B-5140
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RESEARCH ARTICLE Indian Journal of Animal Research

Comparative Evaluation of Different *Aloe vera* Forms Over Quail Performance during Summer

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10.18805/IJAR.B-5140

ABSTRACT

Background: *Aloe vera* (AV) bears antioxidant properties and may improve quail performance during summer. But its action depends upon route of supplementation and dosage. This study thus assesses different AV supplementation forms (Powder and gel) on performance of quail during summer.

Methods: Three hundred day old quail chicks were randomly distributed into 5 groups having 4 replicates of 15 birds. Dietary treatments were: C (Basal diet; BD), T_1 (BD + 0.4% AV powder as dietary additive), T_2 (BD + 0.6% AV powder), T_3 (BD + 0.4% AV gel *via* drinking water) and T_4 (Basal diet + 0.6% AV gel *via* drinking water). Dry-wet bulb temperature was recorded at 7:30 am and 2:30 pm throughout the 6 weeks trial to calculate Temperature humidity index (THI). Growth traits were observed during trial, but carcass traits and blood biochemical parameters were analysed at sixth week of age.

Result: THI results revealed that quail birds were in moderate, severe and very severe heat stress during morning, but they experienced very severe heat stress at day time. Feed conversion ratio (FCR) was significantly better ($p<0.05$) in T_4 than control and T_1, but intermediate values were observed in T_2 and T_3. Cholesterol was significantly reduced in T_4 than C, although intermediate values were seen in T_1, T_2 and T_3. Carcass characteristics (as % live weight) showed no difference. It was concluded that 0.6% AV gel supplementation improved FCR during summer months.

Key words: *Aloe vera* gel, *Aloe vera* powder, Quail, Summer.

INTRODUCTION

High ambient temperature negatively impacts poultry performance by altering feed intake, impaired digestion, immune-suppression (Hirakawa *et al*., 2020), increased respiratory disease incidences (Ranjan *et al*., 2019) besides affecting meat quality (Song and King, 2015). Continuous selection of birds for fast growth/production also leads to high metabolic load, which further warrants thermal stress and physiological changes (Rajkumar *et al*., 2015). Summer stress also alters intestinal morphology and its digestive/ absorptive capacity which in turn increases permeability of bird's intestine to luminal antigens and toxins, thus causes magnification of health problems and mortality rate (Wasti *et al*., 2020).

Quail (Bater) (*Coturnix coturnix*), a diversified poultry species, reared intensively for table eggs and meat delicacy (ICAR, 2013) possess fast growth characteristics (Khan *et al*., 2022). Its meat fetches premium price and is hypochol esteraemic than chicken meat (Khalifa *et al*., 2016). But its full genetic potential cannot be exploited under summer stress.

Amongst numerous strategies of neutralising the effect of high environmental temperature on bird's performance *viz*., environmental and management approaches, nutritional supplements can be exploited to alleviate heat stress (Sheikh *et al*., 2017).

Aloe vera (AV) is a cheap phyto-additive bearing anti-oxidant properties, which may be subjugated to halt heat stress in poultry. Gel portion of AV leaf contains 98.5 to 99.5% water, but its dry matter is rich in biologically active ingredients which has beneficial properties (Nalge *et al*., 2017). Earlier researchers also acknowledge the positive effects of its supplementation on overall performance with or without heat stress (Nalge *et al*., 2017; Singh *et al*., 2017). But, advantage of its supplementation relies on form of use (powder, gel), dosage, *etc*. Based on aforementioned information, present study was conducted to evaluate the efficacy of graded levels of different forms (Powder and gel

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How to cite this article: Kichloo, A.A., Khan, N., Sharma, R.K., Mahajan, V., Kour, K. and Gupta, A. (2023). Comparative Evaluation of Different *Aloe vera* Forms Over Quail Performance during Summer. Indian Journal of Animal Research. DOI: 10.18805/ IJAR.B-5140.

Submitted: 02-05-2023 **Accepted:** 06-10-2023 **Online:** 19-10-2023

form) of AV supplementation on quail performance during summer.

