ENDEMIC GOITRE IN SOUTH AFRICA

The Union Department of Nutrition has published a monograph* serving *inter alia* as a report of the investigations of the Goitre Research Committee appointed 6 years ago under the auspices of the Department of Health, the University of Pretoria, and the Council for Scientific and Industrial Research.

The researches of the Goitre Research Committee are described, the results summarized, and the recommendations made to the Union Government set out. In addition the subject of goitre is treated on general lines (classification of thyroid enlargements, causes of simple or endemic goitre, the symptoms of endemic goitre, prophylaxis etc.).

The Committee's method of approach was to make enquiries concerning goitrous, suspected goitrous and non-goitrous areas through the Departments of Education of the 4 Provinces, the Union Department of Education, and the Department of Health. Schools in the areas concerned were visited and the children examined. Subsequently the homes of the children found to be suffering from goitre were visited and the remaining members of their families examined, and specimens of food and drinking-water collected for analysis.

For purposes of comparison the homes of children free from goitre were visited and similarly investigated.

As many areas as possible were visited, and in addition many private practitioners, district surgeons, medical inspectors of schools, and others, were contacted, who submitted specimens of food, soil and water from goitrous and non-goitrous areas for analysis.

Endemic goitre was reported from the following areas:

UNION OF SOUTH AFRICA

Cape Province

Langkloof-Cougha River area (near Port Elizabeth). The whole of this area can be considered an endemic goitre area, the worst parts being Noeree River valley and the Opkoms area. The number of goitre cases (including slight thyroid enlargements) varied from 3% to 22% in the different schools. A fair number of adults, mostly females, have been operated on for toxic goitre at Port Elizabeth. The whole area (including the Knysna-George area) is known to be deficient in phosphorus and calcium, which is reflected in the very poor teeth of most of the children and adults. In general the diet is fairly satisfactory, containing meat, vegetables and fruit. Fourteen soil specimens in the goitrous area varied in iodine content from 190 μg. to 3,670 μg. per kg., as compared with a non-goitrous Pretoria area 1,500 μg. to 7,500 μg. The drinking-water in the Cougha Mountains is deficient in iodine (6-11 μg. p.l.), and at Braam River (stream water) 22 μg. p.l.

North Western Cape Province. Goitre is endemic in these areas, and it was found that this was not due to iodine deficiency (the drinking-waters are rich in iodine), but to the presence of harmful quantities of fluorine in the drinking-water. The region is well known as an endemic fluorosis area, where teeth are badly mottled. A fair proportion of people, especially women, settling in this part of the country develop thyroid enlargement within 10-15 years. At 20 schools in the places named below 7-25% of the children examined showed evidence of goitre. The iodine and the fluorine in the drinking-waters were as follows:

Place	*Source of Drinking Water*	*Iodine Content (μg. per litre)* *	*Fluorine Content (mg. per litre)* *
Kenhardt ..	River (Municipal supply)	220	*Nil*
Upington ..	Orange River (Municipal)	15	0·05
Kakamas ..	Orange River (Municipal)	15	0·05
Pofadder ..	Boreholes	43-322	2·0–2·6
Springbok ..	Boreholes (Municipal)	50	1·6
O'Kiep ..	Boreholes	42-175	1·7–2·6
Nababeep ..	Boreholes	42-175	1·7–2·6
Port Nolloth	Wells	290-320	*nil*–0·1
Sultana Oord	Orange River ..	15	0·05
Karos ..	Orange River ..	15	0·05
Noenieput ..	Boreholes	270-380	1·4–3·2

* Steyn, D. G., Kieser, J., Odendaal, W. A., Malherbe, H., Snyman, H. W., Sunkel, W., Naude, C. P., Klintworth, H. and Fisher, E. (1955): *Endemic Goitre in the Union of South Africa and Some Neighbouring Territories.* Union of South Africa, Department of Nutrition. Pp. 90, with map and 30 photographs.

Place	Source of Drinking Water	Iodine Content (μg. per litre)*	Fluorine Content (mg. per litre)*
Askham ..	Borehole	22	*Nil*
van Zylsrus..	Boreholes	25-36	*Nil*
Seodin ..	Boreholes	10-14	*Nil*
Kuruman ..	Spring (Municipal) ..	8	*Nil*
Vryburg ..	Boreholes	64	0·3

* One milligram per litre (1 mg. p.l.)=1 part per million. One milligram (mg.)=1,000 micrograms (μg.).

