THYROID FUNCTION AND ITS IMPLICATIONS ON BRAIN AND BODY

K.B. Herath

Introduction

If a child is born with all the organs intact and if the child is given the correct diet theoretically he or she will develop into a normal man or woman. For the child to be born normal, the mother must be normal and she should take the correct diet during pregnancy.

Certain deficiencies in the diet of the mother affect the feotus. One such deficiency is the long standing iodine deficiency. Severe iodine deficiency can cause Cretinism and Myxedema, in off-spring.

The connection between iodine and the thyroid gland was established during the second half of the nineteenth century. By 1919 it has been shown that the thyroid gland produce two hormones using the iodine it traps and since then, due to its extreme importance there has been a rapid increase in knowledge about this particular gland.

Thyroid Physiology

Thyroid gland is an organ which is formed in the human embryo at a very early stage. The feotal thyroid, selectively traps iodide after about the tenth week of gestation. It is first formed at the base of the tongue but before birth it rests on its usual position above the manubrium sternum.

The normal shape of the thyroid gland is like a butterfly, having two lobes on either side joined by a small section called the isthmus. (Fig. I).

The main function of this gland is the secretion of Triiodothyronine (T3) and Thyroxine (T4) hormones into the blood circulation. Function of the T3 and T4 is to regulate the metabolic rate in the body. To manufacture T3 and T4, first the thyroid gland has to trap the iodide that is in the circulation. For it to trap iodide, it (iodide) should be present in sufficient quantities in blood. If the amount of iodine that is present is not sufficient to produce the required amount of T3 and T4, the feed back mechanism causes the pitiutary gland to secrete more and more TSH, to stimulate the thyroid gland to act more efficiently. As the stimulation continues, the thyroid cells enlarge so that the required amount of T3 and T4 could be formed. This is the beginning of the iodine deficiency goitre.

When this condition persists for sometime in addition to the enlargement of the gland, nodules may also be formed in it.

Thyroid Hormones T3 and T4

If the production of T3 or T4 by the thyroid gland is low and remain low then metabolic rate of the body decreases, leading to a condition called Myxedema. Symptoms of Myxedema, are lethargy (cannot work) retention of fat (becomes bloated up) coarse skin low mental ability, etc., all due to low metabolic rate. This is a very serious condition. About 1% of our female thyroid patients and 4% of male ones suffer from this disease.

If for some reason when the mother's diet is extremely low in iodine content (severe iodine deficiency) then there is a possibility that the new born becoming hypothyroid and he or she can even become a cretin. These children may be dull, and their bodies may not develop in the normal way. If this condition is detected early, it could be corrected. For this reason in many countries neonatal screening for hypothyrodism, is being carried out routinely. In Sri Lanka no such programme has yet being started, but we hope to start one in the near future.

If for some reason the thyroid hormones are increased in blood circulation and remain like that, it leads to a condition called thyrotoxicosts. The symptoms of thyrotoxicosis are, Goitre, loss of weight, increased appetite high pulse rate etc. Simply this is due to the increase in metabolic rate. Out of our thyroid patients about 5% are thyrotoxic in the case of females and 8% in the case of males.

Iodine Deficiency Goitre, its Prevalence and its Implications

It was pointed out earlier that severe iodine deficiency causes cretinism in humans. Hence it would be beneficial to investigate the severity of this problem in Sri Lanka.

Iodine Deficiency Goitre Among Thyroid Patients

Thyroid patients to the Nuclear Medicine Unit, Peradeniya are referred from all over Sri Lanka for radiodiagnostic investigations. A survey carried out at this Unit on the goitre patients yielded somewhat realistic pattern of incidence of goitre in Sri Lanka.

From 1972 to 1986 there had been 16,593 patients who attended our clinics for 131-I uptakes, thyroid scans and T3/T4 estimations. The ratio of female to male is 7.6:1, which shows that this condition is mostly common in females. Prevalence according to age groups, it was clear that most number of females who came for thyroid treatment were in the age group 15-40 years and the respective male age group was 25 and above.

According to the disease patterns computed at the centre it was found that 96% of the goitre patients attending our clinics are iodine deficiency cases.

Goitre Among School Children in Kandy Region

School children in the Kandy region, which is known to be endemic for goitre in Sri Lanka, were examined for the presence of goitre

It was found in our Kandy survey that the delay in menarche among girls with goitre, when compared to girls without goitre in rural, urban and in the private school was statistically significant (P 0.01). The delay in menarche in girls with or without goitre in rural areas, when compared with urban areas was highly significant (P 0.001).

This study revealed that delayed menarche associated with goitre is more evident even among girls from different socio-economic backgrounds. It is also seen that girls from low socio-economic levels attain puberty later than the girls from higher socio-economic levels, possibly due to nutritional deficiencies.

