



E-ISSN: 2320-7078

P-ISSN: 2349-6800

www.entomoljournal.com

JEZS 2020; 8(6): 545-548

© 2020 JEZS

Received: 01-09-2020

Accepted: 03-10-2020

Anshita Sharma

M.V.Sc., Department of Animal Genetics and Breeding, Post Graduate Institute of Veterinary Education and Research, Jaipur, Rajasthan, India

Samita Saini

Assistant Professor, Department of Animal Genetics and Breeding, Post Graduate Institute of Veterinary Education and Research, Jaipur, Rajasthan, India

Prakash Chandra Sharma

Assistant Professor, Department of Animal Genetics and Breeding, Post Graduate Institute of Veterinary Education and Research, Jaipur, Rajasthan, India

Sudarshan Mahala

PhD Scholar, Division of Animal Genetics, ICAR- Indian Veterinary Research Institute, Izatnagar, Bareilly, Uttar Pradesh, India

Kiran Kumari Bhat

M.V.Sc., Department of Animal Genetics and Breeding, Post Graduate Institute of Veterinary Education and Research, Jaipur, Rajasthan, India

Piyush Awasthi

B.V.Sc. &AH, Mahatma Jyotiba Fule College of Veterinary & Animal Science Chomu, Bye Pass, Harota, Jaipur, Rajasthan, Rajasthan, India

Corresponding Author:**Anshita Sharma**

M.V.Sc., Department of Animal Genetics and Breeding, Post Graduate Institute of Veterinary Education and Research, Jaipur, Rajasthan, India

Comparative evaluation of immune-responsiveness in indigenous and exotic breeds of chicken

Anshita Sharma, Samita Saini, Prakash Chandra Sharma, Sudarshan Mahala, Kiran Kumari Bhat and Piyush Awasthi

DOI: <https://doi.org/10.22271/j.ento.2020.v8.i6h.7904>

Abstract

In this research we conducted a comparative study of immune responsive traits for the two exotic chicken breeds *viz.* Australorp and Cornish with one of the indigenous Kadaknath chicken breeds. Immune response to Sheep Red Blood Cells (SRBC) was measured in terms of Haemagglutination Titre (HA) and Haemagglutination Inhibition titre (HI) at five stages *viz.*; 0 (pre inoculation), 3rd, 6th, 9th and 12th days post primary inoculation (PPI) of SRBC. The HA titre was significantly ($P < 0.05$) higher in the native breed Kadaknath at all the five stages. The in-vivo cell mediated response to mitogen phytohaemagglutinin was higher in Kadaknath chicken as compared to exotic chicken. The native Kadaknath breed has stood out over Australorp and Cornish for generation of humoral and cell mediated immune response and it indicates that the indigenous breeds have considerable potential to reduce susceptibility to infectious diseases.

Keywords: Chicken, immunocompetence, sheep red blood, phytohaemagglutinin, Kadaknath, Australorp, Cornish

Introduction

Today, poultry farming is the fastest growing agricultural industry in India. The indigenous breeds of chicken in India plays an important role in marginal or rural people where they get nutrition from chicken and subsidiary income by rearing them as backyard poultry farming. According to 20th livestock census the total poultry has increased by 16.81 % while over 45.79% increases has occurred in backyard poultry during 2019 (www.dahd.nic.in)^[1]. Losses due to infectious diseases are the major factor resulting in economic loss in worldwide poultry production. The immune system is the natural way by which animals cope up with infections, and the immunological parameters may reveal the immuno-competence of the immune system for an individual. Incorporation of genetic resistance has several advantages including the enhancement of immune response to vaccines (Gavora and Spencer, 1979)^[2]. The immune system of birds consists of three basic sub-systems, the humoral, cellular and phagocytic. The antigens which are causative agents of disease are used to challenge the birds for evaluation of immune responsive traits. One of the appropriate ways to challenge the birds is with non-pathogenic, non-specific antigens. The ability of the chicken to produce antibodies can be exhibited by the response by antibodies to sheep red blood cells (SRBCs) (Siegel and Gross, 1980)^[3]. In this regard, immune response to a natural, non-specific, non-pathogenic and multi-determinant antigen like sheep red blood cells (SRBC) is widely used to study the immune competence in poultry (Van der Zijpp *et al.*, 1983)^[4]. India has a rich source of native chicken breeds, A few reports are available in literature on the immune responsive traits in exotic and indigenous breeds of chickens (Sivaraman *et al.*, 2005)^[5] and rare in Kadaknath native chicken (Singh *et al.*, 2009)^[6]. Therefore, the present research was carried out to evaluate immune responsive traits in exotic and indigenous breeds of chicken and to find out the suitability of rearing of chicken with minimizing the economic loss due to health.

