

ZINC AND MAGNESIUM IN PEDIATRIC PRACTICE

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Trace elements are present in microamounts in humans and deficiency and excess of these elements are harmful. Although dietary requirements of most of these elements are met by a balanced diet, still there are certain age groups, special diets, treatment, disease states and metabolic disorders which are likely to be associated with deficiency of one or more of these elements. In this article the importance of zinc and magnesium in pediatric practice is emphasized to enable the practising clinician to suspect their deficiency and toxicity.

A. Deficiency

In general, trace deficiency may be primarily due to inadequate intake or secondarily due to various other factors like diarrhea, repeated infections, prematurity, malnutrition, metabolic disorders, drug intake and chronic diseases like cirrhosis, cystic fibrosis and enteropathy. The recognition of subclinical deficiency of these elements is also an uphill task unless a high degree of suspicion is entertained.

Zinc: The features of mild zinc deficiency include a propensity to infection and limitations of lean tissue synthesis with

resultant obesity and acne with frequent infections. The signs and symptoms of severe zinc deficiency are well known which include anorexia, diarrhea, skin lesions, growth failure, loss of hair, mental disturbances, hypogonadism and repeated infections with opportunistic organisms.

Magnesium: The features of magnesium deficiency include muscle irritability, tetany, weakness, confusion, coma, tremors, seizures and arrhythmia. In children, serum magnesium level is 1.5-2.0 mEq/l or 0.5 mmol/l (SI units). Magnesium deficits occur at currently recommended intakes of 10 mg/kg/day for very-low-birth-weight infants; however, with magnesium intakes approaching 20 mg/kg/day, appropriate retention can be achieved(1). Infants with chronic but not acute diarrhea are magnesium depleted at presentation; with the continuation of diarrhea there is a progressive depletion of magnesium and there is a tendency to regain the status during the convalescent period(2).

Diagnosis: Plasma, hair and tissue zinc and magnesium alone are insufficient to exclude their deficiency in early stages and neither normal limits of their levels are well defined nor the biological significance of values observed are known. Only in severe deficiency states their levels are low in blood and other body tissues. Even today, analytical facilities for these elements are not available at many centres; hence a trial of element supplementation, most likely to be deficient on clinical ground and a positive response may provide the most convincing evidence about a specific element deficiency; of course, various biochemical parameters should be monitored. The concentration of magnesium in parotid saliva tended to be higher ($p < 0.09$) in the young compared with the other groups(3).

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B. Toxicity

It is unlikely that zinc and magnesium could be taken by infants and children from therapeutic preparations in amounts that could cause toxicity unless their salts are administered in large doses, e.g., hypermagnesimism in newborn infants of eclamptic mothers treated with magnesium sulphate.

Zinc: Although it is true the overt symptoms of toxicity require ingestion of relatively large amount of zinc, there is increasing evidence that use of zinc supplements by humans even at fairly modest concentrations, may have adverse consequences under certain circumstances(4). The toxicity of zinc induces vomiting and due to its competition with copper for absorption in the intestine may lead to hypocupremia.

Magnesium: The toxicity of magnesium includes depression, hypotonia and in general adversely affects the functioning of nerve, muscle and heart.

C. Requirements

Zinc: The recommended dietary intake of zinc during first half of infancy is 3 mg/day, between 6-12 months is 6 mg/day and during later childhood 10 mg/day. The preterm, low birth weight and children recovering from malnutrition have higher zinc requirement. The daily zinc requirement of adult female is 15 mg while for pregnant and lactating women the requirement is 20 and 25 mg, respectively.

Magnesium: The recommended dietary allowances for magnesium are 350 mg/day for adult men and 300 mg/day for women. During pregnancy and lactation the recommended allowance is 450 mg/day. The allowances for infants and children are similar and based on the magnesium content of human and cow milk.

D. Sources

Zinc and magnesium content of various milk, infant supplements and important food items are listed in *Table I*(5,6).

