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Growth and immune competence potential of Rajasri birds reared under different management systems

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Rajasri, a prolific egg laying chicken variety, has been developed by PV Narsimha Rao Telangana Veterinary University, Rajendranagar, Hyderabad to boost the backyard poultry production. RIR, WLH, DR and nondescript native breeds were involved in development of Rajasri variety. These birds were capable of producing 140–150 eggs per year under scavenging conditions (Srinivas and Swathi 2018). It has long been known that chicken strains show difference in susceptibility to a number of diseases. Variation in immune reactivity during infection is an important source to difference in disease susceptibility. Disease susceptibility and resistance are heritable traits linked mainly to the immmunogenetic background of the individual and influenced by certain physiological and productivity traits such as growth and egg production. This study was carried out to investigate the growth and immune competence potential of Rajasri bird reared under different systems of management and feeding regimes.

Day old chicks (500) were reared up to 6 weeks of age in the nursery. At 7th week of age, 400 growers were randomly distributed into 20 groups (5 treatments × 4 replicates) each with different systems of management (Table 1). The chicks were reared in wire floor battery brooders from day 1 to 56. Feed and water were offered *ad lib.* throughout the experimental period. All the chicks were vaccinated against MD, RD and IBD as per the routine vaccination schedule. Body weight was recorded from 6 to 20 weeks of age.

The humoral immunity was studied by determining the antibody response to Sheep Red Blood Cells (SRBC) and Newcastle Disease (ND) vaccine. At 42 days of age, blood samples were collected from 8 birds in each group, serum was separated and stored at –20ºC until use. The antibody titers were estimated by using haemagglutination assay (Alexander 1992). Antibody titers to ND virus were determined by standard haemagglutination inhibition test and expressed as log2 values. Cell mediated immune response was assessed by the Cutaneous Basophil Hypersensitivity (CBH) response to Phytohaemagglutinin-P (PHA-P). The wattle thickness (mm) was measured using constant tension thickness gauge (Mitutoyo, Japan) and the wattle thickness index was calculated by post injection thickness/preinjection thickness.

The analysis of variance revealed that there were highly significant (P<0.05) differences between treatments in body weights from 6 to 20 weeks of age at biweekly intervals. However, the trend in body weights was inconsistent at all biweekly groups (Table 2). The mean body weight at 20 weeks of age followed the expected trend with highest body weight at *ad lib.* (control) group followed by 40 and 20% *ad lib.* being significantly superior to scavenging. Similarly, Patel *et al*. (2013) reported that growth performance of Gramapriya birds under deep litter system of management was significantly (P<0.05) higher than semi-intensive and backyard system of management. Our results corroborated with Wang *et al*. (2009), who reported that there is significant effect of management system on weekly weight gain. Similar results were also reported by Haunshi *et al*. (2009). The least body weights at scavenging systems were better at farmers' backyard than at farm which is quite understandable as scavenging area was comparatively vast and variable than that available at farm. As suggested by earlier workers, birds under rural conditions while scavenging get diet compromising seeds, fruits, kitchen waste, herbage and invertebrates, which would be of great benefit in crop/ animal rotation systems (Hughes 1984).

Immune response to SRBC both at 20 and 40 weeks of age was not affected by different treatment groups

Table 1. Experimental design

Treatment code	System of rearing	Feeding pattern
T_1	Intensive deep litter	*Ad lib.* feeding control
T_2	Semi-intensive deep litter	20% of *ad lib.* + Lucern meal (500 g)
T_3	Semi-intensive deep litter	40% of *ad lib.* + Lucern meal (500 g)
T_4	Extensive (in the farm)	Scavenging
T_5	Extensive (Backyard)	Scavenging

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Table 2. Mean body weight (g) of Rajasri during 6–20 weeks of age

Treatment	Age in weeks							
	6	8	10	12	14	16	18	20
T_1	277.29	471.28^{a}	691.03^{a}	861.19^{a}	1028.36^{a}	1180.23^{a}	1288.15^{a}	1361.60^{a}
T_2	277.73	355.00^{c}	449.88^{d}	533.87^{c}	621.19 ^{cd}	711.63^{c}	838.68^{c}	938.28^{c}
T_3	276.43	379.54^{b}	504.31^{b}	601.63^{b}	717.61^{b}	831.09^{b}	960.85^{b}	1083.73^{b}
T_4	276.94	373.43^{b}	496.24^{c}	615.78^{b}	671.36^{bc}	748.57^{bc}	805.16^{c}	866.59^{c}
T_5	275.39	316.48^{d}	408.48^{e}	498.95^{c}	591.85^{d}	708.81^{c}	784.50^{c}	901.57^{c}
SEM	0.523	11.861	22.246	29.653	37.215	42.532	44.862	44.117
P	0.711	0.001	0.001	0.001	0.001	0.001	0.001	0.001

Values bearing different superscripts in a column differ significantly (P<0.05).