MATERIALS AND METHODS

Experimental design

The present study was carried out at Division of Animal Nutrition, FVSc and AH, SKUAST-Jammu (1st April-12th May, 2021). Three hundred day old, unsexed quail chicks of same hatch were arbitrarily distributed into five groups (n=60) containing four replicates of fifteen birds in each group. Maize-soya based basal diet was formulated to meet the nutrient requirements as per ICAR (2013) (Table 1). Control group contains no additive, T_1 and T_2 groups were supplemented with 0.4 and 0.6% AV powder as dietary additive, whereas, T_3 and T_4 groups were provided AV gel @ 0.4 and 0.6% through drinking water. These supplements were given consecutively for six weeks (Trial period).

Preparation/Source of Aloe vera (AV) powder and gel

Pure AV powder was bought from AMORVET, UK, India. For gel preparation, AV plants were collected from local nurseries. After proper washing, its outer skin is peeled off and gel is collected. It was then blended in the mixer followed by filtration to extract the liquid product.

Recording of climatic variables

Temperature was recorded by using maximum-minimum thermometer. Whereas Temperature humidity index (THI) was calculated by recording dry-wet bulb temperature daily at 7:30 am and 2:30 pm by using the formula of NRC (1971) (Table 2).

$$THI = 0.72 (Tdb + Twb) + 40.6$$

Where,
Tdb = Dry bulb temperature (°C).
Twb = Wet bulb temperature (°C).

Parameters studied

Performance of quail during experiment was evaluated for feed intake, body weight gain, feed conversion ratio, protein efficiency ratio, water intake and water feed ratio. Eight birds per group (2 birds per replicate) were slaughtered at the end of experiment to collect samples for blood biochemical analysis and carcass characteristics. Biochemical parameters were estimated by using diagnostic kits. But, Hemoglobin (Hb) was estimated by Sahli's method and PCV was determined by Micro-hematocrit method (ICSH, 1980).

Statistical analysis

The data pertaining to different parameters were subjected to statistical analysis as per the method described by Snedecor and Cochran (1994). The means in different treatments were subjected to Duncan multiple range test (Duncan, 1955). The correlation was determined between THI and different parameters by using Pearson correlation coefficient.

RESULTS AND DISCUSSION

The maximum and minimum temperature (!) data signifies that birds remained in stress throughout the trial (Table 2). THI varied from 84.01-86.68 and 86.54-89.35 in morning and afternoon, respectively. Morning THI values depicted that birds were in moderate heat stress during 1st and 3rd week, severe heat stress in 2nd week and very severe heat stress in 4th, 5th and 6th week. Whereas, in afternoon, birds experienced very severe heat stress throughout the trial. Similar scale of THI was used for stress classification of poultry by Habeeb *et al.* (2018).

Feed intake (FI; g) of quail was not influenced on supplementing AV in feed and/or drinking water (DW) at different concentrations (Table 3). Similar observations were reported by Amini and Vali (2016) on supplementing 0.2, 0.4 and 0.6% AV powder in Japanese quails. Likewise, earlier researchers too reported similar observations on supplementing AV in graded levels or single dose in feed or DW in different poultry species (Barman *et al.*, 2019; Islam *et al.*, 2020; Amber *et al.*, 2021). A positive correlation was observed between FI and THI in all groups, indicating no beneficial effect of AV on FI (Table 4).

Body weight gain (BWG) of starter and finisher phase were statistically similar, but for entire trial, it was statistically higher ($P<0.05$) in T_4 than T_1 and C with intermediate values for T_2 and T_3 (Table 3). It may be attributed to antimicrobial, antioxidant, antistress and/or growth promotor properties of AV (Nalge *et al.*, 2017). Besides above-mentioned

Table 1: Ingredient and chemical composition of basal diet (% DM basis) during starter and finisher phase.

