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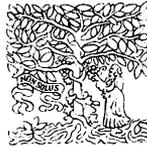
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The Prevention and Control of Iodine Deficiency Disorders

Edited by

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International Council for Control of Iodine Deficiency Disorders

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IODINE DEFICIENCY DISORDERS IN EUROPE

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ABSTRACT

Iodine deficiency continues to exist in Europe. Countries with no endemic goiter currently are Ireland, Iceland, United Kingdom, Norway, Sweden, and Finland; the latter three are goiter-free because of highly effective prophylactic programs. Another group includes Bulgaria, Czechoslovakia, the Netherlands, and Switzerland, and perhaps Belgium and Denmark. These countries have had major IDD problems in the past but have introduced successful prevention programs; goiter is occasionally seen but is rare in children. A third group consisting of 12 countries in which IDD persists. In four of these - Austria, Hungary, Poland, and Yugoslavia - iodine prophylaxis is mandatory, but the levels are inadequate. The remaining countries of this group - Federal Republic of Germany, German Democratic Republic, Greece, Italy, Portugal, Romania, Spain, and Turkey - have no mandatory iodine prophylaxis and IDD continues a major problem, occasionally involving cretinism. These countries require prompt correction of iodine deficiency. A final group consists of Albania, France, and the USSR; adequate information about them is unavailable, although IDD has been known to exist in France and the USSR in the past.

BACKGROUND

This review is based on the report of the subcommittee for the study of endemic goiter and iodine deficiency of the European Thyroid Association (1,2). Epidemiologic information on the prevalence of goiter and alimentary iodine supply is scanty for most European countries. Although regional data are available, these do not necessarily reflect the situation throughout the country from which they originate. The regional data give relatively good information concerning the population sample studied; however, it is frequently difficult to conclude which part of the total population of a given area is represented by the sample studied and what percent of the total inhabitants of the country live in the areas studied.

Most surveys have used the standard classification of goiter size according to the Pan American Health Organization from 1974 (3), which is associated with a significant risk of overestimation in children and underestimation in adults, as sonographic volumetry has shown (4-6).

Daily urine iodine excretion and iodine excretion from spot urine samples have been widely accepted as a satisfactory index of iodine intake (7). Since Europe is, except for one Spanish region (8), not considered to suffer from protein malnutrition, the urine iodine/creatinine ratio is acceptable (9). Hardly any data are available on the potential effects of dietary goitrogens (10-12). Limitations of the study of endemic goiter and

TABLE I. STATUS OF IODINE PROPHYLAXIS IN EUROPE

Country	Iodine Prophylaxis
<u>No endemic goiter</u>	
Finland	v
Norway	v
Sweden	m
Denmark	n
Iceland	-
Ireland	v
United Kingdom	n
<u>Intermediate</u>	
Bulgaria	m
Czechoslovakia	m
The Netherlands	m
Switzerland	m
Belgium	v
Austria	m
Hungary	m
Poland	m
Yugoslavia	m
<u>Endemic goiter</u>	
German Democratic Republic	v
German Federal Republic	v
Greece	v
Italy	v
Portugal	v
Romania	-
Spain	v
Turkey	-
<u>No information</u>	
Albania	-
France	v
USSR	-

m = mandatory; v = voluntary; n = none; - = no information

iodine deficiency are partly due to legal obstacles for epidemiology and to widespread disinterest in iodine supplementation programs among European health administrations.

IDD STATUS BY COUNTRY

This section presents information on goiter prevalence (Fig. 1), iodine supply (Fig. 2), and supplementation programs (Table I) since 1970 (for the older literature the reader is referred to the reference list of this chapter). The following paragraphs summarize each country.

Albania

No information is available.