In these areas 200 adults and 4,813 school children were examined. Several men and women stated that with large doses of iodine (usually Lugol's solution) their goitres disappeared. The investigators gained the impression that in areas where the goitre is fluorine-induced the incidence of nodular goitre in adolescents is greater than where the goitre is due to a primary iodine deficiency; also that the treatment of simple goitre with large doses of iodine in the form of Lugol's solution is, to a certain measure at least, responsible for the high incidence of thyrotoxicosis which they found in the area. (The Kenhardt water supply has been in use for a few years only; formerly the municipal supply was from boreholes. The fairly high percentage of goitre in the children at the Kenhardt schools is attributed to (1) the drinking of the previous borehole supply until some years ago, and (2) the fact that a large percentage of the school children hail from farms where the water contains harmful quantities of fluorine.) Generally speaking the diet of the people in this region is satisfactory; a large proportion of the fruit and vegetables is imported.

Transvaal

Bronkhorstspruit area. Cases of endemic goitre in Europeans and Bantu. The iodine in drinking-water from goitrous families varied from undetectable quantities to 5 μg. p.l.

Belfast-Machadodorp area. Many cases in Bantu.

Nelspruit-Barberton area. Prevalent among Bantu (in one district Dr. T. Blake had found 290 cases in about 300 Bantu women). The iodine in drinking-water varied from undetectable quantities to 13 μg. p.l.

Brits area. A small number of slightly enlarged thyroids found in a primary school at Skeerpoort and a lesser degree at a primary school at Wolhuterskop. A few adolescent girls had markedly enlarged glands and 2 women had exophthalmic goitre.

Koster area. Only one of the 8 families living on the farm Kosterfontein was free from goitre; this was the only family who drank borehole water (16 μg. iodine p.l.); the remainder used water from springs flowing from the 'Witwatersrand' (5-10 μg. iodine p.l.). In the other families 2 elderly women had exophthalmic goitre and 3 more had been operated on for the same complaint. The municipal water supply at Koster, where goitre is not known to occur, contains 32 μg. iodine p.l.

Natal

Polela area. An endemic area. The iodine content in 15 specimens of water ranged from undetectable quantities—less than 3 μg. p.l.—(in 5 specimens) to 64 μg. p.l., and the fluorine content from 0·3 to 214 mg. p.l.

Orange Free State

It appears that the entire Drakensberg area, including the whole of Basutoland, can be regarded as an endemic goitre area.

ADJOINING TERRITORIES

Basutoland

See preceding paragraph.

Caprivi Strip

The Caprivi Strip is about 200 miles in length and varies from 20 to 30 miles in breadth; it has a population of about 15,000. It is a portion of South West Africa and is bounded by Angola, Northern Rhodesia, Southern Rhodesia and the Bechuanaland Protectorate. It is fertile and excellent cattle country and the food position of the Natives (who in parts eat a great deal of river fish) appears to be very satisfactory, and their nutritional state is good. The cattle show no signs of goitre. Throughout the area hygenic conditions are very bad.

Eastern Caprivi Strip. This area has been reported as highly goitrous by Major Trollope, Dr. S. Annecke, Dr. B. Squires and others. This is confirmed by the Committee, who conducted investigations amongst the Natives in the villages of Ikoma, Matanga, Linyanti (and its sub-villages), Kanono, Lisikili, Kalaluka and Silitene. They examined 460 persons of all ages. The average incidence of goitre was 50%, and the figures reached 70% at Linyanti. In females between 20 and 40 years old the incidence of nodular goitre was 16-40%. Earlier observers have reported that even breast-fed babies have enlarged thyroids. The drinking-water is obtained from the Chobe and Zambesi Rivers and from the pans and wells in the rest of the country, of which large tracts are inundated during the rainy season. The different waters varied in iodine content from 8 to 36 μg. p.l. The Committee conclude that the high incidence of endemic goitre in the Eastern Caprivi Strip is due almost entirely to a pronounced primary deficiency of iodine in the soil, food and water. As a general rule, the incidence bears a direct relationship to the degree of iodine deficiency in the drinking-water.