Materials and Methods

Thirty birds of each breed, being maintained at livestock farm complex of Post Graduate Institute of Veterinary Education and Research, Jaipur (Rajasthan), India during 2018 were selected randomly and used in present investigation.

The immune response traits were estimated at the age of 6-7 weeks by two methods: humoral immune response to sheep red blood cells (SRBC) and by *in-vivo* cell mediated immune response to mitogen phytohaemagglutinin. The antibody response to SRBC was assessed using haemagglutination test (Van der Zijpp and Leenstra, 1980) [7] and haemagglutination inhibition test (Miller *et al.* 1992) [8]. *In-vivo* cell mediated immune response to phytohaemagglutinin was evaluated as per the method outlined by Cheng and Lamont (1988) [9] using footpad response to Mitogen PHA-P. Data collected on immunological trait were subjected to analysis of variance (ANOVA) by generalized linear model using IBM Statistical package SPSS version 25.0 [10]. The significance of difference between breeds for different traits was evaluated by Duncan's multiple range tests.

Results and Discussion

Immune response to Sheep Red Blood Cells

Immune response to sheep red blood cells (SRBC) was estimate in terms of haemagglutination titre (HA) in all the three breeds at five stages *viz*; 0 (pre inoculation), 3rd, 6th, 9th and 12th days post primary inoculation (PPI) of SRBC. Haemagglutination titre gives the indication of total antibodies produced in the immune response. The mean with standard errors (\pm S.E) for antibody response (HA titre) expressed as \log_2 for different exotic and indigenous breeds are presented in Table 1. It is evident that all the three breeds possessed natural antibodies. The difference among the breeds

for presence of natural antibodies was statistically non-significant ($P < 0.05$) although the mean titre values of 0-day pre-inoculation were highest in Kadaknath (0.34 ± 0.08) followed by Australorp (0.27 ± 0.09) and Cornish (0.12 ± 0.06).

Table 1: Total antibody titers (Mean \pm SE) before and after primary inoculation of sheep red blood cells in HA titre

Days Post Immunization	Exotic Breeds		Indigenous Breed
	Australorp	Cornish	Kadaknath
	Mean \pm S.E	Mean \pm S.E	Mean \pm S.E
0 Day Base Titre	0.27a \pm 0.09	0.12a \pm 0.06	0.34a \pm 0.08
3 Day	1.76c \pm 0.11	3.89b \pm 0.26	5.24a \pm 0.27
6 Day	5.24b \pm 0.25	5.15b \pm 0.29	6.79a \pm 0.23
9 Day	5.00b \pm 0.24	5.04b \pm 0.30	6.75a \pm 0.26
12 Day	1.79b \pm 0.15	2.81b \pm 0.20	3.65a \pm 0.15

^{a,b,c}Means in the same row with different superscripts letters (a, b,c) were significantly different at ($P < 0.05$)

The results are in corroboration with the earlier studies among divergent indigenous and imported stocks of chicken for natural antibodies (Kundu *et al.*, 1999a) [11]. A similar finding was observed by Pathak *et al.* (2017) [12] for 0 day pre-inoculation titre in Kadaknath. The HA titre increased post primary inoculation in both the exotic and indigenous breeds and attained highest values on day 6th day of post immunization (Figure 1).

