
UNIT 16 MAJOR DEFICIENCY DISEASES — II: ANAEMIA AND IODINE DEFICIENCY DISORDERS

Structure

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16.1 INTRODUCTION

In the previous unit, you have learnt about protein energy malnutrition and xerophthalmia (the two major nutrition-related disorders) which are common among young children in the rural areas as well as urban slums of our country. In this unit, you will be introduced to another two major deficiency diseases — Anaemia and Iodine deficiency disorders. These nutrition-related disorders affect a large section of the population particularly women and children. The unit deals with various aspects of these deficiency diseases i.e. nature, clinical features, causes and control.

Objectives

After studying this unit, you will be able to

- describe the nature and causes of nutritional anaemias and iodine deficiency disorders
- identify the clinical features of anaemias and iodine deficiency disorders, and
- list measures for control of anaemias and iodine deficiency disorders

16.2 NUTRITIONAL ANAEMIAS

Anaemia is a nutritional disorder commonly seen among women in the reproductive age group and young children. It is estimated that over 50 per cent of pregnant women in our country are anaemic. Anaemia is a major contributory cause of high incidence of premature births, low birth weight and perinatal mortality. The prevalence of nutritional anaemia among preschool children is estimated to be 63 per cent.

Do you know deficiency of which nutrient results in anaemia? Anaemia can be due to deficiency of iron. Iron is a part of haemoglobin.



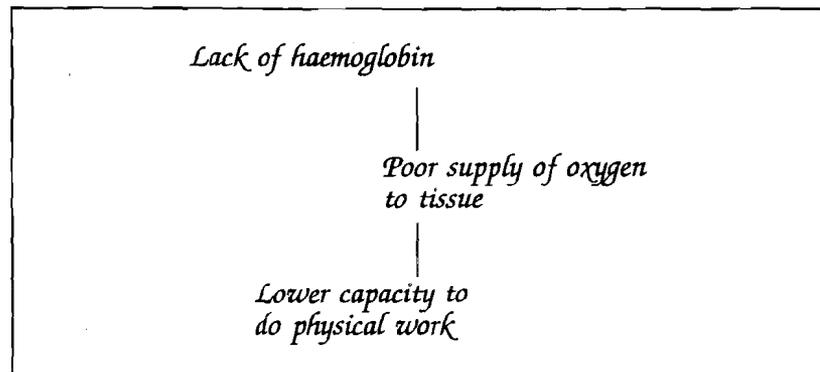
You may recall reading earlier in Unit 1, Block 2 that folic acid and Vitamin B₁₂ also play a role in blood formation. Deficiency of these two vitamins can also lead to anaemia. Next how can we detect iron deficiency anaemia? For detecting anaemia, the World Health Organization (WHO) has recommended certain cut-off levels of haemoglobin for different ages. The cut-off level refers to the level of haemoglobin in the blood of an individual (of particular age group) below which that individual will be termed as anaemic. These cut-off levels of haemoglobin are given in table 16.1 (for individuals of various age groups). For e.g. in the case of normal and healthy adults the haemoglobin in blood should be above 12 g per 100 ml. The adult will be termed anaemic, if the level falls below 12 g.

Table 16.1: Cut-off levels of Haemoglobin (WHO classification)

Age	g/100 ml
6 months to 6 years	11
6 years to 12 years	12
>12 years Male	13
>12 years Female	12
Pregnant women	11

Besides, detecting the levels of haemoglobin, what are the signs and symptoms specific to anaemia. Lets consider.

Clinical Features: The clinical symptoms of anaemia arise when the transport of oxygen by the blood is insufficient to meet the needs of the body. The symptoms are, therefore, related to physical activity. The following flow chart and discussions explains this fact.



Haemoglobin, you know, is a pigment present in the blood which gives red colour to the blood and is important for carrying oxygen to the different tissues in the body. When there is a lack of haemoglobin, the capacity of the blood to carry oxygen to the tissues is reduced. On the other hand our body requires constant supply of oxygen for the various physical activities performed every day. With the poor supply of oxygen to the tissues the capacity to do work is, therefore, reduced. *Inability to make sustained physical effort is the common complaint in anaemia. Usual symptoms of anaemia are fatigue, giddiness, breathlessness on exertion, sleeplessness, palpitation and loss of appetite.*

Other clinical changes which appear include *pallor* or *paleness* of certain parts of the body. Paleness (pallor) is one of the clinical signs based on which anaemia is diagnosed. Paleness of the tongue, conjunctiva (white of the eye) and the nails is seen in an anaemic person. On examining the eyes of a normal person (by pulling the lower lids down) one finds that the conjunctiva is red. Similar is the case with the tongue. In anaemia, due to reduction of haemoglobin, the conjunctiva, tongue and also the nails appear very pale and whitish.

