

# Controlling Iodine

# Deficiency Disorders

# In Developing Countries

Oxfam  
Practical  
Health  
Guide  
No.5

Dr. David Phillips

**CONTROLLING  
IODINE DEFICIENCY DISORDERS  
IN DEVELOPING COUNTRIES**

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# **INTRODUCTION**

For centuries endemic goitre and cretinism have been recognised as health problems particularly in the mountainous parts of the world. The primary cause - iodine deficiency - was identified many years ago and yet it is estimated that 800 million people in the world today may be at risk of developing health problems associated with iodine deficiency. These conditions, which are now known as "Iodine Deficiency Disorders", include not only endemic goitre and cretinism but also reproductive failure and greater or lesser degrees of mental impairment. They can affect whole communities.

Iodization of salt has been used for over 50 years to ensure an adequate supply of iodine in the iodine deficient areas of many countries. However, in several developing countries programmes based on the use of iodized salt have failed because of the administrative difficulties in distributing the salt to remote areas where iodine deficiency disorders are most common. In recent years, single doses of a slow-release iodized oil which can be given orally or by injection have provided an alternative means of prevention.

This manual has been written to assist health workers in developing countries to organise iodine supplementation programmes at the local level. Assessing the severity of iodine deficiency is a most important first step and guidance is given on how to conduct surveys of goitre and cretinism. The manual provides up-to-date information on how to use iodized oil, and ideas for setting up prophylactic programmes.



# **CHAPTER 1.**

## **THE NEED FOR IODINE**

Iodine is an essential element which is used by the thyroid gland to produce the iodine-containing hormones thyroxine (T4) and tri-iodothyronine (T3). These hormones control the body's metabolic rate and are essential for normal growth and development. If the dietary iodine supply is insufficient the thyroid gland cannot function properly and the levels of these hormones are reduced. This causes several different health problems.

### **Endemic goitre**

Goitre or enlargement of the thyroid gland is the commonest and most obvious effect of iodine deficiency. When more than 10% of the adult population in an area have goitres then goitre is said to be endemic. The production of thyroid hormones is controlled by a third hormone called thyroid stimulating hormone (T.S.H.) which is produced by the pituitary gland (see Figure 1). If there is a dietary deficiency of iodine the levels of T4 and T3 fall and this causes the pituitary gland to produce more T.S.H. The increase in T.S.H. causes the thyroid gland to enlarge and, as a result, increase its ability to take up iodine from the bloodstream and produce more thyroid hormones. Goitre is simply the response of the thyroid gland to iodine deficiency.

During puberty and pregnancy, the activity of the thyroid gland and, consequently, the body's demands for iodine, are increased. Because of this, endemic goitre often appears at puberty and is particularly common in women of reproductive age.

Figure 2 shows how the frequency of goitre varies with age in a typical iodine deficient community. It is uncommon in the early

