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Original Research

Trace Element Profile of Ducks during Duck Plague Outbreak

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Abstract

Serum trace minerals viz. Zinc (Zn), Iron (Fe), Copper (Cu) and Manganese (Mn) level were estimated in Pati, Khaki Campbell and Nageswari ducks of Assam and compared the concentration between healthy and those suffered with duck plague. Significant ($P \leq 0.05$) reduction in the serum Zn, Fe and Mn in all varieties of ducks during duck plague outbreak. A non-significant decrease in the serum Cu level was also observed during duck plague outbreak. From the present study, it can be concluded that significantly ($P<0.05$) lower level of Zn, Fe and Mn may act as a contributing factor for duck plague in different varieties of duck.

Keywords: Trace mineral, duck plague, Pati, Khaki Campbell, Nageswari

Introduction

A functional immune system is essential for the ability of the host to prevent or limit any infections. A number of trace elements have been found to play an important role for adequate functioning of the immune system, including copper, zinc, and selenium. The deficiencies and excessive levels of trace elements can influence various parameters of the immune system, such as antibody responses, cell-mediated immunity and natural killer (NK) cell activity (Beck *et al*., (1995). Transition metals such as iron, zinc, manganese and copper have numerous biological roles such as both structural and catalytic cofactors for proteins and therefore these metals are essential for life (Andreini *et al.*, 2008). Besides, trace elements are also required for varieties of cellular processes including the proper functioning of the vertebrate immune system (Wintergerst *et al*., 2007). Trace element nutrition influences the host response to a pathogen (Beck *et al.*, 1995). Keeping in view the importance of trace elements in ducks the current study has been designed to investigate the alteration of trace element profile of ducks during duck plague outbreak.

Materials and Methods

In the present study, 350 blood samples (5ml) from different varieties of duck namely Pati (150), Khaki Campbell (100) and Nageswari (100) were collected from healthy as well during duck plague outbreak from different districts of lower and upper Brahmaputra valley of Assam. Birds were maintained in similar managemental practices. Blood samples were collected from the wing veins of each bird under aseptic conditions. For estimation of the trace elements, the blood was collected in sterile test tube without adding any anticoagulant and was left undisturbed in slanting position for 2-4 hours for serum separation. The separated serum samples were cleared by centrifugation at 3000 rpm for 5 minutes. After the serum was separated, it was kept in plastic vials and stored in deep freeze at -20ºC until analysis. Minerals *viz*. zinc (Zn), iron (Fe), copper (Cu) and manganese (Mn) were estimated from serum using commercially available kit procured from Invitro Diagnostic Kits manufactured by Span Diagnostic Limited (Autospan Liquid Gold), GIDC, Sachin-394 230 (Surat), Gujarat, India and expressed in ppm. Data generated from the experiment were analyzed statistically using SAS Enterprise Guide (Version 4.2).

Results and Discussion

In the present investigation, serum trace minerals *viz*. Zinc (Zn), Iron (Fe), Copper (Cu) and Manganese (Mn) level of healthy Pati, Khaki Campbell and Nageswari ducks of Assam were estimated and compared with the same variety of ducks during duck plague outbreak. The mean serum trace mineral level (Mean ± SE) concentration is presented in Table 1.

Table 1: Serum trace mineral level (ppm) of indigenous ducks (Mean ± SE)

Parameters	Pati variety		Khaki Campbell		Nageswari		Level of significance
	Healthy (N=125)	**Diseased (N=45)**	**Healthy (N=75)**	**Diseased (N=35)**	**Healthy (N=50)**	**Diseased (N=20)**	
Zn (ppm)	$3.25^a \pm 0.65$	$3.13^a \pm 0.79$	$3.35^a \pm 0.62$	$2.98^b \pm 0.45$	$3.15^a \pm 0.56$	$2.19^b \pm 0.23$	0.05
Fe (ppm)	$4.33^a \pm 0.35$	$2.21^b \pm 0.41$	$4.21^a \pm 0.31$	$3.69^b \pm 032$	$2.31^a \pm 0.51$	$1.34^b \pm 0.21$	0.05
Cu (ppm)	$1.01^a \pm 0.09$	$0.82^a \pm 0.25$	$0.99^a \pm 0.04$	$0.98^a \pm 0.09$	$0.82^a \pm 0.06$	$0.79^a \pm 0.04$	NS
Mn (ppm)	$0.87^a \pm 0.08$	$0.78^b \pm .03$	$0.91^a \pm 0.06$	$0.77^b \pm 0.07$	$0.68^a \pm 0.03$	$0.54^b \pm 0.21$	0.05

