

World Literature

Kashin-Beck Disease: Mycotoxins and Selenium

Kashin-Beck disease (KBD) is an osteoarthritic disorder endemic in some selenium-deficient, rural areas of China and other Asian countries. Growth and joint cartilage are affected during childhood and adolescence resulting in deformities and sometimes dwarfism. Later, in early adulthood, these joints degenerate.

As many as 80% of the people in villages in endemic areas may be affected.

Selenium-deficient soils are known to be associated with this disease. Organic selenium compounds in cereals, onions, garlic, and other vegetables are the primary source of selenium for most people. Many KBD-endemic areas are also deficient in iodine needed for thyroid hormone production, and the availability of this element may also affect disease development.

Other suggested etiological factors are the presence of mycotoxins in grain and the presence of organic matter, including fulvic acids, in drinking water. Both of these substances may cause formation of free radicals which damage bone growth. During the 1990s a multidisciplinary study of KBD in Tibet brought together researchers from several countries. Results of their investigations were recently published in *International Orthopaedics*.

Selenium deficiency was severe in all 12 rural villages studied but serum selenium levels did not vary significantly between persons with and without KBD.

Cases were more likely to be iodine deficient and to use smaller water storage vessels with higher levels of organic matter in drinking water than healthy people. A variety of toxigenic fungal species were isolated from grain from both KBD-affected and nonaffected households but there was a greater degree of contamination and a greater prevalence of *Alternaria* in barley from families with KBD. Two other fungal species, *Dreschlera* and *Trichothecium*, were also significantly associated with grain from affected families. When two or

more of these fungal species were isolated from barley, KBD prevalence was 88.5% as compared to a prevalence of 13.1% if none was isolated from the grain. Grain was stored in or near many homes so that villagers may be exposed to airborne fungal spores.

Toxicity is greater when spores are inhaled rather than consumed.

Although *Alternaria* spp. are generally considered weak pathogens, mycotoxins from these fungi can induce lipid peroxidation in rodents, and an unknown, possibly toxic, metabolite has been detected in cultures of *Alternaria* from Tibetan barley.

Data also suggested that *Alternaria* may produce a mycotoxin which interferes with thyroid hormones which aid in building and repair of bones. If *Alternaria* was absent from stored grain, then the incidence of KBD dropped dramatically in persons with higher urinary iodine levels. However, the incidence of KBD was not correlated with urinary iodine levels if *Alternaria* was present in stored grain.

It appears that all of these factors investigated have a role in disease development, and several kinds of interventions may effectively reduce incidence of Kashin-Beck disease. Reduction in mycotoxin contamination of cereals and organic matter in drinking water would reduce lipid peroxidation while iodine and selenium supplements would bolster antioxidant defenses and thyroid hormone production.

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