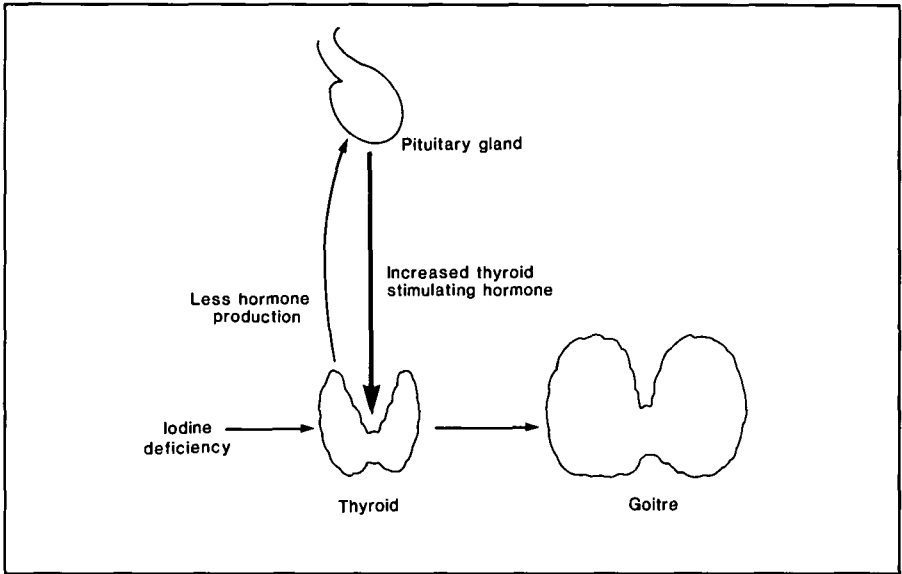


Figure 1.  
The mechanism by which a low iodine intake causes endemic goitre

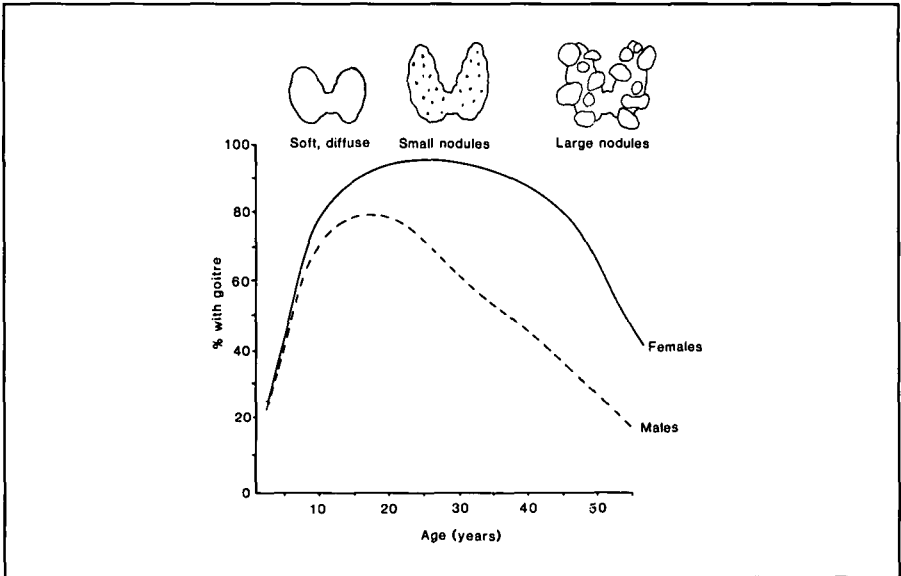


Figure 2.  
The typical pattern of goitre frequency among different ages and sexes in an iodine deficient community. Also shown is the way in which the goitre changes with increasing age.

years of life but increases rapidly in both sexes at around the age of puberty. In women it is particularly common during the reproductive years, but in men the frequency declines during adult life. Among the elderly of both sexes, goitre is seen less often. The type of goitre that occurs changes throughout life. In children up to the age of ten, goitres tend to be diffuse and soft. Following adolescence there is an increase in the number of nodules in the thyroid gland. With increasing age the bulk of the gland may become occupied by multiple nodules which can be very large. In the majority of individuals, however, goitre regresses with age without nodule formation. It is not known why some individuals and not others form nodules.

Usually endemic goitre causes no health problems. If the goitre becomes very large it may be disfiguring. Occasionally it can cause compression of adjacent structures in the neck such as the oesophagus or trachea leading to difficulties in swallowing or breathing, but this condition is rare.

## **Adult hypothyroidism**

If the degree of iodine deficiency is severe the thyroid, even by enlarging, may not be able to produce sufficient thyroid hormone. As a result, signs and symptoms of hypothyroidism may develop. Hypothyroidism results in a general slowing down of the body's functions and is characterised by physical tiredness, reduced mental ability and increased weight. Affected individuals may have a puffy face, coarse skin, and dry hair.

## **Endemic cretinism**

Endemic cretinism is the most serious result of iodine deficiency. It is now thought to occur where a child has lacked iodine in fetal or early neonatal life.

The disease is usually found in association with severe endemic goitre and is recognised by a range of abnormalities. 'Nervous'



**Figure 3**  
Nervous Cretinism. There is obvious mental retardation and the stance is typical with flexed knees and a lumbar lordosis.

cretinism (Figure 3) results in irreversible mental retardation together with deaf-mutism, and sometimes a squint or other locomotor abnormalities (e.g. diplegia). This form is found in several South American and South Pacific countries.

The other major type, known as 'Hypothyroid' cretinism, is more frequent in Central Africa. The main features are mental retardation, stunting of growth and signs of hypothyroidism (Figure 4). These, however, represent extremes and often a wide variety of abnormalities may be found in affected communities. The most commonly seen are mental retardation, deaf-mutism and growth retardation, all of which may occur alone or in combination (Figure 5).

Controlled trials have been carried out in both Africa and the South Pacific conclusively demonstrating that the administration of iodine effectively eliminates both types of cretinism.

Recent research has suggested that even apparently normal individuals in these areas have