Austria

Iodine prophylaxis has been mandatory since 1963 and endemic cretinism has disappeared. The incidence of neonatal hypothyroidism is 1:4600, and goiter prevalence in 6-year-olds is 1.1-1.5%. Goiter prevalence increases with age, up to 13.4% in 18-year-olds. Up to one-third of adults have goiter. Iodine excretion in 2262 patients from 5 cities showed an iodine excretion slightly below 100 μg iodine/g creatinine. In Graz and Oberwolz, urinary iodine is still quite low. In Sieldorf a mean iodine excretion of 132.6 μg iodine/ g creatinine was found. Compared with the epidemiological data before 1963 the situation has drastically improved; however, an increase in potassium iodide from 10 mg to 20 mg/kg salt has been recommended and legislation is pending (13-15).

Belgium

A prevalence of goiter of 1.8% was noted in over 50,000 male army recruits in 1956 (16). A study on the seasonal variation of stable iodine in non-toxic goiter indicated a mean excretion of 50 μg iodine/g creatinine. Data from the 1960s indicate similar figures (17-22). In 1986 the median urinary iodine concentration ($\mu\text{g}/\text{dl}$) in 196 healthy full-term infants born in Brussels was 4.8 and thus lower than in Helsinki, Finland (11.2) but higher than in Gottingen, FRG (1.5) (23). New and methodologically reliable data on goiter prevalence and iodine supply are urgently needed.

Bulgaria

A survey of 1 million school children in 1957 revealed a goiter prevalence of 19.2%. Thereafter, a reduction of the regional goiter prevalence from 55% to 12% was reported. No endemic goiter is now observed below 15 years of age (24). Twenty milligrams of potassium iodide are added to each kilogram of salt.