(Table 3). Immune response to ND vaccine at 20 weeks of age was high to medium (9.25–10.13) in all groups maintained at farm conditions with highest being in control group. Similarly, the titers were high to medium in the same groups maintained at farm condition except the highest being in T_3 (40% of *ad lib.* group). Although the ND titers were consistently low at 20 and 40 weeks of age in T_5 group maintained at farmer's backyard under scavenging conditions, the titers were found above protective level. The low titers in birds maintained under the scavenging conditions at farme'r backyard can be attributed to high stress due to adverse environmental conditions. Similarly, Rajkumar *et al*. (2011) reported that the humoral immune response to sheep red blood cells (SRBC), Newcastle disease vaccine (NDV) and cutaneous basophil hypersensitivity (CBH) did not show any significant difference in naked neck chicken. Similar results were also reported by Kundu *et al*. (1999) and Reddy *et al.* (2002). SRBCs are considered to be a thymus dependent antigen that needs the help of T lymphocytes to produce antibodies whereas ND vaccine antigen is thymus independent antigen that stimulates B cells with little assistance from T helper cell.

The CMI response to PHA-P in terms of wattle thickness index did not show significant difference at both 20 and 40 weeks of age. This finding is consistent with T cell dependant antibody response to SRBC. Further, this indicates that the systems of management and nutritional regimes did not affect the immune response to SRBC and PHA-P.

It can be concluded that intensive system of management had significantly (P<0.05) higher body weight compared to other systems of management. Significant (P<0.05) difference was observed for immune response to ND vaccine. The values revealed that the responses were low at farmer's backyard, but they were above protective levels. The systems of management and nutritional regimes did not affect the immune response to SRBC and PHA-P.

SUMMARY

A study was conducted to evaluate the growth and immunity of Rajasri bird reared under different management systems. At 7th week of age, 400 growers were randomly distributed into 20 groups (5 treatments × 4 replicates). The control group was reared under intensive system offering *ad lib.* feed, while second and third groups were maintained under semi intensive system providing 20 and 40% of *ad lib.* feed respectively. The remaining two treatment groups were reared under scavenging, one group at farm and the other at farmer's backyard. The results revealed that *ad lib*. fed birds (control) recorded significantly highest body weight than 40% *ad lib.* While significantly least weight was recorded on rest of the treatments i.e. 20% *ad lib.* and scavenging on farm and farmer's backyard respectively. Significantly highest ND titer values were recorded in control group at 20 and 40 weeks of age. The values for scavenging at farmer's backyard were constantly low at 20 and 40 weeks of age, but, they were above protective levels. There were no significant differences in SRBC titers at 20 and 40 weeks of age. There was no significant difference in CMI response to PHA-P indicating system of management did not effect the immune response to SRBC and PHA-P.

Table 3. Mean SRBC titers, ND titers and PHA-P values of different treatment groups at 20 and 40 weeks of age

Treatment	SRBC titers		ND titers		PHA-P	
	20 wks	40 wks	20 wks	40 wks	20 wks	40 wks
T1	5.88	4.75	10.13 ^{a}	7.58 ^{c}	0.94	1.17
T2	5.50	2.92	9.88 ^{ba}	7.33 ^{c}	1.09	1.10
T3	6.25	4.08	10.00 ^{ba}	8.75 ^{a}	1.13	1.30
T4	6.19	3.50	9.25 ^{b}	8.08 ^{b}	1.26	1.31
T5	7.13	4.25	8.08 ^{c}	6.08 ^{d}	1.21	1.40
SEM	0.29	0.23	0.20	0.21	0.57	0.39
P-value	0.536	0.098	0.001	0.001	0.473	0.087

Values bearing different superscripts in a column differ significantly (P<0.05).

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