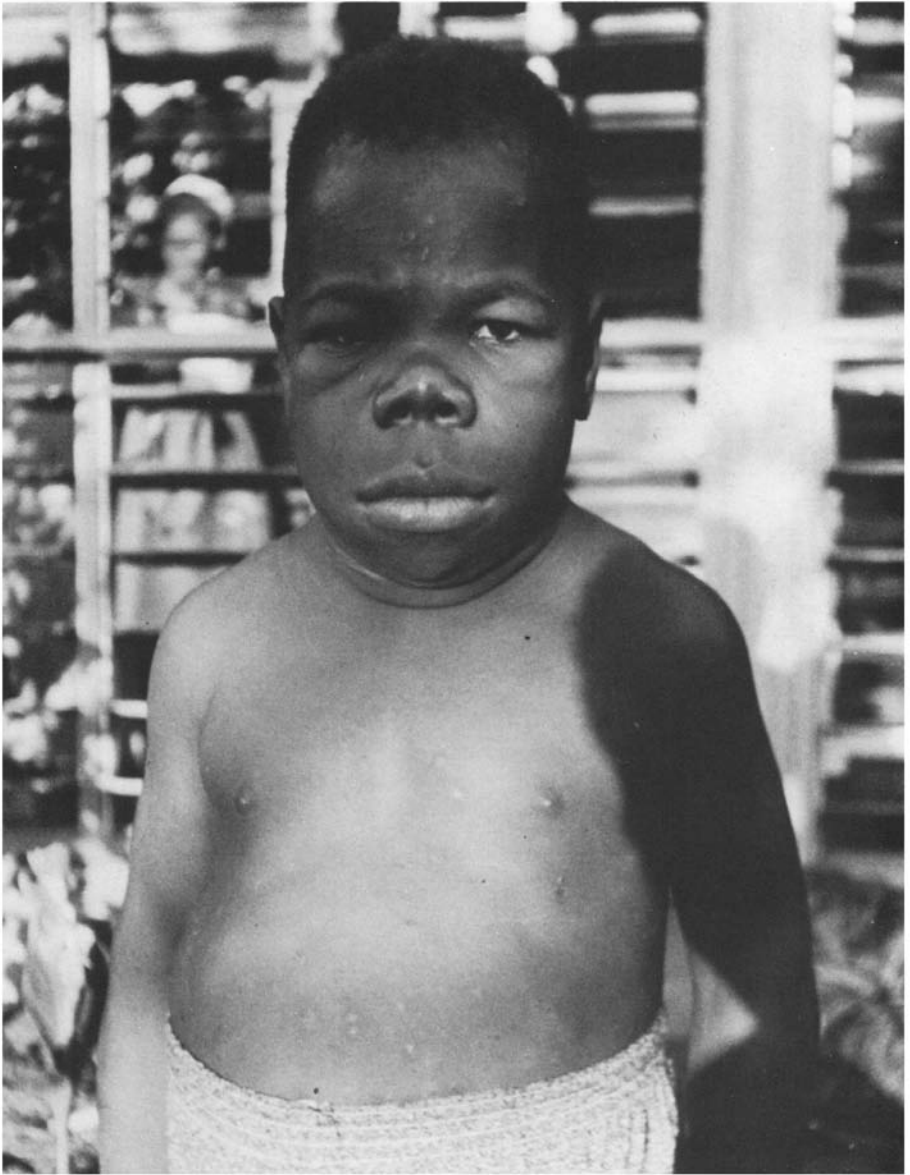


Figure 4  
Hypothyroid Cretinism. The features are coarse and puffy, the nose is broad, and there is a prominent abdomen.

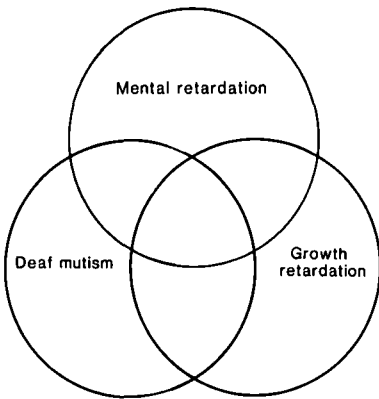


Figure 5  
The main features of endemic cretinism.

mild defects of mental development attributable to iodine deficiency. So, for example, it is known that the administration of iodine to goitrous communities leads to a subsequent improvement of co-ordination, general development and intellectual performance among children. In these circumstances, it is thought that the supplementary iodine may be acting at two different levels. Correcting iodine deficiency in the fetal and neonatal period allows for the normal development of the brain. But iodine could also act in a more immediate way to relieve chronic hypothyroidism and so lead to an improvement in mental performance.

### **Other effects of iodine deficiency**

Increased rates of spontaneous abortion, stillbirth and perinatal mortality are also found in iodine deficient communities. It has been shown that the incidence of these problems can be reduced by iodine supplementation.

In conclusion, it is clear that iodine deficiency results in a wide range of disorders that can affect almost everyone in the community to a greater or lesser degree. Not only is the quality of life for the individual impaired, but the effects on the social and economic development of whole areas may be disastrous. A much more aggressive approach to iodine supplementation is needed than was usual in the past.

## **CHAPTER 2.**

### **DIETARY SOURCES OF IODINE**

The daily requirement of iodine for an adult is approximately 150 micrograms per day. Food is the major source of iodine though water may contribute a little. Most staple foods contain at least some iodine but the actual amount depends on how much iodine was present in the soil on which the crops were grown. As iodine is concentrated in animal tissues, meat is a good dietary source of iodine. The richest natural source, however, is marine fish or other seafood. Iodine deficiency, therefore, tends to be prevalent where:

- a)** The soil lacks iodine. This is particularly liable to occur in areas of the world affected by past glaciation which removes iodine from the soil. This explains why endemic goitre is common in mountainous areas such as the Himalayas or the Andes. Iodine deficient soils are, for other reasons, also found in non-mountainous areas of the world (e.g. large areas of Central Africa).
- b)** The population in such areas with iodine deficient soils is isolated and underdeveloped, the diet limited to locally grown foods and lacking meat or other iodine rich foods.
- c)** Marine fish and seafoods are not available.

For these reasons, iodine deficiency is most severe in poor, isolated, inland communities in areas with iodine deficient soils.

Because of local variations in soil types, the occurrence of iodine deficiency diseases may be sharply circumscribed, only affecting a particular geographical location. The process of economic development often reduces the severity of iodine deficiency as a result of the diversification of food sources and the consumption of iodine rich foods (e.g. meat).