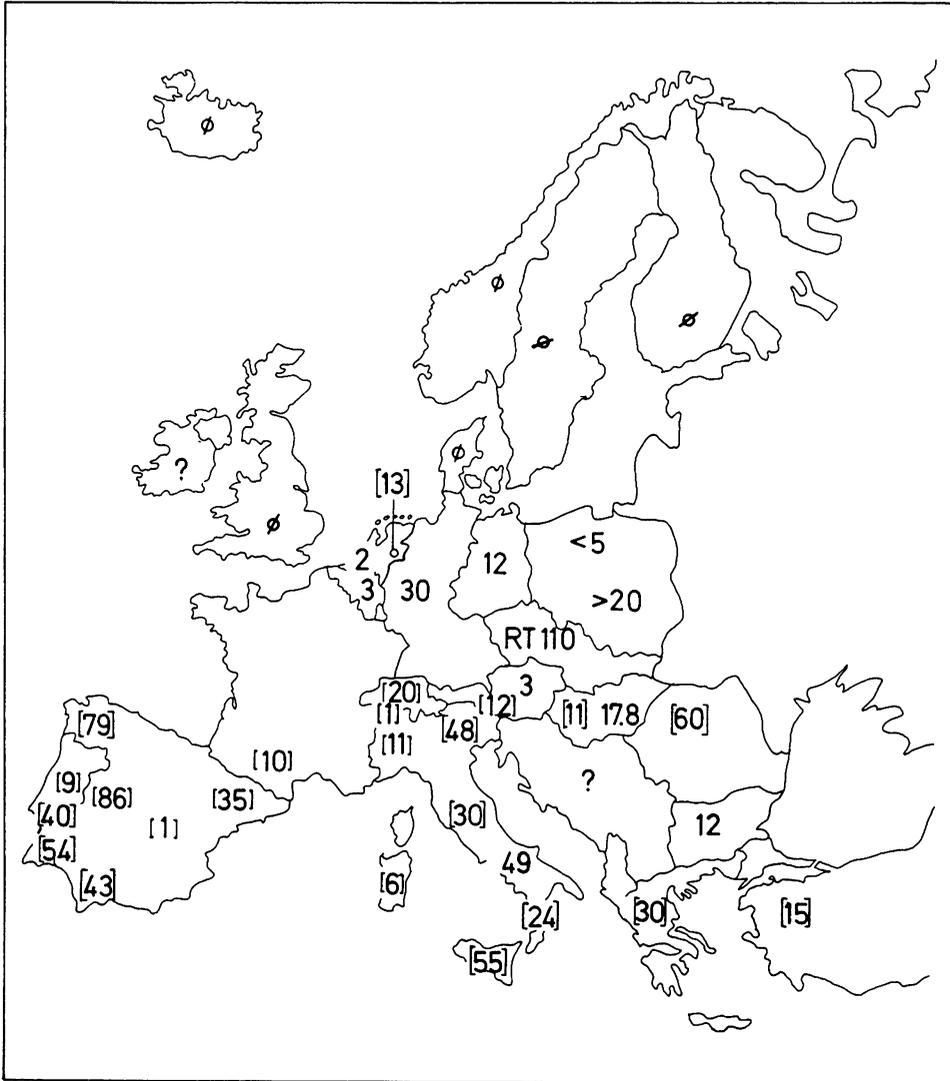


Figure 1. Goiter prevalence in percent, by country; regional values are denoted by brackets.

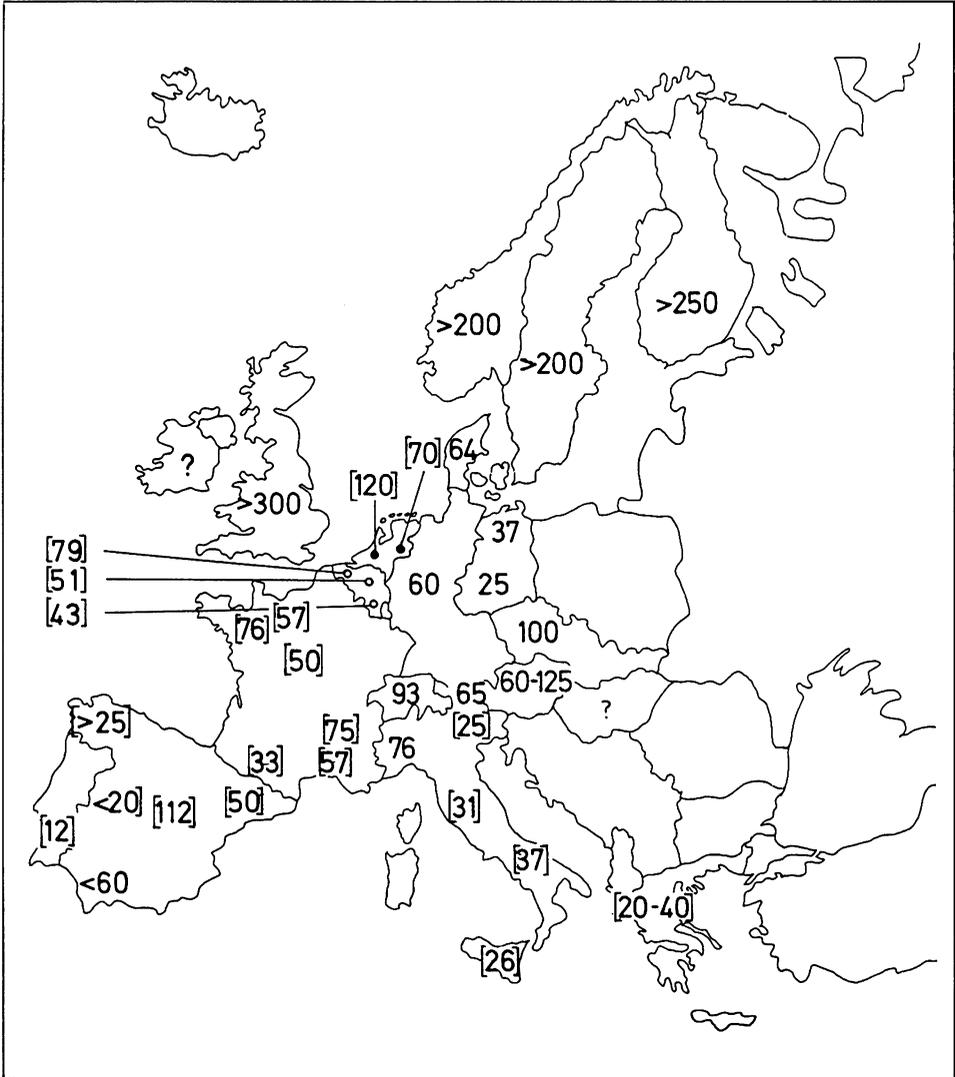


Figure 2. Urinary iodine excretion, in $\mu\text{g I per g creatinine}$, by country; regional values are denoted by brackets.