The patient may feel that someone is *pricking him/her with pins (pins and needles) on the fingers and toes*. Some patients may complain of chest pain due to reduced oxygen supply to the heart muscle. In severe anaemia, the *nails of the fingers and toes become brittle and spoon shaped* (Figure 16.1). The tongue may appear smooth and glazed due to *atrophy (destruction) of the papillae (numerous projections on the tongue)*.

Severe anaemia can even lead to death. The risk of death is higher in anaemic women particularly during pregnancy and delivery. Pregnant women with anaemia are likely to deliver babies before completing the normal term i.e. before 9 months of pregnancy. They usually give birth to low birth weight babies (birth weight less than 2.5 kg.) Infection of uterus, kidney and the urinary tract are more common. In general, anaemic people are at a greater risk of catching infections.



Fig. 16.1: Spoon shaped nails (Photo courtesy : National Institute of Nutrition, Hyderabad)

Causes: What are the causes of anaemia? Anaemia can be due to iron deficiency or folic acid and vitamin B₁₂ deficiency. The various causes of iron deficiency anaemia can be clubbed under two main headings — dietary deficits and iron losses from the body. Let us learn about each of them in detail.

a) *Dietary Inadequacy:* Dietary deficit in the body can be due to two reasons — low dietary intake of iron or reduced (low) absorption of iron in the body. You may recall reading earlier in Block 2 that the requirement of iron increases considerably in certain physiological conditions specially in infancy, pregnancy and lactation. Can you suggest why? During infancy, the blood volume increases and, therefore, iron is required for the synthesis of haemoglobin. What about pregnancy/lactation?

Look up Unit 9, Block 3, to refresh your memory. It is important to remember that if iron intake during the critical periods of life is not adequate, anaemia can set in.

On the other hand, you may be surprised to know that many individuals do consume enough iron rich foods, yet they tend to be anaemic. What is the reason for this? You know that in India most people because of economic and other socio-cultural reasons largely consume vegetarian diets. Vegetarian diets do not contain sufficient absorbable iron (due to the presence of inhibitors). Animal foods from which iron is better absorbed (due to the presence of enhancers) alternatively are expensive and generally not consumed in most families in India. You may recall reading about factors influencing absorption of iron from foods, earlier in Unit 7, Block 2. Hence, because of poor absorption, people consuming vegetarian diets may tend to be anaemic.

b) *Losses of Iron:* The second major cause of anaemia is increased loss of iron from the body. In women of reproductive age group loss of iron occurs every month due to menstrual loss of blood. Apart from menstrual loss, loss of iron occurs during pregnancy, delivery and lactation. During pregnancy, the foetus accumulates abundant stores of iron in the body. This store of iron is obtained from the mother's diet or if the diet is inadequate from the mother's body stores. During delivery, due to loss of blood and iron content of the placenta, the loss is substantial. This poses additional demands for iron on the mother. If proper care of women is not taken during these periods, it can lead to anaemia.

Iron losses from the body are also more in case of people suffering from hookworm and other worm infestations. This is because worms residing in the small intestine of an individual feed on the blood. Heavy loss of iron from the body in conditions of surgery or accident can also lead to anaemia.

Folic acid and Vitamin B₁₂ deficiency: Anaemia can also occur due to the deficiency of folic acid and vitamin B₁₂. Let us now study the causes of deficiency of folic acid