Western Caprivi Strip and South West Africa. Dr. W. H. G. Kuschke (1952) surveyed this portion of the Caprivi Strip and reported as follows: 'It appears quite definite from the results .... that goitre is prevalent amongst all these Native tribes, viz. Barakwengo 69·9%, Okavango Natives 62·6% (Mbukush and Derico). The cause .... must be sought in an iodine deficiency in the food, water and soil of these areas. Of all the enlarged thyroids examined, only a few were nodular ....' Dr. Kuschke suggested that iodized salt should be supplied to the inhabitants of the Caprivi Strip and to all the tribes of the Okavango territory.

It therefore appears that the entire Caprivi Strip is an endemic goitre area.

In the semi-arid southern region of the South West Africa adjoining the North-Western Cape Province subterranean waters also contain fluorine.

Swaziland

Drew, Elder and Glynn (1940) called attention to goitre in Swaziland and stated there was a general iodine deficiency there. F. W. Fox recommended the use of iodized salt. The Committee examined 2,000 Native and Coloured school children and 300 European. The percentage of goitrous non-European children in individual schools varied from 4% to 71%. The average amongst Native school children was 26% and amongst the European children 4%. There was a definite tendency for the incidence of goitre to be directly proportional to the degree of iodine deficiency in the water. The Bremersdorp municipal water contained 18 μg. of iodine p.l. and other river supplies 18-22; spring water contained iodine varying from 8 to 59 μg. p.l. The nutritional state of the children was fair and their teeth good.

IODINE AND FLUORINE CONTENTS

A comparison is made between the goitrous regions of Swaziland, Caprivi Strip and Langkloof-Cougha River and the non-goitrous regions of the Colesberg, Middelburg-Cradock area and Griqualand West. The iodine contents are expressed as μg. p.l. or kg. and the fluorine as mg. p.l.

In these goitrous regions the iodine in the soil varied from 190 to 5,400 and in the grass from 900 to 3,500; in the non-goitrous regions the figures were—soil 1,500-7,500, grass 1,500-3,500 (the analyses of grass were made from the point of view of animal nutrition—see below).

In the goitrous regions the iodine in the water varied from less than 5 to 33 (except in regions where the endemic goitre was considered to be due to fluorine, in which the iodine in the water varied from 39 to 820); in the non-goitrous regions the iodine content of the water varied from 39 to 320.

The fluorine content of the water in regions of fluorine-induced goitre varied from 1·4 to 5·5, and in non-goitrous regions from less than 0·05 to 1·2.

Little evidence of goitre in animals was discovered, even in areas where human goitre is endemic. The Committee's investigations indicate that this is because the grasses eaten by stock in these areas contain much larger quantities of iodine than the vegetables, cereals and fruit grown there.

RECOMMENDATIONS OF THE COMMITTEE

Two years ago the Committee recommended to the Minister of Health that iodized salt should be supplied to all endemic goitrous

areas in the Union and to the entire Caprivi Strip and Swaziland, *but not to the areas of fluorine-induced endemic goitre*. The recommendation is now extended to Basutoland and those northern parts of South West Africa where goitre is endemic. The level of iodization suggested was 1 part of iodine per 100,000 parts of salt, and it was recommended that the iodine should be added in the form of potassium iodate (KIO_3) instead of potassium or sodium iodide, as the iodate is much more stable than the iodides. The advice has been accepted by the Government and it is hoped that iodized salt will be available for distribution within the next few months.

The Committee recommends that individuals showing symptoms of thyroid hyperfunction should not take iodized salt except under medical advice.

The use of salt containing 1 : 100,000 parts of iodine is not sufficient to cure existing cases of simple goitre, and it is recommended that these should be supplied with additional iodine.

It is recommended that when the iodized salt is used care should be taken concerning the simultaneous use of medicines or cosmetics containing iodine. A warning is also issued concerning the use of iodides and iodates as food preservatives. The Committee recommends that all preparations containing iodine should carry labels indicating the quantity present.

Special reference is made to the low iodine content of the Pretoria municipal water supply (average 18 μg. p.l.) and parts of the Witwatersrand and Vereeniging, where a few specimens of water drawn from houses contained an average of 23 μg. of iodine p.l. It is recommended that annual surveys be made of school children in these areas.