Czechoslovakia

The prevalence of goiter was 50% in males and 70% in females from examination of more than 370,000 persons between 1947 and 1953 (24), before the introduction of iodine prophylaxis. Correlations with low iodine excretion and with thiocyanate from brassica (12) were shown. Detailed data have been published on the prevalences of total and nodular goiter, and on the different sizes of goiters in men and women by geographical districts for the years 1949 to 1953 (25,26).

Iodine prophylaxis was started in 1947 in selected areas and introduced into the whole country in 1953. At that time, the content of potassium iodide was either 12 mg/kg salt or 25 mg/kg, depending on the area, but since 1965, 25 mg I/kg salt has been used throughout the country. Consideration is currently being given to increasing the level to 35 mg/kg.

In 1966 follow-up studies in 100,000 subjects showed that urinary iodine values had increased to 100 $\mu\text{g}/24\text{ h}$ and that the prevalence of goiter had decreased (6). An interruption in iodine prophylaxis for almost seven years in two districts was associated with an increase in radioiodine uptake by the thyroid, an increase in serum TSH, a decrease in urinary iodine excretion, from 109.0 to 33.3 $\mu\text{g}/24\text{ h}$ (district BK), and a decrease in serum PBI (27,28). New data on iodine alimentation and goiter prevalence are needed.

Denmark

In 1969 a nationwide screening of 6,000 young men revealed a mean urinary iodine excretion of 64 $\mu\text{g I}/24\text{ h}$. The values were higher in Sealand (range 68 to 139) than in Jutland (range 41 to 28) (29). According to the ETA questionnaire (1981) and to personal communication (P. Lauerberg), a committee under the Danish health department concluded, from unpublished data on goiter prevalence in school children, that iodine prophylaxis was not necessary. Very recent data from Funen, an area considered as representative for the whole of Denmark, showed an estimated daily urinary iodine of 97.7 μg for adult women and 100.9 for men, based on extrapolations from five hour collections in 505 subjects (29a).

Federal Republic of Germany

In 1984, ultrasonography was used to assess thyroid sizes of more than 3,000 school children in 25 towns and more than 3,000 adults from 10 towns. The results (5, 30-34) showed that 40% of all thyroid glands were enlarged. The iodine excretion from spot urine samples was in the range of 60 $\mu\text{g I/g creatinine}$. The iodine excretion of neonates was between 1.7 and 2.7 $\mu\text{g/dl}$, values 3- to 4-fold lower than those in Sweden. Furthermore, alterations in sonographic echo patterns were found in almost 16% of the healthy adult population (5, 30-34).

Iodinated salt (15-25 mg I/kg) is used on a voluntary basis by less than one-third of the population. This salt is only available as additional table salt. Since the mean

intake of table salt is only 1.7 g/day (35), this route has not proven adequate for iodine supplementation. Compulsory iodination of all salt is not legally possible. A recommended remedy for the problem is a gradual increase in iodine content up to 50 mg I/kg table salt and a general use of iodinated salt in food production (36). Programs to increase public awareness have been started.

Finland

Endemic goiter has declined to less than 6%. The use of iodized salt is voluntary, but widespread. Milk products are further iodine sources. The average dietary iodine intake amounts to 340 μg per day per person. However, earlier reports of goitrogens in milk must be remembered (37,38).

France

Reliable data are still lacking. Endemic goiter has been reported from the Pyrenees. According to the older literature (1937) there were several areas of endemic goiter in France (39).

German Democratic Republic

In the last decade several epidemiological surveys have been carried out in the GDR. All studies indicate that the goiter prevalence for the whole country in all age groups is higher than 12%, increasing from north to south. The urinary excretion of iodine is often less than 50 $\mu\text{g/g}$ creatinine. Iodized salt, with an unreliable and unstable content of 2-25 mg KI/kg salt, is used by less than one-third of the population. The introduction of mandatory iodinated salt prophylaxis is planned. An interdisciplinary iodine commission has been established to control and coordinate the necessary measures (40-42).