and vitamin B₁₂ in Indian diets. Do you remember reading earlier in Block 2 that these nutrients belong to the B-complex group of vitamins and play an important role in red blood cell formation. Folic acid is widely distributed in foods. As you know, folic acid deficiency is common only among children and pregnant women. Why? Primarily because their diets are inadequate. Children and pregnant women consume diets which do not contain enough vegetables, fruits, milk or animal foods. We generally, do not come across folic acid deficiency in people who eat foods like green leafy vegetables, fruits and milk regularly (which are good sources of folic acid). Women and children are affected by folic acid deficiency more than men. As regarding deficiency of Vitamin B₁₂, anaemia due to the deficiency of this vitamin is rather rare. The disorder is mainly due to failure to absorb vitamin B₁₂ or due to dietary deficiency. You know, vitamin B₁₂ is present only in foods of animal origin. However, a large population of our country is vegetarian. Further due to economic reasons many cannot afford milk and other foods of animal origin. Hence, dietary deficiency may arise in people who are strict vegetarians or eat no animal products. This is one of the reasons why milk should be added to the diets particularly to those depending on vegetarian diets totally.

Let us now look at the treatment of anaemia.

Treatment: Haemoglobin in blood can be raised by giving iron. Iron tablet is the preparation of choice to treat anaemias. However, the use of tablets may cause certain side effects like constipation, discolouration of stools and gastric upset like nausea. The woman should be clearly told about the possibility of these side effects and be prepared so that they do not discontinue the treatment. In fact, a large number of individuals stop taking iron tablets because of these complaints. Treatment should be continued for atleast 3 months after haemoglobin levels return to normal. In the case of infants and children, sweet liquid iron preparations (syrups) are available. In the case of folic acid and vitamin B₁₂ deficiency anaemia, tablets containing folic acid are given.

Usually anaemia is associated with infections. Treatment of these infections is also crucial. Associated infections should be treated with appropriate medicines. In areas where hookworm disease is common, suitable medicines should be given to treat the disease. Simple medicinal iron in the case of individuals with hookworm infestation will not be adequate to treat anaemia.

Prevention: Given below are the few preventive measures which can help to prevent anaemias.

a) *Dietary Measures:* The most rational method of prevention of anaemia is to ensure consumption of diets adequate in iron. The women, particularly living in villages and urban slums, should be adequately educated about the importance of prevention of anaemia and should be encouraged to consume iron-rich foods regularly. Inexpensive sources of iron are green leafy vegetables (palak, amaranth etc.), rice flakes, groundnuts. Meat and liver are preferably good dietary sources. If one likes and can afford them, these should be consumed. Care should be taken that enough vitamin C-rich and protein-rich foods (as they enhance absorption of iron) are consumed along with iron-rich foods.

b) *Fortification of foods:* One of the methods of ensuring adequate consumption of iron through diets is to add iron to a food item, that is consumed by one and all daily. *The method by which the nutritive value of diets is improved by the addition of one or more nutrients to a food item is known as fortification of food.* The food selected for this should be consumed by all, particularly the needy poorer segments of the populations with very little daily variation in the quantities consumed. Common salt is consumed by the rich and poor daily in our country. It has been identified as the vehicle for fortification with iron. Studies have shown that consumption of common salt to which iron has been added leads to an increase in haemoglobin levels, thus reducing the prevalence of anaemia. Though this programme has not yet been initiated in the country, this is likely to be one of the approaches to control anaemia in future. Baby foods are also fortified with iron to protect infants, fed for long periods on artificial milk formulas, from becoming anaemic.

c) *Distribution of iron and folic acid tablets:* You learnt that by giving iron tablets, the haemoglobin levels in the blood can be raised. One of the approaches, that has been in practice in the country for over 20 years is distribution of tablets containing iron and

CAN YOU IDENTIFY THESE DISORDERS?

Major Deficiency Diseases — II:
Anaemia and Iodine Deficiency
Disorders



Slides Courtesy : Voluntary Health Association of India in
collaboration with Dr. David Morley, Institute of
Child Health, London

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CAN YOU IDENTIFY THESE DISORDERS?

Nutrition Related
Disorders in Early
Childhood



Slides Courtesy : Voluntary Health Association of India in
collaboration with Dr. David Morley, Institute of
Child Health, London

(Tally your responses with the responses given at the end of Appendix 1).

folic acid to the vulnerable sections of the community. Women, pregnant and lactating women, family planning acceptors and children (1-5 years) are the most in need of these tablets. The Government of India has been implementing a programme called National Nutritional Anaemia Control Programme, since the year 1970. Under the programme, the beneficiaries receive 100 tablets of iron and folic acid. This is expected to control the widespread prevalence of anaemia in the country. You will learn more about the programmes in Block 6. Along with prophylactic programmes the community should be educated to protect themselves against anaemia by consuming foods rich in iron.