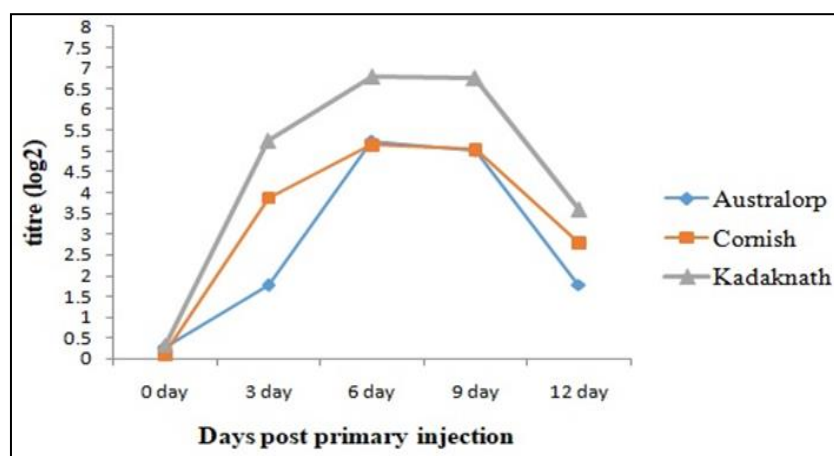


Fig 1: Antibody titres at different periods given primary inoculation of Sheep Red Blood in HA titre

Kundu *et al.* (1999a) [11] and Chatterjee *et al.* (2007) [13] reported higher values of response to SRBC in Kadaknath on 5th day post immunization than the present study. Saxena *et al.* (2012) [14] estimated response to SRBC in Kadaknath on 5th days post immunization as 1.52 ± 0.068 . The indigenous breed Kadaknath showed significant difference ($P < 0.05$) from exotic breeds. At 9th day and 12th day post immunization all the three breeds showed slight decrease in titre values. Kadaknath breed showed highest response followed by Cornish and Australorp. Singh *et al.* (2009) [6] conducted comparative study of immune response to sheep red blood cells in exotic pure (white leghorn and RIR) and crossbred chicken and HA titre was found significantly higher on day 10 in both the breeds. The estimated immune response to Sheep Red Blood Cells (SRBC) in terms of haemagglutination Inhibition titre (HI) at four stages *viz*; 3th, 6th, 9th and 12th day PPI of SRBC is presented in Table 2. The results showed that highest Mercaptoethanol Resistant antibody titre value was obtained by Kadaknath followed by Australorp and Cornish

except at 12th day post immunization which was higher in Cornish. Figure 2 illustrated that the native Kadaknath breed showed highest production of IgG at 3th, 6th, 9th and 12th days post primary inoculation (PPI) of SRBC. Response at 3 day post immunization was highest in Kadaknath while exotic breeds attained highest level of IgG production at 6 day post immunization.

Table 2: Total antibody titers (Mean \pm SE) before and after primary inoculation of sheep red blood cells in HI titre

Days Post Immunization	Exotic Breeds		Indigenous Breed
	Australorp	Cornish	Kadaknath
	Mean \pm S.E	Mean \pm S.E	Mean \pm S.E
3 Day	0.38b \pm .09	0.15b \pm .116	4.24a \pm 0.10
6 Day	1.55b \pm .09	1.30b \pm .117	5.62a \pm 0.16
9 Day	2.52b \pm .09	2.08b \pm .199	5.00a \pm 0.17
12 Day	0.45 \pm .09	0.67 \pm .107	2.72 \pm 0.13

^{a, b} Means in the same row with different superscripts letters (a, b) were significantly different at ($P < 0.05$)

Kundu *et al.* (1999b) [15] also reported the similar results for native chicken breeds. Natural IgG antibodies were present in all breeds as indicated by base titre value at 0 day. The high IgG levels were observed during first two weeks of age which declined rapidly till fourth week of age and finally attained a static level (Figure 2). Martin *et al.* (1989) [16] studied IgM and IgG response in high and low antibody in selected lines of chicken and observed total antibodies increased rapidly, attained peak and persisted at moderate level in high antibody selected line.

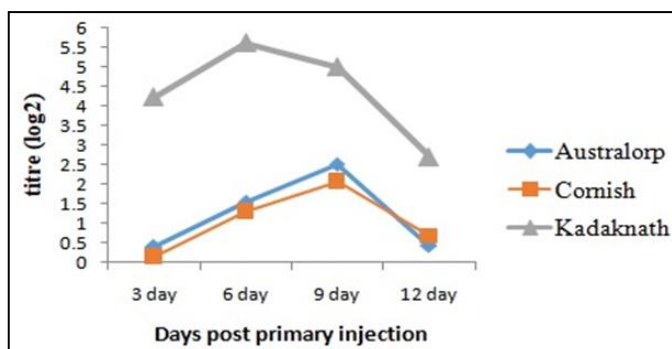


Fig 2: Antibody titers at different periods given primary inoculation of Sheep Red Blood in HI titre

The mean±SE values of Mercaptoethanol Sensitive Antibody titre (MES), representing the Ig isotype was also analysed by the difference of total antibody and presented in Table 3.