The Report includes a map (Fig. 1), from which (the Committee states) 'it is clear that a goitre belt runs from the Letaba area, in the Transvaal, through Swaziland, Natal, the Eastern Cape Province, Southern Cape Province, Villiersdorp, Caledon, Hex River Valley, to Ceres and Tulbagh in the Western Cape Province. It is not maintained that all the inhabitants of this goitre belt are affected by the disease, but that a large number of endemic goitre areas are situated in it. *More intensive and extensive research into our goitre problem will undoubtedly reveal many more endemic goitre areas, not only in the goitre belt but also in other parts of South Africa*'.

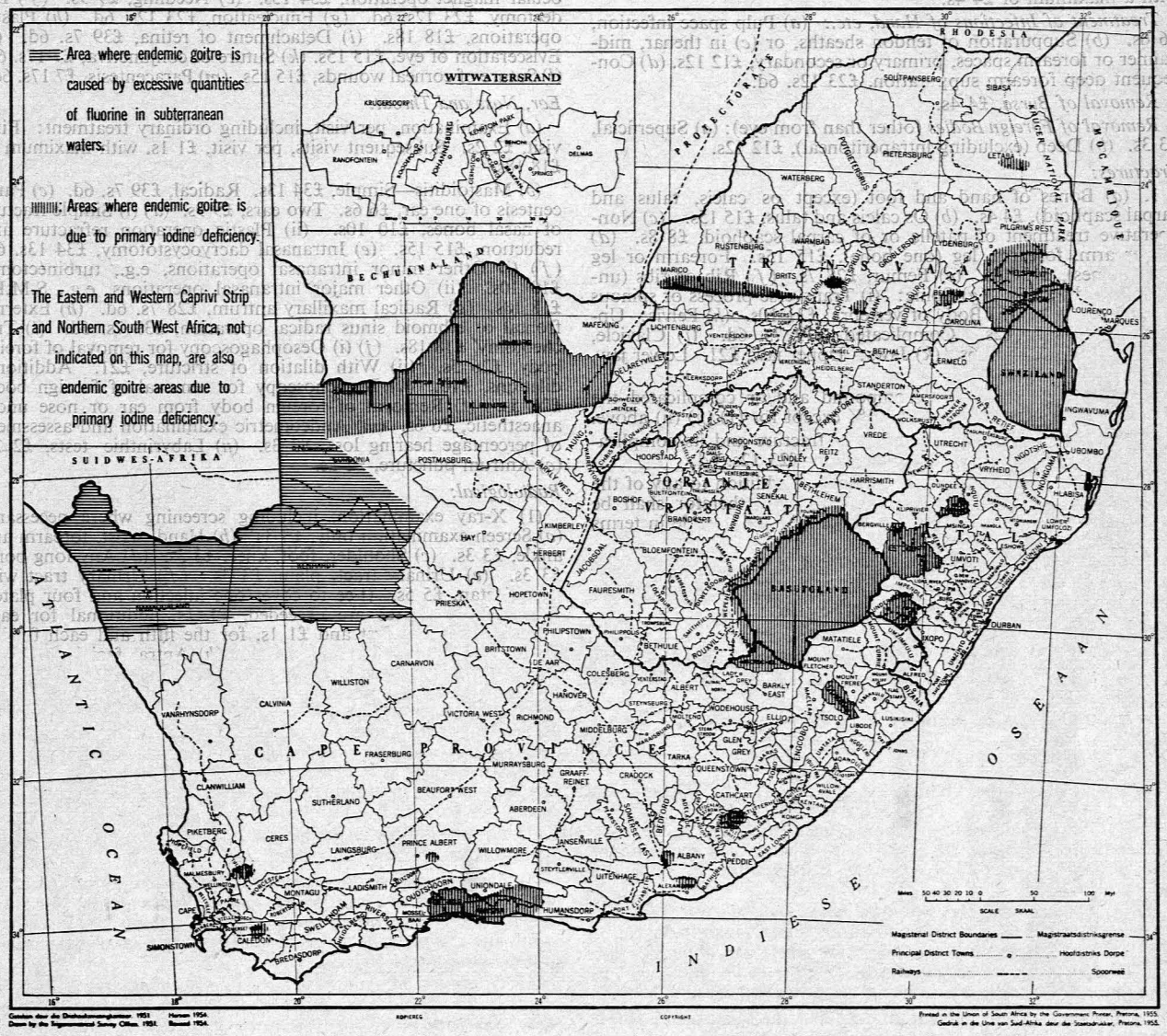

Fig. 1 Map of the Union of South Africa indicating where Endemic Goitre occurs.