Check Your Progress Exercise 1

- 1) List the population groups at risk of developing anaemia.

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- 2) Fill in the blanks:

- a) Nutritional anaemias can be due to deficiencies of,
..... and
- b) Anaemia arises when the transport of by the blood is
insufficient to meet the needs of the body.
- c) In pregnant women, the haemoglobin level below in
blood is considered as anaemia.
- d) Green leafy vegetables are a source of iron.

- 3) Match the following:

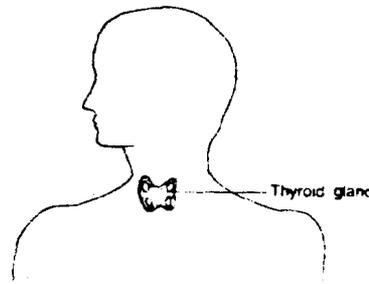
- | "A" | "B" |
|----------------------------------|---|
| a) Vitamin B ₁₂ | i) Oxygen |
| b) Absorption of iron
is high | ii) Present in foods of
animal origin only |
| c) Common Salt | iii) Animal Foods |
| d) Iron | iv) Fortification |
| | v) Important for physical activity |
| | vi) Haem |

16.3 IODINE DEFICIENCY DISORDERS

Iodine deficiency disorders (IDD) present another major health problem in India. It is estimated that about 200 million people are at risk of IDD in our country. Till recently, the disease was observed only in Himalayan and Sub Himalayan belts of India (hilly regions) extending from Jammu & Kashmir in the North to Nagaland in the East. In the recent past, however, newer areas south of Vidhyas in Maharashtra, Andhra Pradesh, Karnataka, Gujarat, Madhya Pradesh, Orissa, Kerala, Tamil Nadu, Goa, Rajasthan, West Bengal and Delhi are being identified as regions where IDD is becoming more common.

The term IDD includes a range of disabling conditions affecting the health of humans starting from life in the womb through adulthood.

Causes: Iodine is essential for the normal growth, development and functioning of the thyroid gland. This gland is located in the front portion of the neck as indicated in the following figure.



Location of thyroid gland

Iodine is very important for functioning of both the brain and body. Iodine helps in the formation of thyroxine, a hormone secreted from the thyroid gland. When iodine is inadequate, the thyroid gland enlarges in an attempt to produce thyroxine for the body needs.

We require very small quantities of iodine as you may recall reading earlier in Unit 3 of Block 2. Usually we obtain the iodine through foods and water. In areas where IDD is very common, the environment is deficient in iodine so that soil, water and foods have greatly reduced amounts of iodine. In mountainous and hilly regions, environmental iodine deficiency occurs due to years of washing of the soil by heavy rains and glaciers. In the case of plains, repeated floods deplete the environment of iodine. As a result, water and all animal and vegetable foods dependent on the soil are deficient in iodine. Thus, when foods which are deficient in iodine are consumed, the diet will also be deficient and this produces iodine deficiency.

Apart from this, certain chemical substances called *goitrogens* (goitre producing substances) interfere with utilization of iodine by the thyroid gland. Foods like cabbage and radish are known to contain goitrogens. Consumption of these foods in large quantities in some cases may produce iodine deficiency. There is however, no evidence as yet, to state that these foods by themselves produce IDD, atleast in India.

Clinical Features: Goitre and cretinism are the best known and easily recognizable forms of iodine deficiency. However, you should remember that these are not the only manifestations of iodine deficiency disorders. In fact, the term '*Iodine Deficiency Disorders*' includes a range of crippling conditions which include goitre, mental retardation, hearing defects, squint, difficulties in standing or walking normally and stunting of limbs. Iodine deficient women frequently suffer abortions and still-births. Their children may be born deformed, mentally deficient or even *cretins*. All these problems are caused by a simple lack of iodine, and goitre is the least tragic of them.

Let us study about the clinical manifestations of both goitre and cretinism.

Goitre: The word 'Goitre' means swelling and/or enlargement of the thyroid gland.