## **Goitrogens**

In discussing dietary sources of iodine, it is necessary to consider goitrogens. These are substances found in food or water that block the normal uptake of iodine by the thyroid. A number of goitrogens have been found in tropical food staples, especially in cassava. The goitrogens in cassava are thought to contribute to the goitre problem in Central Africa, though the amount of goitrogen consumed depends on the method of preparation of the cassava and in particular the thoroughness of washing prior to cooking. Endemic goitre has also, at least in part, been attributed to goitrogens in areas of Colombia, Nigeria and Finland. With few exceptions the effect of goitrogens can be overcome by adequate iodine supplementation.

## **CHAPTER 3.**

### **ESTABLISHING THE PRESENCE AND SEVERITY OF IODINE DEFICIENCY IN A COMMUNITY**

The presence of iodine deficiency in a community is evident to both doctor and layman if significant numbers of the affected population have visible goitres. Preliminary enquiries in the local community will help locate the geographical areas which are recognised as being goitrous. Alternatively, observation of individuals in places where large numbers of people congregate, for example market places, can be a useful guide. If endemic goitre is thought to be a problem the next step is to carry out goitre surveys to quantify the degree of severity and delimit the geographical area affected. The goitre surveys together with observations on the frequency of cretinism are used to determine the severity of iodine deficiency.

#### **CARRYING OUT A GOITRE SURVEY**

##### **Planning and timing**

Before any research is carried out, it is important to find out whether there is already a national programme in existence for the eradication of iodine deficiency. In addition there are local formal channels of approach which differ from country to country. The appropriate government officials, tribal chiefs, religious leaders and/or village leaders should be consulted. The advice and co-operation of local medical personnel and the staff of health centres is also essential at different levels, i.e. Regional, District, local.

The availability of transport and the time of the rainy season are two factors to consider when planning a goitre survey. It is also important to carry out the survey when the population is available and willing to participate. Seasonal activities such as planting or harvesting may take women away to the fields, or certain national or religious

holidays may prevent the survey taking place at all. Local studies can usually be carried out easily by primary health care workers in the area, who can be trained to identify and classify goitre.

## **Selecting whom and where to survey**

Two types of study can be performed to assess the frequency of goitre in an area. The first consists of surveys of school children usually of primary school age. This type of study is quick and easy as large numbers of children can be examined in a short space of time. However, if children are at school, they are likely to be healthy, and many of the severer effects of iodine deficiency, for example cretinism, will be absent from a school population. Surveys of schoolchildren in several locations can, though, provide some indication of the geographical distribution and severity of the problem before embarking on more detailed studies.

In the second type of survey an attempt is made to examine every individual resident within a defined geographical area, for example, all the people living in a particular village. This is time consuming but allows for a more accurate assessment of the severity of iodine deficiency. If the prevalence of visible or palpable goitre (see Chapter 3) is found to be greater than about 10% in schoolchildren, it is recommended that a more detailed community survey should then be carried out.

For practical purposes it is not necessary to measure goitre prevalence to a high degree of precision. A goitre survey must, however, examine a representative sample of the population in the area. In a rural area, the easiest way to do this is to divide the affected region into a number of geographical areas of roughly equal population and to select at random one or two villages from each area. An attempt should be made to examine every individual in these villages. As the distribution of goitre tends to be very patchy, it is important to ascertain whether there are any severely affected areas in the locality which should be visited separately. Such areas

may be identified from an investigation of locally available records and health information, plus informal discussions with local people.

## **Survey techniques**

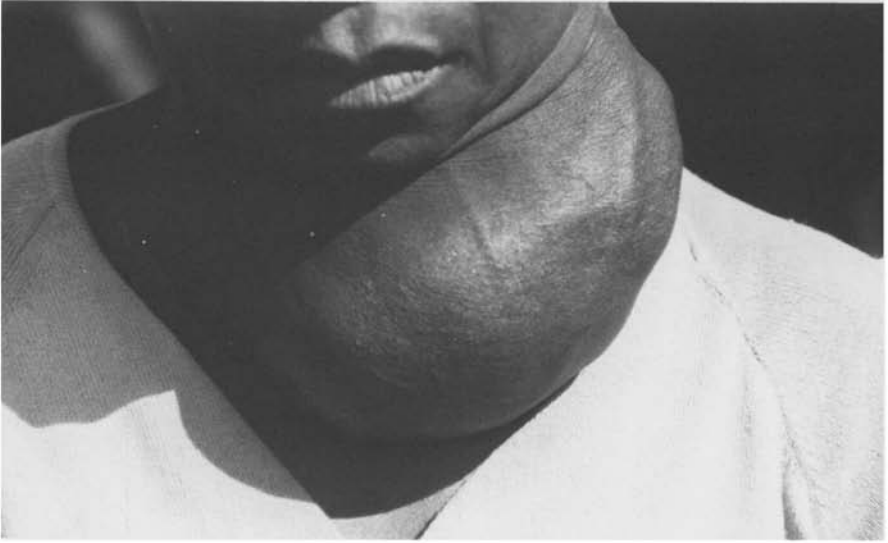
The normal size of the thyroid varies with both the age and build of the individual. It has a firm consistency, is slightly compressible and has a smooth outline. The lateral lobes can usually be felt lying beneath the sternomastoid muscle on both sides of the trachea. A goitre is present if the lateral lobes of the thyroid have a volume greater than the terminal phalanx of the thumb of the person being examined. It is recommended that two grades of enlargement be recorded:

**Palpable goitre:** an enlarged thyroid that is palpable but not visible with the head held in the normal position

**Visible goitre:** the thyroid enlargement is clearly visible with the head held in the normal position (see Figure 6).

Doubtful cases should be classified as belonging to the lower grade. The presence of nodules should also be recorded. Assessment of goitre size is clearly subjective and prone to observer variation. This can be reduced by training which should take place before the survey, especially if a number of individuals are to be employed to do the examinations.

