the newborn infant, but the evolution of the radiographic features and recognition of the characteristic clinical features (notably dwarfism, deformity, articular hypermobility and spinal malalignment) permit confirmation of the diagnosis.

In view of the significant gene frequency in the Afrikaner community the genetic implications are considerable, especially for 'at risk' couples who have already produced an affected child. The basic defect is unknown, but it is likely to reside in the collagen of ligament and bone. We are at present addressing this problem at the biochemical, ultrastructural and molecular levels.

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REFERENCES


Magnesium and deaths ascribed to ischaemic heart disease in South Africa
A preliminary report


Summary

The incidence of death from ischaemic heart disease (IHD) and acute cardiac arrhythmias is increased in some regions where magnesium levels are reduced in soil and water. Magnesium levels in the drinking water of twelve South African magisterial districts have been evaluated together with corrected statistics for deaths apparently due to IHD in White males from the same districts. A significant negative correlation was found between the incidence of deaths ascribed to IHD and the magnesium content of drinking water. Future, prospective, multivariate studies are required to elucidate whether magnesium scarcity in a geological environment is a major coronary risk factor.

In South Africa statistics based on the examination of death certificates indicate that there is a high death rate from ischaemic heart disease (IHD) among Whites, Indians and Coloureds, although a significant number of deaths ascribed to IHD by practitioners who sign death certificates are certainly due to acute cardiac arrhythmias unrelated to IHD or, in some cases, to catastrophic cerebral haemorrhage. Diagnostic errors of this kind are commonly made in all countries, particularly in rural areas where pathology services are often limited.

Data from various sources suggest that the incidences of death from IHD and acute cardiac arrhythmias may be influenced unfavourably by regional deficiencies in dietary magnesium content. This view is supported by clinical and pathophysiological evidence that serious cardiac arrhythmias occur in magnesium deficiency of any origin.

Magnesium concentrations in soil, water and locally grown fruit and vegetables vary in accordance with regional geological characteristics. When domestic water is supplied from natural sources its magnesium content is similar to that of the local soil and farm produce and, in the absence of significant supplementation from other sources, the level of magnesium in drinking water provides an accepted indication of magnesium intake in any given area. Utilizing this principle a preliminary examination of official data has been carried out to determine whether any apparent relationship exists between deaths ascribed to IHD and magnesium levels in the drinking water of several selected South African towns.

Methods

Data on the average magnesium content of drinking water in various districts during 1982 were provided by the Department of Environmental Affairs, Pretoria. These data were based on a sampling procedure whereby water from regional dams and rivers supplying them was repeatedly examined by atomic absorption spectrophotometry. A preliminary survey of the data allowed identification of a set of localities where the magnesium content of water varied from
0.04 to 1.85 mmol/l (1-45 mg/l), allowing a wide range of possible magnesium intakes. The districts studied were those of Bloemfontein, Bothaville, Duiwelskloof, Durban, Hennenman, Mafeking, Pietersburg, Potgietersrust, Postmasburg, Venterstad, Virginia and Welkom. This selection preceded the acquisition of any data on regional death rates from IHD.

Corrected statistics\(^{10}\) for deaths in White males, apparently due to IHD and derived from death certificates issued during 1978, were supplied by the Department of Statistics, Pretoria.\(^{8}\)

Spearman's (non-parametric) correlation coefficient (rho) was calculated to determine whether any correlation existed between deaths attributed to IHD and magnesium content in drinking water. The test was two-tailed and \(P = 0.05\) was considered the limit of significance.

**Results**

A significant negative correlation was found between the incidence of death apparently due to IHD and the magnesium content of drinking water (Fig. 1).

**Discussion**

The view that magnesium deficiency may be of pathogenic importance in precipitating deaths from ischaemic heart disease is currently supported by experimental\(^{31}\) and epidemiological findings.\(^{2,4}\) It may also be postulated that magnesium deficiency is an aetiological factor in IHD since it decreases glucose tolerance\(^{12}\) and decreases the high-density/low-density lipoprotein ratio.\(^{13}\)

The death rates for IHD used in the present study are undoubtedly biased by the inclusion of patients who did not suffer from IHD but died as a result of unrelated acute cardiac arrhythmias. However, since magnesium deficiency is a proven determinant of cardiac arrhythmias\(^{6}\) this bias is of minor importance.

It is possible that a small percentage of sudden deaths attributed to IHD were caused by acute cerebrovascular events. In this regard it is noteworthy that experimental evidence has been published indicating that magnesium depletion causes spasm of the cerebral arteries.\(^{14}\)

Future prospective multivariate studies are required in which somatic magnesium status is related to the prevalence of IHD and occurrence of deaths due to acute myocardial infarction, independent arrhythmias and cerebrovascular accidents. The incidence of all other known risk factors for IHD should also be evaluated. Such studies should be multicentric and be carried out by specially trained medical practitioners in small environmentally and biologically homogeneous communities where patients can be followed up.

**REFERENCES**