Greece

Endemic goiter remains common, with prevalence figures as high as 50% in some areas. Iodized salt (40 mg KI/kg) is available but more expensive than non-iodized preparations, and is used mainly by the urban population. Urinary iodine excretion in Athenians had increased to 94.5 μg per g creatinine by 1982 (43,44).

Hungary

A decrease in goiter prevalence from 32 to 11% in schoolboys from some iodine-deficient areas was reported in 1981. The iodine content of salt was subsequently increased. However, the supply of iodized salt is irregular. From data of 69 newborns it was deduced that iodine deficiency may still persist (2).

Iceland

There are no reports of endemic goiter. No further information is available (16).

Ireland

Available figures date back to the 1970s and before. Goiter prevalences of 27% and 12% were reported in female and male emigrants, respectively (16,45). Random samples taken recently on 411 outpatients in Dublin hospitals showed a mean urinary iodine of 137.5 $\mu\text{g/g}$ creatinine and a median of 111.0; 23.3% had iodine excretion values below 70 $\mu\text{g/g}$ creatinine (45a). It is cautioned that these figures can in no way be taken as representative of the total Irish population; however, they justify more careful examination for iodine deficiency. No further information has been obtained.

Italy

Endemic goiter is widespread in Italy, especially in the mountainous areas, while big cities and other heavily populated areas are apparently free of it. Iodized salt is available in some regions, although its use remains limited (46-54). In Sicily 25 to 80% of the school children had goiter, but prophylactic programs through water iodination carried out in Troina resulted in a nearly complete eradication of goiter by 1982 in that city (51). In Alto Adige the prevalence of goiter was 9.2 to 37.9% among 3,109 school children, with regional values of iodine excretion between 4.57 and 18.5 $\mu\text{g/g}$ creatinine in 1982. In Tuscany thyroid enlargement was found in 63% of school children and 83% of adults in a recent study. The mean urinary iodine excretions in the endemic area ranged from 35.4 to 49.1 $\mu\text{g/g}$ creatinine, compared with 87.8 in coastal areas. The thyroglobulin concentration in serum increased and the serum TSH decreased in relation to goiter size. Functional autonomy of the thyroid was assumed by the finding of low serum TSH (55). A pilot study with voluntary iodinated salt prophylaxis showed that only 1/3 of the population had good compliance, chiefly because iodinated salt was not easily obtainable; the goiter prevalence did decline in children but not in adults.

In May 1986 the Italian Society of Endocrinology approved an Italian Iodine Manifesto (55a). It noted the continued presence of clinical IDD in Italy, as well as the fact that many supposedly non-endemic areas receive only marginally adequate amounts of iodine. It recommends (a) suitable legislation making availability of iodized salt mandatory in all food stores with no price differential from non-iodized salt; (b) an effective national health education program about IDD and its control; and (c) establishment of centers for control and monitoring of iodine prophylaxis in each regional state.

The Netherlands

Endemic goiter has almost disappeared since iodination of bread salt was introduced in 1968. The median urinary iodine excretion varies in different areas between 96 $\mu\text{g/day}$ and 138 $\mu\text{g/day}$. The goiter prevalence is below 3% (2,56,57). The cessation of bread iodination following a recent supreme court decision raises concern that endemic goiter may return.

Norway

No endemic goiter was found in a recent survey of adult subjects from 6 towns in Norway. The iodine excretion ranged from 147 to 247 μg per day, not significantly changed since 1972. The high iodine intake is attributed to feeding cows with seaweed. Salt is iodized with 5 mg KI/kg (58-60).

Poland

A goiter prevalence of 20-40 % in adolescents had been reported, despite the use of 8 mg KI per kg salt. After 20 years of prophylaxis with the current amount of 12 mg KI per kg salt, the goiter prevalence still ranges between 31 and 50% in southern parts of Poland such as the Carpathian Mountains and Cracow. Eastern regions of Poland were heavily affected in 1967 (23,61). New data are lacking.