Conclusion

It has been well documented that endemic cretinism is a cause of endemic goitre. That is if in a major portion of Sri Lanka, goitre is endemic, then it could be reasonable to assume that incidence of cretinism could be high in these areas. If this is true then it is imperative that all children born in these areas, should be checked for cretinism, since if cretinism is detected early it could be corrected to some extent. On the other hand although the children born in these areas may not be exactly cretins it could be that their mental capacity is less and hence may be, they are less intelligent. This statement, of course is not easy to prove but reasonable to assume.

In our Kandy schools' survey we have seen a significant difference in age of menarche between the girls who have goitre and those who do not have goitre. This shows clearly that the girls (or boys for that matter) who have goitre are physiologically immature with respect to the ones who do not have goitre.

Hence it would be justifiable in saying that physiological and mental states of people in these areas are becoming worse and worse. It is therefore very important that remedial action is taken immediately to eradicate this condition for the benefit of the country. For, a country will progress only if the people are healthy in body and mind.

Fig. 01

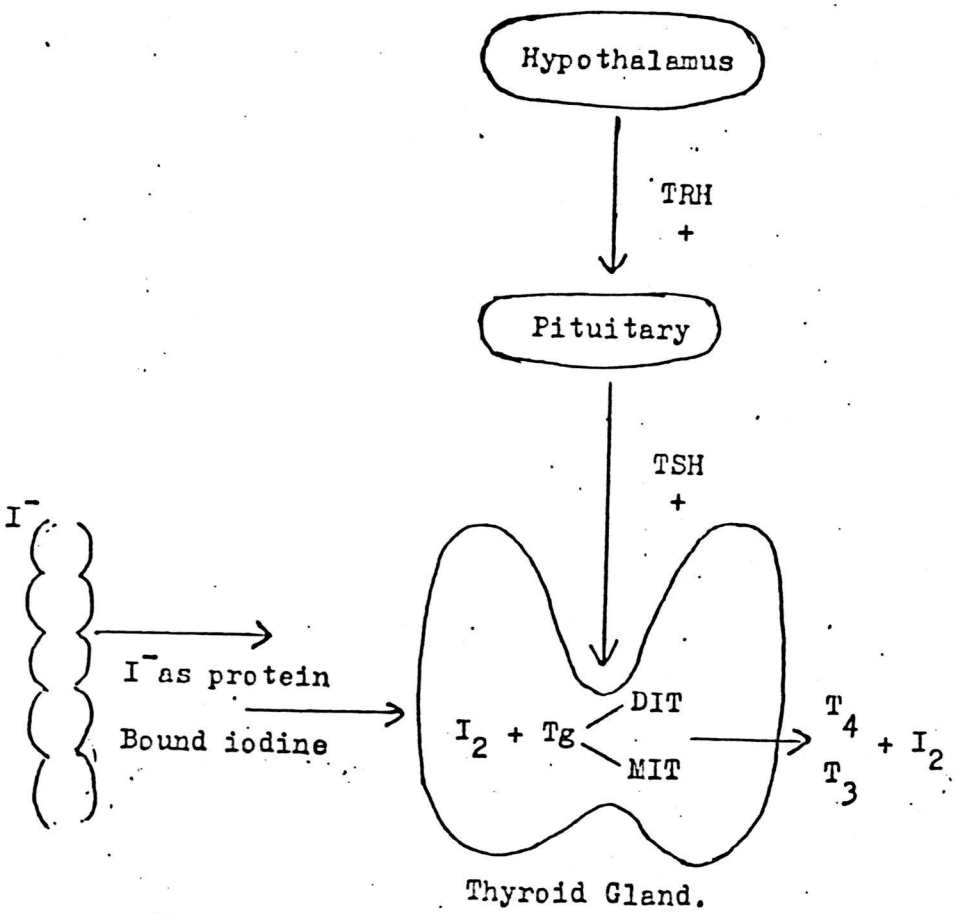
Hypothalamus
TRH
+
Pituitary
TSH
+
I^-
I^- as protein
Bound iodine
I_2 + Tg
DIT
MIT
T_4
T_3
+ I_2
Thyroid Gland.

TABLE 1

WHO Classification of Goitre

Type	Description
1 (a)	Palpable thyroid gland each lobe larger than the 1st pharynx of the thumb.
1 (b)	Visible and palpable.
2	Visible from a distance of 3-4 meters.
3	Large obvious goitre
4	Grossly enlarged goitre with nodules.

TABLE 2

Prevalence of Goitre in some districts in Sri Lanka

District	% prevalence	
	Males	Females
Kalutara	23.2	37.0
Moneragala	22.5	33.6
Ratnapura	19.3	31.5
Kandy	14.5	26.0
Hambantota	15.5	23.9
Galle	11.0	21.9
Colombo	8.1	10.6
Matale	3.7	8.9

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