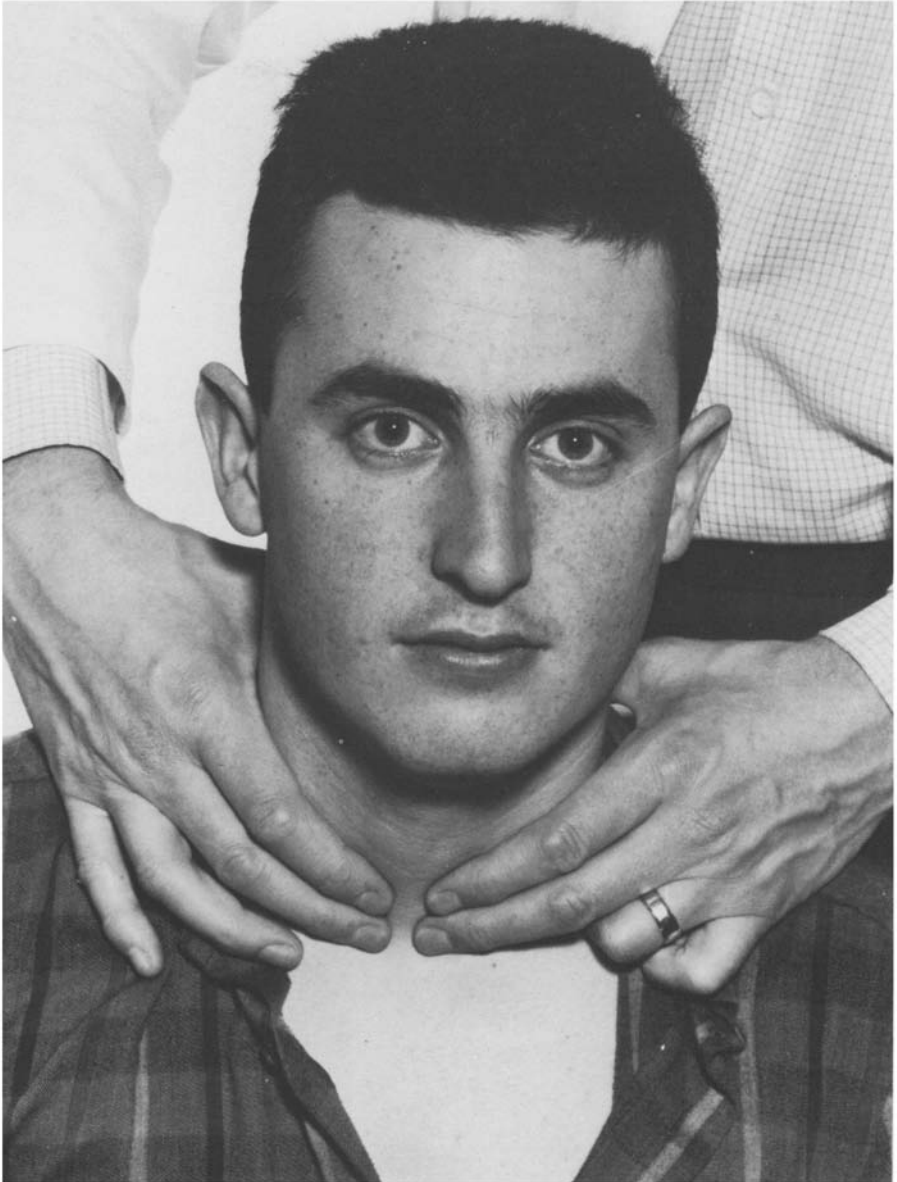
Children and adults are examined while standing with their heads held in the normal position. The neck is first inspected for visible signs of thyroid enlargement and then palpated from behind using the index and middle fingers of both hands (see Figure 7). If the subject bends his neck forwards slightly to relax the neck muscles, palpation is easier and it may be helpful to get the subject to swallow several times (a glass of water will help). Free movement of the gland on swallowing distinguishes the goitre from enlargement of lymph nodes.



**Figure 6a**  
A large nodular goitre in an elderly woman.



**Figure 6b**  
The goitre in this subject is smaller but still clearly visible.



**Figure 7**  
The recommended method of feeling for a goitre.

## The survey

It is important to start with some form of census of the study population. If the study is to be held in a school, the school register can be used. In a village survey, census data is not likely to be available. It can, however, be obtained by a village leader or health worker who should make a list of all the households and the individuals resident in each household.

