Red rice or a red herring? Diet and goitre in Sri Lanka

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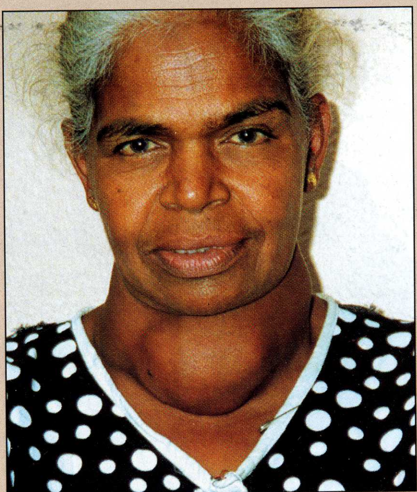
Goitre is one of a number of health disorders associated with iodine deficiency. Indeed, the discovery of the link between iodine deficiency and goitre probably represents the first recognised association between a trace element's concentration in the environment and human health. Sea water is the main source of iodine in its geochemical cycle so it is rather surprising that so many people are affected by goitre in the high rainfall, coastal zone of Sri Lanka where the maritime influence is likely to be strongest. Recent biochemical and nutritional research has indicated that selenium deficiency also has an important role in thyroid hormone metabolism. Since very little information was available on environmental selenium or iodine concentrations in Sri Lanka, a study was carried out to investigate possible links between these elements in the environment and goitre incidence. The investigation formed part of the KAR project 'Prediction and remediation of human selenium imbalances' and was carried out in consultation with environmental geochemists, biochemists and medical specialists from the Institute of Fundamental Studies and the University of Peradeniya in Sri Lanka.

The concentrations of selenium and iodine in soils, rice grain, and drinking water, as well as human selenium status (indicated by hair analysis), were determined for villages characterised by different goitre incidence rates. Analytical data indicate that the amount of organic matter, secondary iron oxides and clay minerals in the soil, as well soil pH, appear to control the total concentration of selenium and iodine as well as the availability of these elements to food crops. Whereas soil selenium and iodine in the areas with the highest goitre rates are not particularly low, geochemical factors appear to severely restrict their uptake by rice plants. No major differences were detected between the amounts of selenium and iodine in rice consumed in areas with high and low goitre incidence. However, iodine in drinking water is much higher in the villages with low goitre incidence and forms a significant source of dietary iodine to the people living in these villages – all of which are located in the low rainfall zone of Sri Lanka. Hair analysis indicates that a significant proportion of the Sri Lankan population is selenium deficient, although no correlation was detected between selenium status and goitre incidence. It was concluded that selenium and iodine deficiency may both be implicated in the etiopathogenesis of goitre, though neither factor appears to play a dominant role in Sri Lanka.

Whereas iodine deficiency is accepted as the main environmental determinant in the etiology of endemic goitre, there are a large number of naturally occurring agents, called goitrogens, that are known to adversely affect the function of the thyroid gland and interfere with the process of hormone synthesis. Some staple foodstuffs, such as cassava and millet, contain goitrogenic substances that can exacerbate the effects of iodine deficiency. Previous studies in Sri Lanka indicated that foods potentially high in goitrogenic substances, including cabbage and cassava, are not consumed in larger amounts in those areas where goitre is more prevalent. However, during the current investigations, it was observed that red rice is cultivated and consumed mainly in those areas with high goitre incidence. This may be important insofar that red rice is likely to contain flavonoids, which are known to be goitrogenic. Thus, goitrogenic substances in red rice may be a contributory factor and this, along with other potential factors, such as nutritional status, clearly require further investigation.



Woman suffering from goitre, one of the primary health effects of iodine deficiency.

Ongoing projects

R7115, G1 Best practice in small-scale gemstone mining. (Daniel Start, Intermediate Technology)

R7116, G1 Evaluating possible uses of Zimbabwean phosphate based wastes. (Ottos Ruskulis, Intermediate Technology)

R7120, G1 Recovering the lost gold of the developing world. (Mike Styles, British Geological Survey)

R7181, G1 Design and pilot implementation of a model scheme of assistance to small-scale miners. (Jeffrey Smith, Wardell Armstrong)

R6491, G2 Environmental arsenic exposure: health risks and geochemical solutions. (Barry Rawlins & Pauline Smedley, British Geological Survey)

R7118, G2 Cost-effective evaluation of hazards from mine waste. (Ben Klinck, British Geological Survey)

R7117, G4 New hydroponoic and construction uses for porous volcanics (VOLCON). (Steve Mathers, British Geological Survey)

R6839, G5 Implementation strategy for landslide hazard preparedness. (David Greenbaum, British Geological Survey)

R7198, G5 Appropriate technology for low-cost geological mapping. (Eugene O'Connor, British Geological Survey)

R7199, G5 Strategies and systems for maximising geoscience data value. (John Laxton, British Geological Survey)

R7200, G5 The societal value of geoscience information in LDCs. (Tony Reedman, British Geological Survey)

New projects

G1 Low-cost lime for small-scale farming (FARMLIME). (Clive Mitchell, British Geological Survey)

R7354, G1 Mercury-free coal-gold agglomeration (CGA) process for gold. (Professor Michael Mingos, Imperial College of Science Technology and Medicine)

G1 Local phosphate resources for sustainable agriculture. (Don Appleton, British Geological Survey)

G1 Sustaining communities through mine waste reclamation. (David Harrison, British Geological Survey)

G2 Environmental controls in iodine deficiency disorders. (Chris Johnson, British Geological Survey)

G4 Bentonite-enhanced soils technology transfer. (Tony Di Stefano, Knight Piesold Ltd (KP))

G5 Protecting vulnerable small islands by improved forecasting and warning. (Professor Bill McGuire, Benfield Greig Hazard Research Centre)