As you have read, in case of deficiency of iodine in the body, thyroid gland enlarges in order to trap more iodine (whatever is available). The swelling or enlargement can vary in size depending on the severity of the deficiency. In fact, you can grade goitre based on the size of the swelling in the neck. At one end is the swelling which is only visible on careful examination with the neck of the patient stretched, and at the other end is the big, monstrous goitre which can be seen even from a distance as indicated in Figure 16.2. The prevalence rate (i.e. number of cases in 100 individuals) of goitre increases with age reaching a maximum at adolescence. It is more frequent in girls than boys. In fact, if one wants to find out whether goitre is a major problem in an area so as to start a control programme, the goitre rate over the ages 8-14 years is used as an indicator to know whether an area is endemic (highly affected area) for goitre or not. A prevalence of 10% (i.e. girls out of 100 of this age examined) is taken as an indication that goitre is an important health problem in that particular area.



Fig. 16.2: Goitre (Photo courtesy : National Institute of Nutrition, Hyderabad)

Cretinism: It is the most severe manifestation of IDD. Cretinism refers to adverse effects of iodine deficiency on the infant and young child. Let us see how cretinism sets in or why does a child become cretin? A baby growing in the mothers womb needs a steady supply of iodine for the normal growth and development of its brain and body. Only the mothers diet/body can provide the essential iodine. But if the mother is deficient in iodine, the child too is deprived of this essential nutrient. In case the mother is severely deficient, the childs brain and body are seriously and permanently stunted and the child becomes a cretin, unable to walk, talk or think normally. On the other hand, if the mothers deficiency is minor, the child will still be effected, although in physical appearance he/she might look normal. The damage to the brain usually shows up years later, in poor school performance, inability to concentrate or perform normally in everyday tasks. Millions of children in our country suffer from this form of iodine deficiency which many a times go undetected. *Remember criticism is permanent and incurable.*

Fortunately there are very few areas in our country where cretinism is common. However, it has been found that in severely iodine deficient areas more than 80 per cent of children are disabled to some extent due to IDD.

Control: Since IDD is primarily due to reduced intake of iodine, the control strategy aims at ensuring sufficient intake of iodine by the population living in areas where IDD is common. A few methods that have commonly been used to increase the iodine intake of people residing in endemic regions include:

- 1) Use of iodized salt
- 2) Use of tablets containing potassium or sodium iodide.
- 3) Use of iodized oil.

Let us discuss each of these methods separately.

1) *Use of Iodized salt:* The oldest and the most extensively used method is fortification (enrichment) of common salt with iodine (Potassium iodate). The amount of iodine added to salt is such that, daily consumption of common salt would ensure daily requirements of iodine. The iodized salt (common salt to which iodine is added) smells, tastes and even looks exactly like the common salt. Now a days, in the market in a number of towns, several brands of iodized salt are available. The procedure of iodation is simple and costs little. In India distribution of iodized salt in the endemic areas, is in practice for about 25 years. In these areas entry of non-iodized salt is completely banned by law. However, for various reasons — mainly due to inadequate supplies of iodized salt—salt which is not iodized is being sold in the areas. The Government of India has now decided to make available only iodized salt so that non-iodized salt is not available in the market. According to the available scientific evidence, consumption of iodine by humans even in areas where goitre is not common may not be a health hazard. Consuming iodine more than the body needs will be simply rejected by the body. Any additional quantities consumed will be excreted unused through the urine.

2) *Use of tablets of sodium or potassium iodide:* Provision of sodium/potassium iodate tablets to school children and addition of iodine to the drinking water supplies have been tried in some countries. However, this is not a widely accepted method of administering iodine.

3) *Use of Iodized oil:* During the last decade, injection of oil to which iodine has been added, has been adopted for the control of goitre and cretinism in areas where the IDD is severe. The advantage is that an injection of 1 ml dose of iodized oil can provide protection to an individual for 3-5 years. But this is more expensive and reaching all those at risk by this method is difficult. It is used as a temporary measure particularly in areas which are not easily accessible and iodized salt may not reach due to communication problems.

You know that giving injections to a large number of people is difficult and the people also may not accept them. Hence, efforts are being made to use iodized oil (oil to which iodine has been added) by mouth for controlling goitre. This will also be equally expensive as injections of oil. But of course the acceptability by the community will be better.

