

Impact of immunocompetence index based selection on health conditions in broiler chicken

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ABSTRACT

Present investigation was carried out to assess the impact of immunocompetence index based selection on the survivability of Synthetic Dam Line of broiler chicken. The base population (G_0) was screened for various immunocompetence traits, which were then combined in to an index, called immunocompetence (IC) index and two generations (G_1 and G_2) were obtained after selection for high and low IC index values. Significant differences in percent mortality patterns were noticed in the base population ($P < 0.05$) and G_1 generation ($P < 0.01$), whereas, in G_2 generation, high index line had comparatively higher per cent mortality (2.07) as compared to the low index lines (1.29). However, the overall mortality rate was reduced substantially over the two generations of divergent IC index based selection in broiler chicken. The present investigation revealed that selective breeding for better immunocompetence status using IC index could lead to better health status in terms of reduced mortality in broiler chicken.

Key words: Broiler, Chicken, Immunocompetence, Mortality.

Mortality has always been a cause of concern in poultry industry and the typical mortality rates in Indian farms are 8-10% while developed countries have less than 5% mortality rates thereby suggest potential for further improvement in domestic poultry industry (ICRA Rating Services, 2011). Information on mortality patterns under selective breeding using single or a combination of several IC traits is scanty. So the present study was aimed to evaluate the contribution of immunocompetence index based selection on viability of synthetic dam line of broiler chicken under farm conditions for two generations.

Synthetic Dam Line (SDL) of broiler chicken maintained at Experimental Broiler Farm, Central Avian Research Institute, Izatnagar, Bareilly, UP, India, were utilized in the present study. A base population of 303 birds, consisting of 183 females and 120 males were screened for various immunocompetence traits, viz., humoral immune response to sheep erythrocytes; cell mediated immune response to Phytohemagglutinin – P, serum lysozyme and serum IgG concentrations. The protocols have already been described earlier (Sivaraman *et al.* 2005). All the birds were ranked on the basis of IC index constructed by combining these traits. Birds (5-6 males and 30-36 females) both at the high and low extremes were chosen as parents of G_1 high and low IC

index lines, respectively. In G_1 generation, 92 chicks in high and 112 in low IC index lines were obtained. Similarly, parents of G_2 generation were selected in the respective lines and 152 and 148 chicks of high and low IC-index lines, respectively were obtained in G_2 generations. Mortalities were recorded on a daily basis in all the lines up to 6 weeks of age along with the reasons ascertained after post mortem inspection at Indian Veterinary Research Institute, Izatnagar. The mortality patterns in each line were recorded, calculated in percentages and compared by Chi square test.

The per cent mortality rates up to 6 weeks of age in base population, G_1 and G_2 generations are given in Table 1. Statistically significant differences ($P < 0.05$) in per cent mortality patterns in different periods were observed in the base population indicating that the mortality rate is influenced by different factors such as feed, water, vaccination, exposure and/ or outbreak of diseases and stress etc. (Yunis *et al.*, 2000; Mench, 2002). The highest mortality (2.77%) was observed in 0-4 week's period followed by 0.63% in 4-5 and 0% mortality in 5-6 weeks of age; the overall mortality percent was 3.69%.

There were highly significant ($P < 0.01$) differences in per cent mortality rate between the high and low IC- index lines up to 6 weeks of age in G_1 generation with values of 4.6

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TABLE 1: Per cent mortality in Synthetic Dam Line of broiler chicken up to 6 weeks of age in base population and high and low IC-index lines over two generations of divergent selection based on IC-index

Generations	Lines	Period			Overall (0-6 weeks)
		0-4 weeks	4-5 weeks	5-6 weeks	
Base (n= 303)		2.77 ^a	0.63 ^b	0.0 ^c	3.69
G ₁ Generation	High IC-Index line (n= 92)	4.60 ^A	1.20 ^A	1.22 ^A	6.9 ^A
	Low IC-Index line (n= 112)	2.38 ^B	0.0 ^B	0.0 ^B	2.38 ^B
G ₂ Generation	High IC-Index line (n= 152)	1.38	0.70 ^A	0.0	2.07 ^A
	Low IC-Index line (148)	1.29	0.0 ^B	0.0	1.29 ^B

Comparisons were made among periods in base population, between lines within each period as well as in overall in each generation. Means bearing common superscript do not differ significantly ($P < 0.05$).

vs 2.38, 1.2 vs 0.0 and 1.22 vs 0.0 in the periods 0-4, 4-5 and 5-6 weeks of age, respectively; the overall percent mortality rates in high and low IC- index lines were 6.9 and 2.38%. In G₂ generation, significant differences ($P < 0.05$) were observed between high and low IC-index lines at 4-5 weeks of age only.

Trends in mortality patterns over generations showed that the overall mortality was reduced after two generations of selection in both the lines (2.07 and 1.29% in high and low lines vs 3.69% in base population) which were in agreement with the earlier reports that decrease in the general mortality of the chick's belonging to high humoral immune response line selected on the basis of GAT as compared to low line (Kim *et al.* 1987), antibody response to *E.coli* had better survivability (Yunis *et al.* 2000) and immunocompetence index selection of SDL to immunological traits had lower mortality rate (Sivaraman *et al.* 2012). However, Gross and Siegel (1985) found that birds selected for low immune response were more susceptible to infection from endemic bacteria and external parasites when placed in a low stress environment, but the high line in a high stress

environment was more susceptible to viral infections. Moreover, Cheng (2010) and Laible, (2009) also suggested that selection for identification of candidate genes related to desirable physical or behavioral characteristics and biological traits will lead to high production efficiency and optimal welfare of the birds.

The study also revealed that breeding for better immunocompetence status employing IC index could lead to better health status in term of reduced mortality rate in broiler chicken. It further suggested that IC index selection for more number of generations coupled with economic traits could be a viable preposition for improving the health status of broiler chickens.

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