E. Therapeutic preparations

Important therapeutic preparations containing significant amount of zinc and magnesium are listed in *Table II*. The elemental zinc in various zinc salts is as follow: zinc sulphate (40.5% Zn), zinc oxide (80.3% Zn), zinc chloride (47.9% Zn) and zinc acetate (35.6% Zn). The dose of zinc during deficiency state is 2 mg/day of elemental zinc.

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TABLE I—Zinc and Magnesium Content of Milk, Formulas, Weaning and Other Food

Milk & other foods	Zinc	Magnesium
	mg/L	mg/L
Human milk		
Colostrum	9.32 ± 1.63	46.22 ± 15.77
Transitional	6.71 ± 1.21	40.71 ± 13.29
11 days—1 mo	2.90 ± 0.47	38.18 ± 14.21
1 mo—6 mo	2.01 ± 0.27	36.39 ± 12.16
above 6 mo	2.16 ± 0.38	39.66 ± 12.90
Cow milk	2.98 ± 0.90	111.60 ± 19.40
Goat milk	2.87 ± 0.39	122.00 ± 12.80
Buffalo milk	3.01 ± 0.21	139.10 ± 18.00
Dairy milk	4.95 ± 1.19	168.60 ± 16.70
Formulas	mg/100g	mg/100g
Lactogen I	3.7	41
Lactogen II	3.4	61
Soy based formulas	3.0	40
Infant weaning food (Cerelac, Farex)	5.0	60
Food items	mg/100g	mg/100g
Cheese	4.0	Cashewnuts 267
Chocolate (bitter)	0.9	Chocolate (bitter) 292
Cabbage (common)	0.4	Cabbage (common) 13
Carrots (raw)	0.4	Carrots (raw) 23
Chicken (cooked)	0.8	Banana 33
Coffee (instant dry)	0.6	Coffee (instant dry) 456
Eggs (whole)	0.02	Eggs (whole) 11
Fish	0.8	Fish 30
Sugar (white)	0.06	James & jellies 12
Wheat (flour)	2.4	Wheat (flour) 25
Tea (dry leaves)	3.3	Potatoes 22
Popcorn	4.1	Peas 20
Rice	1.3	Mangoes 18

TABLE II—Therapeutic Preparations Containing Zinc and Magnesium

Name of preparation	Zinc	Name of preparation	Magnesium
	Elemental		
Cap Zevit	22.5 mg/cap	Syp Alprovit	10 mg/15 ml
Syp Zevit	10.0 mg/5 ml	Syp Altone	3 mg/5 ml
Cap Fesofoz Z	22.5 mg/cap	Tab Calcinol	50 mg/tab
Tab Zincolac	50.0 mg/tab	Tab Cyltab	1.25 mg/tab
Cap Becadexamine	0.1 mg/cap	Cap Becadexamine	0.01 mg/cap
Elixir Neogadine	6.0 mg/15 ml	Elixir Neogadine	24.0 mg/15 ml
Syp Nutriplon	9.0 mg/15 ml	Cap Nutrisan	0.5 mg/cap
Cap Revital	0.5 mg/cap	Cap Revital	3.0 mg/cap
Tab Supradyn	2.2 mg/tab	Tab Supradyn	60.0 mg/tab
Tab Theragran M	6.6 mg/tab	Tab Theragran M	2.8 mg/tab
Tab Vimgran	6.6 mg/tab	Tab Vimgran	2.8 mg/tab
Cap Prozenfer	5.0 mg/cap	Syp Santevini	22.0 mg/5ml
Syp Prozenfer	0.4 mg/15 ml	Syp Nervitone	5.3 mg/10 ml
Syp Protostan Z	0.5 mg/15 ml	Most of the antacids contain Mg	
Topical preparation		Intravenous preparation	
Anthical	15%	Magnesium sulphate 50% w/v	
Anugesic	10.7%		
Anusol	10.7%		
Shield	5.0%		
Siloderm	7.5%		
Zinco sulpha	0.1%		
Andre eye drops	0.01%		
Eidrox	0.1%		