**Superscripts bearing the different letter in columns for same trace element are significant; NS- Non significant, Significant at 5 % (P≤ 0.05)*

All the three varieties of ducks showed a decrease in the level of Zn during duck plague outbreak than that of the healthy group. The mean serum Zn level in Pati duck during healthy state and during duck plague outbreak were recorded as 3.25± 0.65 and 3.13±0.79 ppm respectively and this might be due to the breed variety. Serum Zn concentration was apparently lower in during duck plague outbreak in Pati duck. The Khaki Campbell group of ducks showed a significant (P≤ 0.05) reduction in the level of zinc during disease outbreak (2.98±0.45 ppm) than the healthier (3.35±0.62 ppm) one. Similarly, in the Nageswari varieties also, a significant (P≤ 0.05) reduction was observed during duck plague outbreak (2.19 ±0.23 ppm) compare to healthier (3.15 ±0.56 ppm) one. Zinc is critically important for proper immune function as even a mild zinc insufficiency results in widespread defects in both innate and adaptive immunity (Wintergerst *et al*., 2007). Deficiency of Zn has been found to result in high susceptibility to infectious disease (Bogden *et al*., 1988). Thus, both excess as well as deficient Zn level, can adversely affect the functioning of the immune system. In the present investigation, it is recorded that all the three varieties of ducks showed a decrease in the level of Zn during duck plague outbreak and out of them the decrease in concentration was significant ($P<0.05$) in Khaki Campbell and Nageswari ducks than that of the healthy group. Our findings are corroborated with Wintergerst *et al*., (2007) and decrease in Zn concentration in some varieties of duck due to breed difference might have lowered the immunity of the duck and thus made it susceptible to duck plague. The serum iron concentration was significantly higher ($P\leq 0.05$) in healthy Pati duck (4.33 ±0.35 ppm) than those suffered from duck plague (2.21 ±0.41 ppm). Similarly, the Khaki Campbell and Nageswari variety of ducks also showed a significant ($P\leq 0.05$) reduction of mean serum iron level during duck plague outbreak. The mean serum iron (Fe) levels of healthy and diseased Khaki Campbell duck variety were found to be 4.21 ±0.31 ppm and 3.69 ± 0.32 ppm, respectively. Similarly, in the healthy Nageswari breed of duck mean serum iron level was 2.31 ± 0.51 ppm whereas in the diseased group the concentration was 1.34 ± 0.21 ppm. All three varieties of duck revealed an apparently lower level of copper during duck plague outbreak than that of the healthy. The level of serum copper of Pati duck during duck plague outbreak was recorded as 0.82±0.25 ppm and in the healthy group it was 1.01 ±0.09 ppm. The recorded levels of serum copper in Khaki Campbell duck during healthy and diseased conditions were 0.99±0.04 ppm and 0.98±0.09 ppm respectively. The mean serum level in healthy Nageswari breed of duck was found to be 0.82±0.04 ppm and during the duck plague it was recorded as 0.79±0.06 ppm. Copper deficient animals are more susceptible to bacterial, viral and parasitic infections (Stabel *et al*., 1993). Thus, in our experiment, the decrease serum concentration might have increased the susceptibility to duck plague maintain in similar managemental practices.

In the present investigation significantly ($P<0.05$) higher mean serum manganese (Mn) concentration was obtained in the healthy Nageswari duck from that of bird suffered from Duck plague. In healthy Pati duck the recorded concentration was 0.87±0.08 ppm while during duck plague outbreak the concentration was 0.78 ±.03 ppm. Similarly, diseased Khaki Campbell variety (0.77 ±0. ppm) of ducks showed a significantly ($P\leq 0.05$) lower Mn than that of healthy group (0.91 ±0.06 ppm). The recorded mean serum level of Mn in Nageswari breed of duck during duck plague outbreak was found to be 0.54 ±0.21 ppm which was significantly ($P\leq 0.05$) lower than the concentration of healthy group *i.e*., 0.68 ±0.03 ppm. Mn is an important element to increase immunity for various diseases and our findings can be correlated with the study of Jankowski *et al.* (2019) who conducted a study on Mn supplementation in the turkey ration to stimulate the immune system.

Conclusion

The current study revealed that there was a significant ($P\leq 0.05$) reduction in the serum level of Zn, Fe and Mn in all varieties of ducks except pati during duck plague outbreak. A non-significant decrease in the serum Cu level was also observed during duck plague outbreak. From the present study, it can be concluded that significantly ($P<0.05$) lower level of Zn, Fe and Mn may act as a contributing factor for duck plague occurrence in different varieties of duck.

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Conflict of Interests

There is no conflict of interest.

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