Portugal

Most of the population of Portugal lives near the coast. Endemic goiter is not found there, but several regions of the interior are severely affected. Prophylaxis with iodized salt (20 mg KI/kg) in one area in Castel Branco reduced the goiter prevalence in school children from 51% in 1971 to 9.3% in 1977, compared with 40% in another region of this district. The prevalence is reported to be 54% in Portalegre, Baixo Alentejo, and Algarve, and endemic cretinism is described (2,62,63).

Romania

A regional prevalence of more than 60% was reported for the Carpathian Mountain region in 1980. Special centers were organized in all the endemic regions during the 1949-1978 period. Iodized salt for the population and, in addition, iodinated tablets for school children and pregnant women, have been used (23). In 1986, 20,000 children from Mures County, representing 91.2% of all enrolled 6- to 14-year-olds, were examined. Goiter was found in 16.8% (64).

Soviet Union

No information about the European part of the Soviet Union has been obtained. An endemic area of Usbekistan with iodine deficiency goiter was described (65); subjects in this area receive 1 mg iodine per day as prophylaxis.

Spain

Several surveys from this decade have been published. In a study of 2,872 school children in Galicia, the goiter prevalence was 79%. with 85% excreting less than 25 μg I/l urine. In Andalusia the goiter prevalence in 4,949 school children was 29%; 40% had a urinary iodine excretion of less than 40 μg /l. In Catalonia a survey of 255 rural communities showed a goiter prevalence of 35.8% and a mean excretion of 79 μg I/g

creatinine. In Asturias 6,922 school children had a goiter prevalence of 20% and a urinary iodine excretion of 63 $\mu\text{g}/\text{l}$. In Guadalajara, near Madrid, 58% of school children had goiter and 46% had urinary excretions of less than 50 μg . In the Las Hurdes region the goiter prevalence in school children was 86% and cretinism persists. Prophylaxis with iodized oil has been introduced in this region (66).

Surprisingly, on the island of S. Miguel (the Azores) the prevalence of goiter in school children varied between 11 and 41%. In the most affected region, 16% of the adult males and 48% of the women had goiter. The median urinary excretion of iodine varied between 10 and 49 μg I/g creatinine (67). Since 1981 iodized table salt (60 mg KI/kg) is available but not mandatory, and is rarely used, particularly in rural areas.

Sweden

There is probably no endemic goiter in Sweden. Salt is iodized at a current level of 50 mg/kg. The initial level in 1930 was 10 mg/kg, which was raised to 20 mg/kg in 1940. Commercial baby diets and animal foods are iodinated. In Stockholm the median iodine excretion was 141 $\mu\text{g}/\text{g}$ creatinine in adults and 124 in 13-year-olds. Swedish neonates showed median urinary iodine excretions several times greater than those from Switzerland or Germany. The median thyroid volumes of adults and 13-year-olds, as estimated by sonography, were twice as small as those found in iodine-deficient Germany (5.23.30.68). There are no more extensive data on iodine excretion or goiter prevalence.

Switzerland

In 1975 a survey showed a goiter prevalence of 20% in adults aged 20-39 and of 60% in the 60-79 age group. The higher figures in the elderly reflect inadequate iodination of salt before 1980. In 1983 a goiter prevalence of only 1% was found in 19-year-old male army recruits. Iodination of salt is virtually mandatory. The potassium iodide content of table salt has been increased progressively over the last two decades to a current level of 20 mg/kg. Table salt is the major source of iodine, which raises the question of how to meet the recent decrease in salt consumption (2,69,70).

Turkey

Endemic goiter is a problem on the Black Sea coast and in the inner parts of eastern and western Anatolia. In some provinces, including Bolu, Bursa, Isparta, Kastamonu, Rize, and Trabzon, goiter prevalence exceeds 15%. In many provinces, including Adiyaman, Artvin, Bilecik, Bingol, Burdur, Canakkale, Denizli, Eskisehir, Gumushane, Izmir, Kars, Konya, Kutahya, Malatya, Mardin, Mus, Sakarya, Samsun, Sinop, Sivas, Tokat, Yozgat, and Zonguldak, goiter prevalence is 5-15%. A nationwide detailed investigation of the prevalence of endemic goiter is in progress. Screening and grading of goiter by neck palpation has started, beginning with the regions of high goiter prevalence. Urinary iodine excretion will also be determined in those regions (71).

