

CYCLICAL FEEDING PATTERNS AND TERATOGENESIS IN ZINC-DEFICIENT RATS

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In rats, zinc deficiency results in the establishment of individual 4-day cyclical feeding patterns which are inversely related to fluctuations in the maternal serum zinc levels. A maternal dietary zinc deficiency has also been shown to be highly teratogenic in rats, producing abnormalities in every organ system. Taken together, these observations suggest that during development, the zinc-deficient rat embryo might be exposed to several waves of zinc deficiency, interspersed with adequate supplies of zinc. We have examined aspects of cyclical feeding in zinc-deficient and control rats, and the effects on the morphological development of the embryo over the first 11.5 days of gestation.

Pregnant animals fed the zinc-deficient diet since mating produced 11.5 day litters with varying degrees of malformation, at an overall rate of about 30%. Presentation of the diet in a systematic fashion intended to induce a low maternal serum zinc concentration on days 8 and 9 of gestation increased the rate of major malformations observed on day 11.5 to about 70%. When low maternal serum zinc levels were induced on days 6, 7, 10 and 11, the number of implantation sites was decreased, as was the incidence of major and minor malformations.

Further studies were performed in which single feeding cycles were timed to provide peak intakes of food on days 7 and 8 of pregnancy in one case and on days 9 and 10 in another. While in both cases the prevalence of terata was high (49% and 67% respectively) at the end of gestation, the type of abnormality differed between groups from a predominance of skeletal malformations in the day 7 and 8 group to mainly palatal and soft tissue defects in the day 9 and 10 animals.

These results demonstrated that judicious regulation of the food intake of zinc-deficient rats can influence the maternal serum zinc levels, and hence the availability of zinc to the embryo at selected stages of development, thus producing specific malformations of the organs developing at that time.

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