

ABSTRACT

Antioxidant status of malnourished children

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Free radicals, by virtue of their reactive nature, could account for the clinical features of kwashiorkor. These chemical species are produced in excess only after antioxidant defenses fail. The possibility of this situation occurring in children with kwashiorkor was therefore investigated.

Whole blood glutathione (GSH) levels were significantly decreased in children with kwashiorkor and marasmic-kwashiorkor. This indicates the presence of an overwhelming pro-oxidant stress. At a GSH level of 1.90 mmol/Lrbc ($6.80 \mu\text{mol/gHb}$) oedema could be diagnosed with a sensitivity, specificity and positive accuracy of greater than 90%. GSH correlated inversely with the degree of oedema ($r = -0.69$). In children with marasmus GSH was normal.

Erythrocyte concentrations of NADP_{tot} were normal in all children. The percentage of this nucleotide in the oxidized form ($\%\text{NADP}^+/\text{NADP}_{\text{tot}}$) was normal in children with marasmus, but abnormally elevated in oedematous children. This means that there is an acute change in the cellular redox in oedematous children, and implies that the cellular environment is oxidising.

The activities of erythrocyte glutathione reductase, glutathione S-transferase (GST) and glyoxalase I were either normal or markedly elevated. Riboflavin status was poor. The end products of detoxification by GST, urinary mercapturic acids (UMCA), were between 3 and 5 times higher than normal. There were no intergroup differences. This suggests that the body's burden of toxins is significantly increased.

During recovery from malnutrition, children with marasmus showed a rapid restoration of normal antioxidant status, whereas those with oedematous malnutrition did so only after loss of oedema. This was followed by a progressive, and unexpected, deterioration in antioxidant status: plasma vit.E and GSH levels decreased, and UMCA levels remained elevated. It was reasoned that the high PUFA content (60%) of the recovery diet may be a source of oxidative stress.

In a second study the recovery diet contained an oil (coconut), rich in saturated fatty acids. On this diet children maintained normal levels of vit.E and GSH, and UMCA decreased significantly. This confirmed the high PUFA diet as a source of oxidative stress.

Collectively, these data suggest that free radicals are involved in the aetiology and pathogenesis of kwashiorkor. It is recommended that: (1) whole blood levels of GSH be used in the diagnosis of oedematous malnutrition, and (2) coconut oil and antioxidants be used to treat malnourished children.