broiler chicken

Time period (days)	Treatments				
	T_1	T_2	T_3	T_4	T_5
0-7	3.35^{a} ± 0.07	3.08^{b} ± 0.02	3.08^{b} ± 0.07	3.06^{b} ± 0.09	2.95^{b} ± 0.13
0-14	3.02^{a} ± 0.06	2.88^{a} ± 0.05	2.90^{a} ± 0.05	2.72^{b} ± 0.03	2.92^{a} ± 0.03
0-21	2.82^{a} ± 0.05	2.63^{b} ± 0.05	2.70^{ab} ± 0.05	2.58^{b} ± 0.05	2.68^{ab} ± 0.04
0-28	2.85 ± 0.05	2.78 ± 0.03	2.79 ± 0.05	2.71 ± 0.04	2.93 ± 0.13
0-35	2.79^{ab} ± 0.03	2.75^{ab} ± 0.04	2.73^{b} ± 0.02	2.69^{b} ± 0.03	2.88^{a} ± 0.09
0-42	2.70 ± 0.04	2.67 ± 0.02	2.67 ± 0.04	2.62 ± 0.01	2.71 ± 0.02

Each value is a mean of three replicates.(n=45)

Means bearing different superscripts, differ significantly ($P<0.05$) row wise.

Table 4: Effect of Ajwain on mean energy efficiency (E.E) of broiler chicken

Time period (days)	Treatments				
	T_1	**T_2**	**T_3**	**T_4**	**T_5**
0-7	$26.38^{a} \pm 0.56$	$24.21^{b} \pm 0.19$	$24.21^{b} \pm 0.57$	$24.11^{b} \pm 0.73$	$23.17^{b} \pm 1.02$
0-14	$21.74^{a} \pm 0.41$	$20.72^{a} \pm 0.38$	$20.86^{a} \pm 0.39$	$19.56^{b} \pm 0.22$	$21.03^{a} \pm 0.24$
0-21	$20.30^{a} \pm 0.53$	$18.96^{b} \pm 0.34$	$19.45^{ab} \pm 0.35$	$18.56^{b} \pm 0.39$	$19.31^{ab} \pm 0.26$
0-28	17.83 ± 0.32	17.35 ± 0.22	17.46 ± 0.28	16.95 ± 0.24	18.31 ± 0.81
0-35	$17.46^{ab} \pm 0.18$	$17.21^{ab} \pm 0.22$	$17.03^{b} \pm 0.12$	$16.80^{b} \pm 0.18$	$18.02^{a} \pm 0.55$
0-42	16.85 ± 0.23	16.68 ± 0.16	16.71 ± 0.26	16.38 ± 0.09	16.91 ± 0.15

Each value is a mean of three replicates. (n=45)

Means bearing different superscripts, differ significantly (P<0.05) row wise.

Table 5: Effect of Ajwain on mean production number (P.N) of broiler chicken

Time period (days)	Treatments				
	T_1	**T_2**	**T_3**	**T_4**	**T_5**
0-7	139.24±4.69	123.41 ± 2.25	125.63 ± 5.02	127.15 ± 6.16	121.71 ± 8.18
0-14	156.14^{a} ±4.62	150.04^{ab}±4.97	$152.74^{a} \pm 6.17$	$136.80^{b} \pm 3.04$	$152.21^{a} \pm 3.84$
0-21	175.73^{a} ±4.81	163.39^{ab}±4.91	173.45^{ab}±7.37	$157.36^{b} \pm 6.52$	$168.05^{ab} \pm 3.31$
0-28	198.93 ± 6.41	195.50 ± 4.21	199.61 ± 7.73	187.15 ± 4.65	214.20 ± 18.82
0-35	218.08^{ab}±4.95	218.79^{ab}±6.03	216.00^{ab}±5.07	$207.84^{b} \pm 5.18$	$238.56^{a} \pm 14.31$
0-42	233.60±7.10	233.54 ± 5.45	235.42 ± 9.24	223.78 ± 3.58	239.16 ± 2.97

Each value is a mean of three replicates. n=45

Means bearing different superscripts, differ significantly (P<0.05) row wise.

Mortality

No effect of Ajwain supplementation on broiler diet was observed on mortality. The mortality percent for experiment was 0 % (**Table 6**). The Nil mortality may be attributed to beneficial properties of Ajwain as concluded by various researchers which now strengthen its use as alternative to antibiotic growth promoters in commercial poultry production as well as better managemental practices followed with proper vaccination schedule and conducive macro and micro environment during the period of study.

Table 6: Effect of Ajwain supplementation on mortality of broiler chicken

Time period (days)	Treatments					Total Mortality
	T_1	T_2	T_3	T_4	T_5	
0-7	0	0	0	0	0	Nil
8-14	0	0	0	0	0	Nil
15-21	0	0	0	0	0	Nil
22-28	0	0	0	0	0	Nil
29-35	0	0	0	0	0	Nil
36-42	0	0	0	0	0	Nil
Total	0	0	0	0	0	Nil
Mortality (%)	0	0	0	0	0	Nil

Cost of production

The cost of production of broilers, considering the cost of chicks and feed consumed up to six weeks of age, reared under different treatments is presented in Table 7.

At the start of experiment there were forty five birds in each treatment group. The cost of chicks was calculated on the basis of birds survived at the end of experiment under each treatment. The initial cost of one-day-old broiler chicks was `27.00 per chick. This cost remained same till completion of experiment due to nil mortality. Feed cost was calculated to be `29.17 per kg of feed. Antibiotic chlortetracycline was purchased @ of `245/kg. Ajwain was purchased @ of `160/kg. The total cost of production of birds up to six weeks of age, based upon the cost of chicks, cost of feed consumption as well as cost of Ajwain/antibiotics consumed up to this age, was found to be `142.17 ($T_1$), 143.80 ($T_2$), 144.76 ($T_3$), 144.89 ($T_4$) and 147.83 ($T_5$). The cost per kilogram of live weight ranged from ` 66.35 (T_2) to 68.79 (T_4), respectively.

The effect of supplementation of Ajwain depicted that the cost of production of live weight (` /kg) at six weeks of age was decreased as much as `0.33 (T_2) as compared to T_1 (control) and increased as much as 0.65 (T_3), 2.12 (T_4) and 0.48 (T_5) as compared to T_1 (control).

Table 7: Cost of production of broiler chicken under different treatments at the end of experiment

S.No	Particulars	Treatments				
		T_1	T_2	T_3	T_4	T_5
1	Live body weight at 6th week of age (g)	2132.41	2167.54	2149.97	2106.48	2201.64
2	Total feed consumption up to 6th weeks of age per bird (g)	3898.99	3981.78	3993.55	3954.00	3967.00
3	Feed cost (`) per kilogram feed	29.17	29.17	29.17	29.17	29.17
4	Total feed cost per bird (`)	113.73	116.14	116.49	115.33	115.71
5	Chick cost (`)	27.00	27.00	27.00	27.00	27.00
6	Cost of antibiotic up to 6th weeks of age (`)	1.44	0	0	0	0
7	Cost of Ajwain up to 6th weeks of age (`)	0	0.63	1.27	2.59	5.17
8	Total cost of production up to 6th weeks of age (`)	142.17	143.80	144.76	144.92	147.88
9	Cost of production/kg of live body weight	66.68	66.35	67.33	68.80	67.16

CONCLUSION

The results of the present investigation inferred that dietary supplementation of Ajwain improves nutrients utilization efficiency in terms of protein & energy, reduces cost of production and mortality without affecting growth performance in broilers.

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