

Influence of Dietary Boron on Gut Absorption of Nutrients, Blood Metabolites and Tissue Pathology

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Abstract : Boron (B) is a newer trace element and its biological importance and dietary essentiality is unclear in animals. The available literature suggests its putative role in bone mineralization, antioxidant status and steroid hormone synthesis. A feeding trial was conducted in Wistar strain (*Rattus norvegicus*) albino rats for duration of 90 days. A total of 84 healthy weaned (3-4 weeks) experimental rats were randomly divided into 7 dietary groups (4 replicates of three each) viz., A (Basal diet/ Control), B (Basal diet + 5 ppm B), C (Basal diet + 10 ppm B), D (Basal diet + 20 ppm B), E (Basal diet + 40 ppm B), F (Basal diet-Ca 50%), G (Basal diet-Ca 50% + 40 ppm B). Dietary level of calcium (Ca) was maintained at two levels, 100% and 50% of requirement. Sodium borate was used as source of boron along with other ingredients of basal diet while preparing the pelletized diets. All the rats were kept in proper ventilated laboratory animal house maintained at temperature ($23\pm 2^{\circ}$ C) and humidity (50 to 70%). At the end of experiment digestibility trial was conducted for 5 days to estimate nutrient digestibility and gut absorption of minerals. Eight rats from each group were sacrificed to collect the vital organs (liver, kidney and spleen) to study histopathology. Blood sample was drawn by heart puncture to determine biochemical profile. The average daily feed intake (g/rat/day), water intake (ml/rat/day) and body weight gain (g/rat/day) were similar among the dietary groups. The digestibility (%) of organic matter and crude fat were significantly improved ($P < 0.05$) by B supplementation. The gut absorption (%) Ca was significantly increased ($P < 0.01$) in B supplemented groups compared to control. However, digestibility of dry matter and crude protein, gut absorption of magnesium and phosphorus showed a non-significant increasing trend with B supplementation. The gut absorption (%) of B ($P < 0.01$) was significantly lowered ($P < 0.05$) in supplemented groups compared to un-supplemented ones. The serum level of triglycerides (mg/dL), HDL-cholesterol (mg/dL) and alanine transaminase (IU/L) were significantly lowered ($P < 0.05$) in B supplemented groups. While serum level of glucose (mg/dL) and alkaline phosphatase (KA units) showed a non-significant decreasing trend with B supplementation. However the serum levels of total cholesterol (mg/dL) and aspartate transaminase (IU/L) were similar among dietary groups. The histology sections of kidney and spleen revealed no significant changes among the dietary groups and were observed to be normal in anatomical architecture. However, the liver histology revealed cell degenerative changes with vacuolar degeneration and nuclear condensation in Ca deficient groups. But the comparative degenerative changes were mild in 40 ppm B supplemented Ca deficient group. In conclusion, dietary supplementation of graded levels of boron in rats had a positive effect on metabolism and health by improving nutrient digestibility and gut absorption of Ca. This indicates the beneficial role of dietary boron supplementation.

Keywords : boron, calcium, nutrient utilization, histopathology

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