Chapter VII

Summary
SUMMARY

To study the influence of dietary zinc on \(\beta\)-carotene conversion to vitamin \(A\), 27 weanling rats were fed a synthetic diet devoid of vitamin \(A\) active ingredients and containing 9.8 ppm zinc for first 12 days of depletion period. At the end of depletion period, 3 rats were killed at random (Group I) to estimate initial vitamin \(A\) levels in the liver. Remaining 24 rats were divided at random into 3 groups and they were fed basal diet (Group II), basal diet + 10 mg of \(\beta\)-carotene per kg (Group III) and basal diet + 10 mg of \(\beta\)-carotene per kg + 38.2 ppm zinc (group IV). After 13 days of experimental feeding, the rats were killed, and carotene and vitamin \(A\) were estimated in liver. Vitamin \(A\) levels decreased from 10.92 \(\mu g/g\) of liver in control group to 6.54, 7.32 and 7.64 \(\mu g/g\) and from 14.85 to 9.02, 12.00 and 13.20 \(\mu g\) in whole liver in groups II, III and IV respectively. Gain in body weight, liver weight and vitamin \(A\) content of whole liver was almost equal in all groups; however, the group III had a higher value \((P \leq 0.05)\) than group II. Thus, the influence of zinc on \(\beta\)-carotene conversion to vitamin \(A\), if any, could not be detected when zinc was supplemented to the diet containing 9.8 ppm zinc.
Second experiment was carried out to study the effect of two dietary factors, zinc and vitamin A, on nucleic acids and protein syntheses in the liver of rats. Thirty two weanling rats were divided into 4 groups to fit in 2x2 factorial design. The diet contained 4.25 or 40 ppm zinc and 0 or 10,000 I.U. of vitamin A/kg. It was observed that growth rate and feed consumption increased significantly due to zinc supplementation by 0.61 g and 7.90 g/3 days respectively. Zinc or vitamin A supplementation did not have any effect on dry matter digestibility and feed to gain ratio. Zinc and vitamin A supplementation significantly increased fresh liver weight by 0.2406 g and 0.1689 g, dry liver weight by 0.0743 g and 0.0676 g, liver weight/100 g body weight by 0.143 g and 0.142 g, RNA/whole liver by 3.083 mg and 3.135 mg, RNA/g of fresh liver by 0.811 mg and 1.087 mg, RNA/g of dry liver by 3.554 mg and 4.983 mg, DNA/whole liver by 0.322 mg and 0.333 mg and RNA to DNA ratio by 0.51 and 0.65. Protein content of whole liver was increased due to zinc by 48.7 mg and due to interaction of zinc and vitamin A by 36.9 mg. However, there was no effect of zinc or vitamin A supplementation on DNA or protein/g of fresh or dry liver. It was apparent that zinc and vitamin A supplementation accelerated RNA, DNA and protein syntheses in the liver of rats, but increased DNA and protein syntheses might have occurred only during the initial stage, and it ceased by the end of 15 days experimental period.
In the third experiment, samples of rumen liquor were collected from two cows and two buffaloes maintained on common farm ration low in zinc (22 to 25 ppm). The animals were offered the feed at regular intervals of two hours. Maximum microbial protein synthesis in vitro was obtained when 10 ml of strained rumen liquor was incubated for 24 hours at 39°C along with 20 ml of McDougal's buffer, 10 ml of distilled water, and 1 g of starch and 151 mg of ammonium sulphate. Addition of 4 mg zinc as ZnSO$_4$ and ZnCl$_2$ to in vitro experiments significantly increased microbial protein synthesis, decreased ammonia nitrogen level and decreased volatile fatty acids production, and showed no effect on pH. Two in vivo trials were conducted employing switch over design, and half of the animals each time were given every day a single oral dose of 87 mg zinc per kg of dry matter consumed in a day. Increased microbial protein synthesis and decreased ammonia nitrogen concentration due to zinc supplementation, as found in in vitro studies, was not observed in vivo.
Six lactating Beetal goats were fed low zinc diet for a total adaptation period of 21 days. Thereafter, 3 balance trials were conducted on the pattern of 3x3 Latin square design. A single dose of 128 µc of zinc-65 was administered orally on the starting day of each trial along with 0 (Treatment A), 95.2 (Treatment B) and 170.4 (Treatment C) mg stable zinc in the form of ZnSO₄. The total intake of zinc per day per goat from the basal diet alone was 31.4 mg. The turnover rate of zinc-65 was observed to be approximately 3 days. As the level of dietary zinc increased, the excretion of zinc in faeces, urine and milk increased proportionately. Usually, the peak excretion of zinc was at 36 hours after dosing. However, with higher dose peak excretion was observed earlier. The excretion of zinc in milk was 3.1%, in urine 8.8% and in faeces 87.1%. The zinc content of milk of goats in treatments A, B and C was 7.7, 17.3 and 25.9 ppm on dry matter basis. It might be inferred that milk was deficient in zinc, and zinc content of milk could be increased by increasing dietary zinc levels.