Before the survey is carried out forms should be prepared for keeping a record of the results. An example of such a form is given in Figure 8, rewriting the data for a household on a single sheet of paper. Similar forms can easily be duplicated on cheap paper. Name, age, sex, and geographical location are recorded together with the result of the examination and, where there are several examiners, a space for the examiner's initials. Exact age is frequently difficult to obtain but for the purposes of the survey broad age-bands are sufficient, for example, 0-4 years, 5-14 years, 15-44 years, 45 years and over.

<u>GOITRE SURVEY</u>	
VILLAGE. <u>Rukingo</u> .....	SURVEY NUMBER... <u>19/026</u> ..
LOCALITY. <u>Bweso</u> .....	
DATE OF SURVEY... <u>5. Feb. 84</u>	NO. IN HOUSEHOLD... <u>5</u> ....
HEAD OF HOUSEHOLD. <u>Habyarimana</u> .....	
AGE : 15-24    25-34 <u>35-44</u> 45 or over	
SEX : <u>(M)</u> F	
GOITRE : NIL <u>(PALPABLE)</u> VISIBLE <u>(SMOOTH)</u> NODULAR	
1. NAME... <u>Nyiraba mwanga</u> .....	
AGE : 0-4    5-9    10-14    15-24 <u>(25-34)</u> 35-44    45 and over	
SEX : M <u>(F)</u>	
GOITRE : NIL    PALPABLE <u>(VISIBLE)</u> SMOOTH <u>(NODULAR)</u>	
2. NAME... <u>Sibomana</u> .....	

Figure 8

An example of a record form for use in a goitre survey.

It is also important to give advance warning to the community before the day of the survey. This could be done via the village leader/health worker, or an announcement could be read out in a church or any other place where people congregate. When the survey team enters the village a simple explanation should be given in the local language. To carry out the survey, it is helpful to set up a 'line of flow' with a number of desks at which different tasks are performed. Each household is called forward in turn. At the first desk the basic demographic details are recorded. At the second station the thyroids are examined and signs of cretinism (deaf-mutism and mental retardation) are also noted. If treatment is to be given at the same time (see Chapter 5), this can be carried out at a third station. With proper organisation it is possible to examine 100-200 people per hour. In order to make the sample studied as representative of the total population as possible, an attempt should be made to locate families or individuals who have not attended. Houses or compounds may have to be visited by the survey team, as in some parts of the world handicapped or abnormal individuals may be concealed by their families.



Figure 9  
Carrying out a goitre survey in a village in the Northern Kivu area of Zaire.

## **Analysis and presentation of results**

The goitre prevalence should be calculated for each sex and age group. The prevalence of 'overall' goitre (palpable and visible goitre) and the prevalence of visible goitre should be worked out separately (an example is shown in Table 1).

## **Observations to supplement endemic goitre surveys**

Cretinism, deaf-mutism and mental deficiency are associated with severe endemic goitre. An effort should be made, therefore, to discover the existence of such cases in endemic areas and if possible to verify the diagnosis by examination of each reported case. The main features of cretinism are deaf-mutism and mental retardation. If a child is said to be deaf, simple clinical examination can confirm this and examination of the ear-drums should be carried out to exclude otitis media and/or perforation. Cretins frequently have associated neurological defects such as a squint, abnormalities of gait (widestepping gait) and in severe cases, a spastic diplegia. If the cretinism is of the 'hypothyroid' variety the predominant features are mental retardation, growth retardation, coarsening of the features, a rough dry skin and a protruberant abdomen.

## **Interpretation of the results**

Endemic goitre has been defined as a prevalence of palpable goitre in 10% or more of the adults in a community. As the iodine deficiency gets more severe, goitre prevalence rises. Males are affected as often as females and goitres are found in very young children and sometimes even in newly born babies. The results of the goitre survey and the prevalence of cretinism should be compared with the classification of severity in Table 2. In assessing the severity of iodine deficiency the presence of cretinism is very important and if cretins are found, this is an absolute indication for initiating an iodization programme. In lesser degrees of iodine deficiency the decision as to whether to embark on a programme is less easy and has to be weighed against other health priorities in the community.

# TABLE 1

## SAMPLE TABULATION OF GOITRE SURVEY DATA

Village Rukingo

Area Bweso

Date January 1986

Age	Total Population	Number with palpable goitre	Number with palpable and visible goitre
<b>Males:</b>		<b>%</b>	<b>%</b>
0-4	29	13 (45)	2 (7)
5-14	27	20 (74)	9 (33)
15-44	45	37 (82)	16 (35)
45+	10	5 (50)	1 (10)
<b>Females:</b>			
0-4	28	20 (71)	8 (28)
5-14	38	30 (79)	9 (24)
15-44	40	35 (87)	30 (75)
45+	14	10 (71)	2 (14)

**TABLE 2****ASSESSING THE NEED FOR AN IODIZATION PROGRAMME**

<b>Overall Goitre Prevalence</b>	<b>Prevalence of cretinism</b>	<b>Observations</b>
Above 70-80%	Population at high risk from endemic cretinism.	Iodization programme needed.
30-70%	Population not at risk from cretinism. Hypothyroidism may occur.	Cost of iodization programme should be balanced against other health needs in the area.
Less than 30%		Goitre may be seen but iodization unlikely to be a health priority

## **CHAPTER 4.**

### **METHODS OF PREVENTION**

The aim of preventative measures is to provide the daily iodine requirement of 150 micrograms per day. Various methods have been used to achieve this and the choice to some extent depends on local circumstances.