Attributes	Experimental diets	
	Starter (0-21 days)	Finisher (22-42 days)
Ingredient composition (%)		
Maize	52.80	64.08
Meat bone meal	5.00	4.90
Soyabean meal	39.80	29.76
Salt	0.25	0.25
Sodium bicarbonate	0.01	0.01
Soyabean oil	1.50	0.30
DL-Methionine	0.15	0.16
Lysine	0.16	0.15
Dicalcium phosphate	0.05	0.00
Limestone powder	0.18	0.26
Vitamin supplement	0.05	0.05
Trace minerals	0.10	0.10
Chemical composition (%)		
Organic matter	93.68	94.96
Crude protein	24.91	21.45
Ether extract	5.81	5.69
Crude fibre	4.79	4.25
Total ash	5.12	4.72
ME (kcal/kg) calculated value	2900	2950

properties, AV is also rich in nutrients (protein, vitamins, enzymes, *etc.*) which could have added to the nutritional composition (Surjushe *et al*., 2008). These results are in line with the findings of earlier researchers that AV supplementation in graded levels or single dose in feed or DW resulted in higher BWG in broilers (Sakadzo and Chibi, 2020; Amber *et al*., 2021). In contrast, Barman *et al*. (2019) found no difference in BW of broilers on AV supplementation due to different species and climatic conditions. Feed conversion ratio (FCR) of entire trial was significantly better ($P<0.05$) in T_4 (3.76) than C (3.98) and T_1 (3.96). Thus, it may be inferred that AV intake through DW is more effective than feed supplementation. The present results corroborate with the findings of Islam *et al*. (2020); Amber *et al*. (2021) and Gowri *et al*. (2022), who too found improved FCR on AV supplementation. FCR and THI showed positive

Table 2: Environmental parameters recorded during the experimental period.

Days	Maximum temperature^{l} (°C)		Minimum temperature^{l} (°C)		THI$^{l\wedge}$	
	M*	A^{+}	M*	A^{+}	M*	A^{+}
1$^{\#}$	32.11	35.78	28.39	34.51	84.01	86.54
7	32.14	36.00	28.43	34.57	84.11	87.40
14	34.14	36.00	32.57	34.43	85.24	89.05
21	31.57	33.57	29.43	31.14	82.77	86.27
28	34.00	36.57	31.40	33.10	86.27	88.43
35	35.57	37.71	33.00	34.43	86.68	89.35
42	34.71	36.86	32.29	34.29	86.06	88.64

M*- observation recorded at 07:30 am, A^{+} observation recorded at 02:30 pm.

THI^-Temperature humidity index, ^{l}represents the mean of 7 days observation.

1$^{\#}$ represents the values of 1st day.

Table 3: Effect of supplementation of different forms of aloe vera on cumulative feed intake, body weight gain, feed conversion ratio, protein efficiency ratio, water intake and water feed ratio of meat quail.

Particulars	Groups				
	C	T1	T2	T3	T4
Feed intake (g)					
0-3 weeks	188.00±11.62	195.86±11.10	200.54±11.96	208.09±10.06	214.69±11.97
3-6 weeks	445.34±22.21	467.56±18.42	475.67±24.33	481.97±15.76	472.71±13.34
0-6 weeks	633.34±27.72	663.41±19.07	676.21±30.52	690.06±17.07	687.39±7.38
Body weight gain (g)					
0-3 weeks	79.59±3.30	83.89±4.53	86.72±4.08	91.59±3.31	94.01±2.90
3-6 weeks	79.16±2.50	83.59±5.01	88.40±2.06	88.38±2.43	88.74±2.40
0-6 weeks	158.74^{a}±4.53	167.49^{ab}±5.15	175.11^{bc}±4.97	179.96^{bc}±3.49	182.75^{c}±3.75
FCR					
0-3 weeks	2.36±0.05	2.33±0.03	2.31±0.04	2.27±0.03	2.28±0.07
3-6 weeks	5.62±0.15	5.61±0.12	5.37±0.18	5.46±0.18	5.33±0.17
0-6 weeks	3.98^{b}±0.08	3.96^{b}±0.03	3.86^{ab}±0.12	3.84^{ab}±0.10	3.76^{a}±0.07
PER					
0-3 weeks	1.70±0.04	1.71±0.02	1.73±0.03	1.76±0.03	1.76±0.05
3-6 weeks	0.83±0.02	0.83±0.02	0.87±0.03	0.85±0.03	0.87±0.03
0-6 weeks	1.11±0.02	1.12±0.01	1.15±0.04	1.16±0.03	1.18±0.02
Water intake (ml)					
0-3 weeks	357.83±20.14	386.85±28.50	393.47±20.60	405.85±23.33	428.78±24.42
3-6 weeks	818.94±31.16	856.54±23.10	903.01±37.89	885.82±28.83	889.97±17.05
0-6 weeks	1176.77±43.81	1243.38±28.81	1296.48±52.71	1291.67±22.08	1318.75±20.83
Water feed ratio					
0-3 weeks	1.91±0.02	1.97±0.04	1.96±0.02	1.95±0.02	2.00±0.02
3-6 weeks	1.84±0.03	1.83±0.03	1.90±0.04	1.84±0.03	1.88±0.03
0-6 weeks	1.86±0.03	1.88±0.03	1.92±0.03	1.87±0.02	1.92±0.03

