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# Evaluation of the status of trace minerals and immunoglobulin G in calves of Indian zebu cattle suffering from acute undifferentiated diarrhoea

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Calf diarrhoea due to complex interaction of the environment, infectious agents and the calf itself are the major constraints for raising replacement stock. It has been estimated that 75% of early calf mortality in dairy herds is caused by acute diarrhoea in the pre-weaning period and also, a commonly reported disease in young animal and still a major cause of productivity and economic loss to cattle producers and also a cause of high morbidity and mortality in the cattle industry worldwide (Uhde *et al.,* 2008; Bartels *et al.,* 2010). New-born calves are born aggamaglobulinemic, without any measurable circulating IgG or IgM. The new-born calf acquired passive immunity by absorbing immunoglobulins from colostrum provided within the first hour of life. In the calf, passively acquired immunity is of importance to the calf health for the extended period of time until they are capable of making their own antibodies (Morrill and Tyler, 2012). Trace minerals such as copper and zinc deficiencies, impaired colostral transfer of immunoglobulin is the major reason of this decreased resistance of calves, mainly resulting in perinatal mortality and diarrhea (Enjalbert *et al.,* 2006). Keeping in view the above facts, present investigation was undertaken to evaluate the blood trace mineral and immunoglobulin G status of calf diarrhoea in Indian zebu cattle breeds.

In present investigation, 12 cow calves having acute diarrhoea and 6 healthy calves (healthy control) aged within 0-1months of Indian zebu cattle breeds' *viz.* Sahiwal and Haryana was selected at LFC of DUVASU. Blood samples were collected and serum was harvested from diarrhoeic and healthy calves of both breeds processed and stored at -20°C for estimation. Serum samples were digested by Microwave digestion method as per the standard procedure described (Felipo and Rennan, 2017). Digested serum samples were transferred to a plastic auto sampler tube and diluted with water to 10 ml mixed and centrifuged at 4000 rpm for 5 minute and dilute further fivefold for ICP analysis. The trace minerals namely copper (Cu), zinc (Zn) were analyzed by the inductively coupled plasma optical emission spectroscopy (5800 ICP- OES Agilent, CA, USA) facility at Animal nutrition department, DUVASU Mathura. The wavelength (nm) used were 324.7 for Copper, 213.8 for Zinc. The instrument conditions were 12 l/min plasma gas flow, 0.7 L/min nebulizer gas flow, 1l/min Aux flow and viewing mode was axis at 8 mm height for analysis of the minerals. All the samples were run in triplicate. Standard was 0,0.1,0.2,0.5,1,5 and 10 ppm were prepared with ICP multi element standard solution IV (Merck chemicals, Dermstadt, Germany). From these standards calibrations curve was prepared for various mineral by plotting the absorbance against the concentration. After plotting the calibration curve the concentration of mineral (mg/l) in the sample was calculated automatically by system using ICP expert software. Assessment of serum immunoglobulin IgG in diarrhoeic and healthy calves of Haryana and Sahiwal breed were estimated by using bovine specific quantitative ELISA Kits (Sincere Biotech, Beijing, China). Standard procedure of estimation was followed as provided in kits literature. Curve expert basic version 1.4 software was used to draw standard curve for ELISA. Statistical analysis of all the data to test significance of means was done as per the method described by Snedecor and Cochran (1994).

Calf diarrhoea generally results from complex interaction of the environment, infectious agent and the calf itself. These are the major constraints for raising replacement stock, adversely affecting the current status, longevity in the herd, the productive and reproductive performance of animals (Muktar *et al.,* 2015). Present study was designed to evaluate the blood trace minerals viz zinc, copper and serum immunoglobulin was done to know their status in acute undifferentiated calf diarrhoea

The Mean ±SE value of serum copper concentration was found to be significantly higher in diarrhoeic calves of Haryana and Sahiwal breeds in comparison to healthy calves of respective breeds. There was no any variation observed in serum Copper concentration in healthy and diarrhoeic calves of Sahiwal