Table 3: Mercaptoethanol Sensitive Antibody titre (Mean±SE) titers at different periods after primary inoculation of Sheep Red Blood Cells

Days Post Immunization	Exotic Breeds		Indigenous Breed
	Australorp Mean± S.E	Cornish Mean± S.E	Kadaknath Mean± S.E
3 Day	1.38b±0.15	3.74a±0.30	1.00b±0.25
6 Day	3.69a±0.25	3.85a±0.31	1.37b±0.13
9 Day	2.48a±0.26	2.96a±0.32	1.89b±0.24
12 Day	1.34b±0.15	2.27a±0.21	1.03b±0.20

^{a, b} Means in the same row with different superscripts letters (a, b) were significantly different at ($P < 0.05$)

The majority of antibodies during a primary immune response are of class Ig. Ig has the ability to easily agglutinate large antigens and to cause the precipitation of soluble antigens, thus greatly enhancing the immune system's ability to remove antigens through phagocytosis. Mean ± SE values of Mercaptoethanol Sensitive Antibodies were calculated at 3th, 6th, 9th and 12th day post immunization. Highest value was observed in Cornish (3.74±0.305) whereas lowest values were obtained in Kadaknath (1.00±0.25). Results showed that the higher IgM antibody were produced in exotic breeds as compared to indigenous breed and attained its peak at 6th day post immunization. Indigenous breed attained its peak at 9th day post immunization. Kundu *et al.* (1999b) [15] also reported the similar results. Natural IgM antibodies were present in all breeds under study and significant variation to Mercaptoethanol Sensitive response among various breeds on different day post sheep red blood cell immunization was observed.

Response to Phytohaemagglutinin (PHA-P)

In-vivo cell mediate immune response to Mitogen, Phytohaemagglutinin (PHA-P) was used as an indicator of

general cellular immune responsiveness. The response to Phytohaemagglutinin and Foot Pad Index (FPI) obtained are presented in Table 4. After Phytohaemagglutinin inoculation the foot web thickness was highest in Kadaknath followed by Cornish and Australorp. The response, calculated as difference between increase in foot web index calculated by phosphate buffer saline and Phytohaemagglutinin response, was highest in Kadaknath (0.57±0.09) followed by Cornish (0.50±0.10) and Australorp (0.40±0.04). Pathak *et al.*, (2017) [12] found similar response (0.43±0.05) in Kadaknath breed of chicken indicated that indigenous Kadaknath breed is the superior breed in producing cell mediated immunity. Thus, it is economically more feasible to rear Kadkanath for the backyard poultry farming as it will naturally reduce the inputs in health care. The response obtained after inoculation of Phytohaemagglutinin was significantly higher ($P < 0.05$) in Kadaknath whereas values of Cornish and Australorp did not differ significantly. The comparison of different breeds for *in-vivo* cell mediate immune responsiveness to Phytohaemagglutinin, calculated by Foot Pad Index showed that the exotic and indigenous breed did not differ significantly ($P < 0.05$). Similarly, Haunshi and Sharma (2002) [17] also reported non-significant effect of breed on general immunocompetence in four pure breeds and their selective crosses.

Table 4: Mean±SE value for response to Phytohaemagglutinin (PHA-P) in different breeds

Traits	Exotic Breeds		Indigenous Breed
	Australorp Mean± S.E	Cornish Mean± S.E	Kadaknath Mean± S.E
Phosphate Buffer Saline	0.96b±0.09	1.03b±0.13	1.59a±0.18
Phytohaemagglutinin	1.37b±0.11	1.38b±0.15	2.06a±0.19
Foot Pad Index	0.40a±0.04	0.50a±0.10	0.57a±0.09

^{a, b} Means in the same row with different superscripts letters (a, b) were significantly different at ($P < 0.05$)

Conclusion

Breed had significant ($P < 0.05$) effect on immune responsive traits. Among exotic and indigenous breed, Kadaknath have excelled over Australorp and Cornish for generation of humoral immune response and for generation of cell mediate immune response. The results of the study revealed that indigenous breed were superior to exotic breeds in antibody production and disease resistance. We therefore advocate that it is more advantageous than exotic breeds to rear indigenous chicken breeds like Kadaknath as backyard poultry farming.