#### **Iodine supplementation of food**

Iodization of salt has been the mainstay of preventative programmes in developed countries. The iodization is normally organised on a national or regional basis. The amount of iodine supplement is calculated on the basis of the amount of salt consumed and the quantity of iodine required. In many developing countries, however, salt iodization programmes have been hampered by administrative difficulties in manufacturing the salt and in ensuring that it replaces locally produced salt, or in distributing it to remote areas - where goitre and cretinism tend to be most common. Another disadvantage of using iodized salt in tropical countries is the loss of potency in humid conditions. Even in stitched plastic bags, half the added iodine is normally lost after nine months' storage, but in very adverse conditions up to 90% of the iodine could be lost during this time.

#### **Iodized oil**

In areas where salt iodization is not feasible, single doses of iodized oil have been used to provide a long lasting source of iodine. Iodized oil is a vegetable oil to which iodine has been added. Current supplies contain 475mg iodine per ml (37% iodine by weight). A list of suppliers is given in Appendix 1. The oil can either be given by injection or orally. Most studies with injected oil have shown effective supplementation for three to four years following a 2ml

dose. Iodized oil given orally appears to be effective for medium term prophylaxis, a 2ml dose being sufficient for up to two years.

## **OTHER METHODS**

### **Iodide tablets, Lugol's iodine**

The distribution of iodide tablets on a weekly basis has been tried but has not generally proved successful largely due to organisational difficulties. The use of large single doses of iodide is also ineffective.

### **L-thyroxine**

Thyroxine tablets are widely used in developed countries to treat non-toxic goitres. However, it is much more expensive but no better than iodine supplementation and it is also more complex to administer.

### **Partial thyroidectomy**

Surgery should only be considered after iodine supplementation has failed to reduce goitre size, and then only if compression of adjacent structures in the neck is a problem. Partial thyroidectomy is a difficult and dangerous operation to perform if facilities are limited. If the patient returns to the iodine deficient area there is also the risk of recurrence or of hypothyroidism.

## **CHAPTER 5.**

# **CARRYING OUT A PREVENTATIVE PROGRAMME**

### **Choice of method**

This will depend on local circumstances, the severity of the problem and the means available to reach individuals at risk. The sale of iodized salt may be feasible, but if the marketing infrastructure is poor and salt traditionally obtained from a variety of sources, iodized oil should be used. Iodized oil is also more practicable where the affected population lives in small, scattered rural communities. The choice between giving iodized oil orally or intramuscularly will be influenced by the availability of trained workers capable of giving safe injections, cost and acceptability in the local community.

The use of injections may also risk spreading AIDS infection and hepatitis B, particularly if needles are re-used and not properly sterilised (Table 3). In a recent African programme using orally given oil, it was found that large communities could be treated rapidly with virtually untrained assistants. However, treatment with oral oil must be repeated every two years. In areas where the iodine deficiency is marginal, treatment could be restricted to certain age groups. Giving iodized oil only to women of childbearing age and schoolchildren may be more cost effective in these circumstances. Current dosage recommendations are given in Appendix 3.

### **Funding the campaign**

The major cost of an iodization programme is the iodized oil. The current (1989) price from manufacturers varies between £2 and £5 for 10ml, and therefore any large scale eradication programme will be relatively expensive. However, it is expected that low cost preparations of iodized oil suitable for oral use will become available within the next few years, as research and development is

**TABLE 3****THE CHOICE BETWEEN ORAL AND INTRAMUSCULAR IODIZED OIL**

<b>ORAL OIL</b>	<b>INJECTED OIL</b>
Prophylaxis for two years.	Prophylaxis for three to four years.
Can be given by untrained assistants.	Needs trained personnel.
Easy and quick to give.	Injections take longer to give.
Safe under all conditions.	Risk of causing injection abscess or spreading AIDS or hepatitis infection through poor sterilisation techniques.
Cheaper.	Additional cost of syringes and needles, sterilisation equipment and consumables, i.e. cotton wool, spirit etc.

currently in progress. Funding from charities and aid agencies will probably be necessary if a large scale project is contemplated.

## **Promoting the campaign**

It is important to stimulate community awareness of the problem and the proposed prophylactic measures early in the programme. Clearly, the campaign will not work if people are not fully aware of the reasons for it, the way it will operate and exactly what is going to happen. It is wise, at the start, to approach government officials and local leaders to get their backing and advice, particularly on any aspects of the campaign that may offend local sensibilities. Discussions with the staff of local health centres and hospitals could be a starting point, followed by talks with village health workers and community leaders in the area, giving a full explanation of the programme. The community at large could be made aware of the programme through announcements in churches and mosques, the use of posters and possibly by using local media including newspapers and radio. The explanation of the programme needs to be put in simple terms easily understood by poorly literate people and the benefits of the treatment should be stressed.