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**Table 1: Serum Copper, Zinc (mg/L) and Serum Immunoglobulin G (mg/ml) levels in acute undifferentiated diarrhoeic calves**

| Group | Serum copper (Cu) concentration (mg/L) | Serum Zinc (Zn) concentration (mg/L) | Serum immunoglobulin G (IgG) level, (mg/mL) |
|---|---|---|---|
| Sahiwal healthy | $0.52^{a}$ ±0.006 | $4.48^{a}$ ±0.04 | $21.52^{a}$ ± 0.76 |
| Haryana healthy | $0.53^{a}$ ± 0.008 | $4.35^{a}$± 0.07 | $20.47^{a}$ ± 0.60 |
| Sahiwal diarrhoeic | $0.83^{b}$ ± 0.004 | $3.65^{b}$ ± 0.07 | $16.11^{b}$ ± 0.45 |
| Haryana diarrhoeic | $0.83^{b}$± 0.070 | $3.48^{b}$± 0.08 | $15.50^{b}$± 0.55 |

Values (Mean ±SE) with different superscript between healthy and diarrhoeic calf differ significantly ($p< 0.05$)

and Haryana breeds (Table 1). The Mean ±SE value of serum zinc concentration were found to be significantly lower in diarrhoeic calves of Haryana and Sahiwal breed in comparison to healthy calves of respective breeds. There was no any variation observed in serum Zinc concentration in healthy and diarrhoeic calves of Sahiwal and Haryana breeds. The Mean ±SE value of serum immunoglobulin (IgG) concentration were found to be significantly lower in diarrhoeic calves of Haryana and Sahiwal breeds in comparison to healthy calves of respective breeds. There was no any variation observed in serum Immunoglobulin (IgG) concentration in healthy and diarrhoeic calves of Sahiwal and Haryana breeds.

Serum Cu concentration in acute undifferentiated diarrhoeic calves was found to be significantly higher while serum Zn concentration was significantly lower in diarrhoeic calves than healthy calves of Haryana and Sahiwal breed. Significantly lower level of copper and zinc in calves with diarrhoea was earlier reported (Gherariu and Kadar, 1979), possibly due to adrenal insufficiency, however findings of present investigation are contrary to the findings earlier reported. The lower serum Zn level in diarrhoeic calves could be due to excessive loss of Zn from gastrointestinal tract during diarrhoea and poor absorption from the gut. These findings of present investigation are in accordance of the findings reported by Ranjan *et al.*(2006). The role of zinc in pathogenesis of gastrointestinal disorder has been thoroughly investigated in human. Copper is an integral part of acute phase protein ceruloplasmin which contains about 95% of circulatory copper and its level rises in acute phase infection. In present investigation the higher level of serum Cu concentration in diarrheic calves might have occurred due to acute phase reactions in the gut mucosa, which might be the reason of increased serum level of copper in diarrhoeic calves in comparison to healthy calves. These findings are in agreement with findings earlier reported (Ranjan *et al.,* 2006). Hypozincaemia and Hypercupremia have been recorded in several infection and inflammatory condition (Conner *et al.,* 1986, Naresh *et al.,* 2001).

The value of serum immunoglobulin (IgG) in acute undifferentiated diarrhoeic calves significantly lower than healthy calves of Haryana and Sahiwal breeds. In present investigation partial failure of passive transfer of immunoglobulins might be the reason that calves may suffered with acute episode of diarrhoea. Low gamma-globulin in diarrhoeic and dehydrated calves had been reported (Thronton *et al.,* 1972). The risk of development of infectious diseases is greater in calves in which there has been failure of passive transfer of maternal immunoglobulins (Gay, 1983). The mechanism by which colostral immunoglobulin protects against these diseases probably depends on the agent and system involved. Successful passive transfer resulting in protective calf serum immunoglobulin concentrations requires formation of high immunoglobulin-concentration colostrum by the dam, and ingestion of adequate colostrum by the calf, and (3) the absorption of immunoglobulin from the gut to the blood by the calf. Failure of passive transfer may occur because of failure at any of these levels (Besser and Gay, 1985). Infectious disease remains the leading cause of morbidity and mortality in neonatal calves. Numerous publications in the past three decades correlated neonatal morbidity and mortality rates with low levels of serum immunoglobulins popularly termed failure of passive transfer of immunoglobulin (PTI) in calves (Wittum and Perino, 1995).

Trace mineral elements such as Cu and Zn have important roles in the health and immunity of peripartal dairy cows and their offsprings as colostrum is the main source of minerals and immunoglobulins which are

essential for the peripartum health of the calf and the levels of trace minerals and collostrum immunoglobulins may enhanced by mineral supplementation to the dam during the transition period (Enjalbert *et al.,* 2006).

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