Acknowledgements

The authors are grateful to the Dean, Post Graduate Institute of Veterinary Education & Research (PGIVER) for providing facilities to carry out this study, administrative and research support.

Ethical approval

Prior permission from Committee for the Purpose of Control and Supervision of Experiments on Animals (CPCSEA) was taken for slaughtering of the birds and collection of blood samples under sterile condition to carry out the current research work.

References

1. Livestock census. Department of Animal Husbandry, Dairying and Fisheries, Ministry of Agriculture, Govt. of

- India 2019.
2. Gavora JS, Spencer JL. Studies of genetic resistance of chickens to Marek's disease - A review. *Comparative Immunology, Microbiology and Infectious Diseases* 1979;2(2-3):359-371.
 3. Siegel. Gross Production and persistence of antibodies in chicken to sheep erythrocytes. 1. Directional Selection. *Poultry Science* 1980;59:1-5.
 4. Van der Zijpp AJ. Breeding for immune responsiveness and disease resistance. *World's Poultry Science Journal* 1983;62:205-211.
 5. Sivaraman GK, Kumar S, Saxena VK, Singh NS, Shivakumar BM. Genetics of immunocompetence traits in a synthetic broiler dam line. *British Poultry Science* 2005;46(2):169-174.
 6. Singh P, Kumar S, Singh HN, Singh DP, Jaiswal G, Meena SR, *et al.* Genetics of immunocompetence traits in Kadaknath native chicken. *Indian Journal of Poultry Science* 2009;44(2):173-176.
 7. Van der Zijpp AJ, Leenstra FR. Genetic analysis of the humoral immune response of White Leghorn chickens. *Poultry Science* 1980;59:1363-1369.
 8. Miller LL, Siegel PB, Dunnington EA. Inheritance of antibody response to sheep erythrocytes in lines of chicken divergently selected for fifty six day body weight and their crosses. *Poultry Science* 1992;71:47-52.
 9. Cheng S, Lamont SJ. Breeding and Genetics: genetic analysis of immunocompetence in White Leghorn chicken line. *Poultry Science* 1988;67:989-995.
 10. IBM Corporation. IBM SPSS Statistics for Windows, Version 25.0. IBM Corporation, Armonk, NY 2017.
 11. Kundu A, Singh DP, Mohapatra SC, Dash BB, Moudgal RP, Bisht GS, *et al.* Antibody response to sheep erythrocytes in Indian native vis-à-vis imported breeds of chicken. *British Poultry Science* 1999a;40:40-43.
 12. Pathak P, Dubey PP, Dash SK, Deka D. Comparative evaluation of growth, carcass and immune responsiveness traits in native chickens breeds of India. *International Journal of Pure and Applied Bioscience* 2017;5(2):612-620.
 13. Chatterjee RN, Sharma RP, Reddy MR, Niranjana M, Reddy BLN. Growth, body conformation and immune responsiveness in two Indian native chicken breeds. *Livestock Research for Rural Development* 2007, 19.
 14. Saxena R, Stephanb R, Mishra S, Shukla S, Saxena DP, Pratap SO, *et al.* Assessment of Immunocompetence Status of Native Breed of Chickens. *Biomedical & Pharmacology Journal* 2012;5:285-293.
 15. Kundu A, Singh DP, Mohapatra SC, Dash BB, Moudgal RP, Bisht GS, *et al.* Immunocompetence status of Indian native vis-à-vis imported breeds of chicken: 2-Mercaptoethanol resistance (IgG) and sensitive (IgM) antibody response to sheep erythrocytes. *Indian Journal of Poultry Science* 1999b;34(3):295-302.
 16. Martin A, Gross WB, Siegel PB. IgG and IgM responses in high and low antibody selected lines of chickens. *Journal of Heredity* 1989;80(3):249-252.
 17. Haunshi S, Sharma D. Immunocompetence in native and exotic chicken populations and their crosses developed for rural farming. *Indian Journal of Poultry Science* 2002;37(1):10-15.