## **Carrying out the programme**

The objective of the programme is to administer iodized oil to everyone in the affected area, even if they do not have a goitre. If the villages have not previously been visited to ascertain the prevalence of goitre and cretinism, this data should also be collected during the initial treatment phase. It is also useful to have census data on the people in each village which can be obtained as described in the section on goitre surveys. As the programme is being carried out, the village headman should be present to identify which families belong to the village, to make sure that individuals receive only one dose. Efforts should be made to obtain a good take-up rate for the treatment. The objective should be to treat at least 80% of the population. Side effects are uncommon (Appendix 2) - the most

commonly observed is transient pain and swelling of the salivary glands.

There are a number of ways in which a programme can be carried out:

**a)** Special teams can be formed consisting of two or three auxiliary medical workers who have undergone a short training course. Each team should be able to treat several hundred individuals per day.

**b)** The preventative programme can be integrated with a vaccination programme. Mothers and children should be encouraged to attend and the treatment with iodized oil offered together with the immunizations.

**c)** A prophylactic programme concerned with eradicating iodine deficiency disorders can be used as an opportunity to establish a primary health care programme in a remote area which previously has had little or no contact with Western medicine.

## **CHAPTER 6.**

### **REPORTING, MONITORING AND FOLLOW-UP**

It is important to report back to the government health department or national organisation co-ordinating the prevention of iodine deficiency both the survey findings and the number of treatment programmes that have been completed.

Monitoring helps to ensure that the work is being carried out efficiently and to identify problems. Monitoring should be carried out at regular intervals during a treatment programme and a number of questions need to be asked.

**Are the survey techniques (e.g. goitre grading) being carried out correctly?**

**Is the coverage adequate?**

**Are the forms of treatment given acceptable?**

**Are there any other problems with the programme?**

Follow-up should be carried out at approximately two-yearly intervals on samples of the target population. The prevalence of goitre and cretinism should be assessed. Goitre prevalence will decline in the months following supplementation, though this has not been observed in every endemic area. The decline will be most marked among the young and those with soft, diffusely enlarged thyroid glands. Subjects with hard, nodular glands will rarely notice any change. In addition, no new cretins should have been born since the initial visit (except to mothers already pregnant at that time).





## **APPENDIX 2**

### **ADVERSE EFFECTS OF IODIZED OIL**

Hyperthyroidism may occur following iodized oil administration particularly in individuals aged over 40, or those with large nodular goitre. For this reason the dose of oil should be reduced in this group. Hyperthyroidism usually presents as weight loss, tremor or sweating in association with fast heart rate.

Transient sialadenitis (pain or swelling of the salivary glands) may occur particularly after giving iodized oil orally.

Occasionally allergic reactions are seen (e.g. a rash).

There is no evidence of an adverse effect on fetal survival or the occurrence of neonatal goitre or hypothyroidism following its use in pregnancy.

## **APPENDIX 3**

### **RECOMMENDED DOSES OF IODIZED OIL**

#### **INJECTED OIL**

<b>Age</b>	<b>Dose ml</b>
Under 1 year	0.5
1-5 years	1.0
6-45 years	2.0

**N.B. This dose should be reduced to 0.2ml for all persons with nodular goitre or presenting single thyroid nodules.**

#### **ORAL OIL**

There is not enough information to make precise recommendations about dosage.

Current studies suggest that 1ml would give coverage for one year and 2ml for two years.

## APPENDIX 4

### FURTHER READING AND RESOURCES

**The International Council for Control of Iodine Deficiency Disorders** publishes a quarterly newsletter. It is available, free of charge, by writing to Dr J.T.Dunn, Box 511, University of Virginia Medical Centre, Charlottesville, VA 22908, USA.

**Teaching Aids at Low Cost (TALC)** produces a set of slides and commentary for teaching public health workers and nutritionists in areas where iodine deficiency is a problem. It is available from TALC, PO Box 49, St Albans, Herts, AL1 4AX, UK.

*Towards the Eradication of Endemic Goitre, Cretinism and Iodine Deficiency* is available from the **Pan American Health Organisation** (PAHO Publication No.502, edited by J. T. Dunn et al) and provides information on iodine deficiency in Africa, Asia and Latin America. (PAHO, 525 23rd St., N.W. Washington D.C. 20037, USA).

*Iodine-Deficiency Disorders in South-East Asia* has been produced by the **WHO** regional office for South-East Asia in New Delhi (SEARO Regional Health Paper No.10). It provides a review of IDD and data on programmes in Asia. Available from W.H.O. Regional Office for South East Asia, World Health House, New Delhi 110 002, India.

For an up-to-date and more technical review see "Endemic goitre and iodine deficiency disorders - aetiology, epidemiology and treatment" by C. J. Eastman and D.I.W. Phillips (*Baillieres Clinical Endocrinology and Metabolism* Vol.2, No.3 August 1988, pp.719-736, edited by R. Hall and J.H. Lazarus).



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*Cities of Hunger* will be of interest both to those working in the field of health and nutrition in particular, and those with a more general interest in development.

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**Controlling Iodine Deficiency Disorders in Developing Countries**

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