Zinc

Atomic number 30
Atomic weight 65.37

Collection

Serum/Plasma	2 mL	Plastic tube. No anticoagulant
Urine	20 mL	Sterile Universal

Reference ranges

			Reference
Serum/plasma	µmol/L	10.1 to 20.2 (men aged 19-64 y) 9.6-20.5 (women aged 19-64 y)	1
Blood	µmol/L		
Urine	µmol/L		
	µmol/24 h	3 to 19.3	2
	µmol/mmol creatinine		
	µmol/mol creatinine	<1.1 95th percentile	6

Age	Serum/plasma	Reference
Neonates	5.0 to 21.5	3
Children	9.8 to 19.0 (0.5-18 y)	4
Over 65s	8.0 to 20.0 (men) 9.2 to 19.2 (women)	1

References

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Clinical

Zinc is an essential trace element, stored mainly in muscle and bone. Most circulating zinc, some 80%, is present in erythrocytes. Around 80% to 90% plasma zinc is albumin bound with most of the remainder bound to alpha-2 macroglobin. Zinc is a cofactor of over 300 enzymes and is crucial for optimal nucleic acid and protein metabolism. Zinc is important in the secondary structure of proteins, binding to specific amino acids to produce finger-shaped folds (zinc fingers). It is also structurally important in growth of skin and connective tissue; in malnourished children, the rate of recovery of lean body mass is related to dietary zinc intake.

Zinc is regulated through its absorption by intestinal mucosa in processes depending on intracellular zinc binding proteins. Increased oral zinc ingestion results in increased metallothionein production in enterocytes. As a result, zinc absorption can vary significantly depending on the body's requirements. Copper is more avidly bound to metallothionein and so high-dose zinc supplementation can result in copper deficiency. Zinc bioavailability may be reduced as a result of interactions with iron, copper and phytates.

Good dietary sources of zinc are animal protein (red meat, fish, eggs, dairy products) grains, seeds and legumes although its bioavailability may be reduced from vegetables and grains because binding to phytate. The UK Food Standards Agency recommended daily allowance is 5.5 to 9.5 mg/day (men) and 4 to 7 mg/day (women) while the US Food & Drugs Administration allowances are 15 mg/day (men), 12 mg/day (women), 10 mg/day (children), and 5 mg/day (infants). The tolerable upper intake level for zinc is 40 mg/day set by the US Food and Nutrition Board

Deficiency

Frank zinc deficiency, secondary to limited intake and ingestion of phytates, was originally diagnosed in Iranian men presenting with anaemia, growth retardation, rough skin, impaired immunity and male hypogonadism. Acrodermatitis enteropathica is a rare, autosomal recessive inherited defect of zinc absorption, which presents with failure to thrive, chronic diarrhoea and a characteristic skin rash; if untreated, children usually die as a result of infections. Lifelong therapy with large doses of zinc (3mg/kg/day) is an effective treatment. Zinc deficiency may occur in premature infants prior to weaning, due to smaller accumulated stores at birth, interrupted feeding or increased requirements (such as an infection), or when zinc concentration in maternal milk is low. The reversal of symptoms on treatment is often dramatic. Zinc deficiency, with symptoms including characteristic rash, abdominal pain, diarrhoea, depression and lethargy has been well documented in patients on total parenteral nutrition with inadequate supplementation.

Dramatic loss of zinc may occur during catabolic processes. Plasma zinc may fall dramatically following operations and infections, however, this is largely as a result of the systemic inflammatory response and so does not indicate status. Likewise low albumin concentrations usually result in low plasma zinc concentrations, for example in pregnant women; again this finding does not indicate deficiency. There is no evidence supporting zinc supplementation in such patients.

Laboratory Indices of Zinc Status

Serum/plasma zinc assay is the simplest means of assessing zinc status although the degree of any systemic inflammatory response (measurable by C-reactive protein concentrations) and albumin concentration are both required to allow reliable interpretation. Zinc concentrations tend to be slightly higher in fasted patients and are lower in samples collected in the afternoon and evening. Marginally low values are hard to interpret but concentrations below 5 to 6 µmol/L would suggest deficiency. Concentrations tend to be lower with steroid use and in women taking the oral contraceptive pill.

Urinary zinc excretion is also difficult to interpret; low excretion is associated with zinc deficiency, but normal values do not exclude the possibility. Zinc is excreted when substances to which it can bind are excreted in the urine, such as organic acids, amino acids, low molecular weight proteins or certain drugs. In catabolic states, zinc excretion can increase markedly.

Measuring the activity of alkaline phosphatase, a zinc-requiring enzyme, is not a good measure of zinc status since adequate zinc is present in the reagent. Erythrocyte zinc may be normal in individuals with zinc deficiency and so is a poor indicator of status.

Zinc contamination of serum and plasma may result from the use of tubes containing metal or rubber inserts, separating beads or separating gel. Powder in gloves may also be a source of contamination.

References:

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