^{abc}Mean with different superscript within a row differ significantly ($P<0.05$).

correlation, signifying that with the increase in environmental temperature, there is rise of FCR values (Table 4).

Protein efficiency ratio (PER) values were similar (Table 3) and negative correlation was observed between PER and THI, showing no beneficial effect of AV supplementation on protein utilization (Table 4). Also, water intake (WI) and water feed ratio showed no significant difference (Table 3). A similar result has been shown by Islam *et al*. (2017) on supplementing AV extract in DW of broilers. A positive correlation was observed between WI and THI in C, T_1, T_2 and T_3, but T_4 had non-significant positive correlation with THI (Table 4). It signifies that 0.6% AV supplemented group was not in extreme stress.

The plasma glucose (mg/dl) values and liver function indices (SGOT, SGPT; IU/L) of quails showed no significant difference with the control group, suggesting no deleterious effect of AV supplementation on vital organs of quail birds (Table 5). Similarly, Amini and Vali (2016) reported similar glucose values of Japanese quails on supplementing 0.2, 0.4 and 0.6% AV powder. Concurrent with the present study, Amber *et al*. (2021) stated that broilers given AV gel had no SGOT and SGPT changes. As far as the lipid profile is concerned, cholesterol (mg/dl) was significantly reduced in T_4 than C with intermediate values in rest of the groups. But no significant difference was observed for triglycerides (mg/dl). In line with the present study, Amber *et al*. (2021) illuminated that poultry supplemented with 1.5% AV gel in drinking water had reduced cholesterol. AV has acemannan, a polysaccharide that can modify blood cholesterol by regulating fat metabolism in the liver (Beppu *et al*., 2006). AV also enhances the sensitivity of cells to insulin, leading to reduction of free fatty acids released from fat tissue to the blood (Misawa *et al*., 2012). However, cholesterol values obtained in present study were in normal physiological range (33.33-266.67 mg/dl; Agina *et al*., 2017).

Hb (g/dl) and PCV (%) values were statistically similar and within the range as reported by Agina *et al*. (2017) for Japanese quails (8.61-20.57 g/dl and 25.00-66.00% for Hb and PCV, respectively). Similarly, Islam *et al*. (2020) reported no change in Hb and PCV of broiler chicken when AV was administered @ 0.5 and 1% in drinking water.

Different carcass traits (as % live weight) and dressing percentage showed statistically similar values (Table 6).

Table 4: Correlation coefficient of growth parameters with THI in quails.

Parameter	Control		Treatment 1		Treatment 2		Treatment 3		Treatment 4	
	Value of r	Level of significance	Value of r	Level of significance	Value of r	Level of significance	Value of r	Level of significance	Value of r	Level of significance
Body weight gain										
THI	-0.275	NS	-0.195	NS	-0.215	NS	-0.253	NS	-0.252	NS
Feed intake										
THI	0.423	*	0.461	*	0.450	*	0.460	*	0.423	*
Feed conversion ratio										
THI	0.441	*	0.461	*	0.469	*	0.48	*	0.457	*
Protein efficiency ratio										
THI	-0.538	**	-0.516	**	-0.538	**	-0.546	**	-0.502	**
Water intake										
THI	0.453	*	0.453	*	0.468	*	0.456	*	0.403	NS
Water feed ratio										
THI	-0.068	NS	-0.303	NS	0.046	NS	-0.220	NS	-0.282	NS

THI: Temperature humidity index, *Significance at P<0.05; **Significance at P<0.01; n=60.

Table 5: Effect of supplementation of different forms of aloe vera on haemato-biochemical profile of meat quail.