Among the various methods available for control of IDD, *salt fortification seems to be the method of choice for long-term solution of the problem.* In fact, fortification of common salt with iodine is the major aspect of India's National Programme for Control of Iodine Deficiency Disorders. You will learn about the programme in Unit 18 Block 6. Education of the people about the dangers of IDD and creating political will in the country are important steps in the control of Iodine deficiency disorders (IDD). It is only when the community is sufficiently aware of the various dangers of IDD can we succeed in the implementation of the Iodine Prophylaxis Programme where iodized salt is distributed to the communities in the endemic areas. You will learn more about this programme in Unit 18, Block 6.

Check Your Progress Exercise 2

1) Which are the areas in India where iodine deficiency has been prevalent for years?

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2) List the methods of control of iodine deficiency disorders.

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3) Fill in the blanks:

- a) Iodine is required for formation of the hormone.
- b) We require iodine for the normal functioning of both
and
- c) Substances which interfere with utilization of iodine by the thyroid gland are
called
- d) The most suitable method for control of iodine deficiency in India is by the use
of
- c) and are the most easily
recognized forms of IDD.

16.4 SUMMING UP

In this unit you have learnt about two major nutritional deficiency disorders i.e. anaemia and iodine deficiency disorders.

Nutritional anaemias are common in children and in women particularly during pregnancy and lactation. In India, most of the anaemia is due to iron deficiency. The anaemic subjects have easy fatigability, giddiness and breathlessness on physical exertion. Paleness of conjunctiva, tongue and nail beds is present. In severe cases, chest pain and spoon-shaped nails may be present. Dietary inadequacy, menstrual loss and frequent pregnancies in women are important causes. Iron tablets should be given for treating cases of anaemia. Educating people to consume foods rich in iron and distribution of tablets of iron and folic acid to vulnerable groups are important measures to prevent anaemia.

Iodine deficiency occurs due to reduction of iodine in the environment i.e. in soil, water and foods. It leads to iodine deficiency in the diets. The commonest manifestation is swelling of thyroid gland (goitre). Cretinism presents the most severe form of iodine deficiency disorder. It is characterized by mental retardation, growth failure and hearing defects. Goitre and cretinism represent the extreme ends of the range of iodine deficiency disorders. Within these two forms of IDD are the several others. Iodine deficiency can be prevented by enrichment of common salt with iodine. This programme is in operation in the country since the past 25 years. Injections of iodized oil can protect population from iodine deficiency for 3-5 years. Nutrition education of the community to utilize the services will be important in the control of IDD.

16.5 GLOSSARY

Decilitre	:	1/10
Deworming	:	Treatment for removal of worms like in roundworm disease, hookworm disease etc.
Endemic	:	A disease which more or less prevails continuously in a given region.
Endocrine gland	:	Organs that secrete specific substances (hormones) which are released directly into the circulatory system. These glands influence metabolism and other body processes.
Family planning acceptor	:	Women who underwent sterilization operation or accepted intrauterine device to prevent pregnancy.
Intrauterine device	:	A device which is placed in the uterus of women as a measure for family planning.

Palpitation	:	Forcible pulsation of the heart perceptible to the patient.
Papillae of tongue	:	Numerous projections of the mucous membrane on the tongue.
Perinatal Mortality	:	It is assumed to imply the number of later foetal death (stillbirths) and deaths in the first week of life (neonatal deaths) per 1000 live and still births.
Squint	:	Abnormality of an eye which does not turn to match the other eye's direction.
Thyroid gland	:	An endocrine gland located at the front of the neck.
Thyroxine	:	Active iodine compound made in the thyroid gland and functioning as a hormone.

16.6 ANSWERS TO CHECK YOUR PROGRESS EXERCISES

Check Your Progress Exercise 1

- 1) Pregnant women, lactating women, children under the age of five years and women in the reproductive age group.
- 2) a) Iron, folic acid, Vitamin B₁₂
b) oxygen
c) 11 g per 100 ml
d) good
- 3) a) — ii)
b) — iii)
c) — iv)
d) — v)

Check Your Progress Exercise 2

- 1) Sub Himalayan belt extending from Jammu & Kashmir in the north to Nagaland in east.
- 2) Iodization of salt is the simplest method of prevention of IDD. In remote areas intramuscular injection of iodized oil can protect the community for 3-5 years against IDD or sodium/potassium iodide tablet can also be given.
- 3) a) thyroxine
b) brain, body
c) Goitrogens
d) Iodized salt
e) Goitre, cretinism