United Kingdom

The average British diet provides 323 μg iodine a day. Milk is the most important individual source of iodine but is also the most variable. The regional prevalence of goiter reported in 1924 does not permit epidemiological conclusions for current conditions. There is little evidence that major areas of endemic goiter persist (72-75).

Yugoslavia

Persisting regional prevalence of endemic goiter up to 25%, despite the mandatory use of iodized salt (10 mg KI/kg) since 1956, has been reported. Defects in iodizing techniques and/or loss of iodine from salt are considered to be responsible for the incompleteness of goiter eradication (11). Further information is lacking.

DISCUSSION

Certainly, the data reported above are not uniform; variations between countries may represent methodological differences, incomplete information, and, in some instances, failure to use the generally-accepted classification of thyroid size. Nevertheless, this report attempts to elucidate the present status of endemic goiter and iodine intake in Europe. Obviously, goiter remains a significant problem.

The European countries can be grouped into four categories:

No endemic goiter. This applies to Ireland, Iceland, and the United Kingdom. In Norway, Sweden, and Finland highly effective goiter prophylaxis programs have been established. These countries define the goal which can and should be achieved elsewhere in Europe.

Intermediate. This group comprises Bulgaria, Czechoslovakia, the Netherlands, and Switzerland. These countries have had major problems with endemic goiter in the past but have introduced goiter-prevention programs. Epidemiological surveys have shown that goiter persists in some adults in these countries but that it is hardly seen in children.

Belgium and Denmark probably also belong in this group. Iodine prophylaxis is voluntary and urine iodine excretion and balance studies indicate that iodine intake is not adequate in all regions. These data, however, are incomplete and further studies are required.

Endemic goiter persists. This group contains 12 countries -- 50% of the total in this review:

Iodine prophylaxis mandatory: This sub-group consists of Austria, Hungary, Poland, and Yugoslavia; substantial areas of high goiter prevalence persist despite iodine prophylaxis. Dietary iodine intake remains borderline, and analysis of the iodine content of salt from three of these countries gave values ranging from 4 to 12 mg I/kg salt (1). Experience in other countries with mandatory iodine prophylaxis shows that the iodine content of salt must be at least 20 mg/kg to meet the WHO-recommended iodine intake (150-300 $\mu\text{g}/\text{d}$) in areas where there is little iodine in other components of the diet.

Iodine prophylaxis not mandatory: This large group consists of the Federal Republic of Germany, German Democratic Republic, Greece, Italy, Portugal, Romania, Spain, and Turkey. Goiter continues to be a major problem in these countries, either nationwide or regional.

Adequate information unobtainable

Albania, France, and the USSR are in this group.

DISCUSSION

The data of this survey provoke concern rather than complacency. More epidemiological studies (including investigation of other goitrogenic mechanisms) and comprehensive iodination programs are urgently needed. Such programs must be monitored for their effectiveness, and attention must be paid to the possibility of iodine-induced hyperthyroidism. Furthermore, the quality and standardization of iodized salt preparations must be checked carefully (76). In a recent study the iodine content of 104 commercial salt samples from 19 European countries was analyzed. The results showed that the iodine content was significantly lower than that intended by the manufacturer in approximately 30% of the samples (1).

In the newborn, iodine deficiency causes transient effects on thyroid function and increased susceptibility to the toxic effects of acute iodine loads (23,68,77). The increased frequency of elevated thyrotropin levels noted in neonatal screening programs may also be regarded as a sensitive index of iodine deficiency.

Considerable sums are spent on the diagnosis and treatment of goiter by public health systems or insurance companies in many countries -- more than \$200 million US in 1979 in the Federal Republic of Germany (78). Prevention is straightforward and cheap. There is a clear need for increased efforts at introducing effective prophylaxis in much of Europe.

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