Parameters	Groups				
	Control	T1	T2	T3	T4
Glucose (mg/dl)	182.50±12.20	189.25±10.91	190.50±10.22	194.75±11.18	200.75±19.33
Cholesterol (mg/dl)	190.73^{b}±8.39	181.10^{ab}±8.48	176.93^{ab}±10.11	169.03^{ab}±9.16	159.17^{a}±5.94
Triglycerides (mg/dl)	156.03±6.70	149.78±9.47	139.63±7.29	136.57±8.01	137.75±6.83
SGOT (IU/L)	41.79±4.48	39.77±4.89	44.47±6.35	43.64±5.84	48.27±6.15
SGPT (IU/L)	19.12±1.10	17.86±1.46	17.83±1.70	17.41±1.02	19.78±1.32
Hb (g/l)	12.37±0.65	12.55±0.55	13.33±0.38	13.02±0.66	13.42±0.46
PCV (%)	37.11±1.94	37.64±1.65	39.98±1.13	39.07±1.99	40.26±1.38

^{ab}Mean with different superscript within a row differ significantly (P<0.05).

Table 6: Effect of supplementation of different forms of aloe vera on carcass characteristics of meat quail.

Attribute	Groups				
	C	T1	T2	T3	T4
Live weight (g)	163.40^{a}±0.81	174.00^{b}±1.41	178.80^{c}±1.20	182.40^{cd}±0.93	183.80^{d}±1.69
Bled weight (g)	157.60^{a}±0.51	168.60^{b}±1.36	173.00^{c}±1.05	175.60^{cd}±1.30	178.00^{d}±1.30
% of live weight	96.45±0.21	96.90±0.14	96.76±0.20	96.27±0.21	96.85±0.71
De-feathered weight without skin (g)	127.20^{a}±1.59	137.20^{b}±1.98	141.00^{bc}±1.67	144.00^{c}±2.00	146.00^{c}±0.71
% of live weight	77.84±0.71	78.84±0.79	78.85±0.60	78.94±0.83	79.46±0.78
Drumstick weight (g)	4.44^{a}±0.04	4.69^{b}±0.08	4.92^{bc}±0.11	5.03^{c}±0.06	5.10^{c}±0.12
% of live weight	2.72±0.03	2.70±0.03	2.75±0.05	2.76±0.03	2.77±0.04
Eviscerated weight (g)	107.00^{a}±1.34	115.40^{b}±1.40	119.16^{bc}±1.39	121.60^{c}±1.66	122.80^{c}±1.59
% of live weight	65.49±0.85	66.33±0.72	66.64±0.61	66.66±0.73	66.81±0.60
Dressing %	71.01±0.76	72.10±0.90	72.39±0.64	72.45±0.75	72.46±0.75
Giblet weight (g)	9.03±0.51	10.03±0.44	10.27±0.22	10.56±0.40	10.38±0.41
% of live weight	5.52±0.28	5.77±0.30	5.75±0.15	5.79±0.21	5.65±0.22
Heart weight (g)	1.00^{a}±0.05	1.19^{ab}±0.03	1.25^{abc}±0.04	1.32^{c}±0.04	1.30^{bc}±0.03
% of live weight	0.69±0.03	0.68±0.02	0.70±0.02	0.72±0.02	0.71±0.01
Liver weight (g)	3.37±0.16	3.73±0.15	3.68±0.18	3.82±0.18	3.69±0.20
% of live weight	1.94±0.17	2.14±0.07	2.06±0.10	2.10±0.09	2.01±0.09
Gizzard weight (g)	4.53±0.32	5.16±0.29	5.26±0.19	5.46±0.25	5.42±0.23
% of live weight	2.77±0.18	2.96±0.15	2.94±0.09	2.99±0.13	2.94±0.10
Spleen weight (g)	0.45±0.01	0.51±0.02	0.53±0.02	0.54±0.02	0.29±0.01
% of live weight	0.27±0.01	0.29±0.01	0.30±0.01	0.54±0.03	0.30±0.01

^{abc}Mean with different superscript within a row differ significantly (P<0.05).

Amini and Vali (2016) and Shokraneh *et al*. (2016) also reported similar carcass traits on supplementing AV powder and/or gel in poultry.

CONCLUSION

It may be concluded that 0.6% AV gel supplemented quails performed better during summer.

Conflict of interest: None.

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