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ORIGINAL ARTICLE

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## A Study on Hypothyroidism in a School for the Mentally Retarded in Bandung

by

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### Abstract

*A study was made on 114 pupils from a school for the mentally retarded in Bandung. In 50 subjects the length ratio between the upper and the lower segment of the body were more than one; of 44 subjects (32 debils, 11 imbecils, 1 borderline debil-imbecil) we found 2 with hypertelorism, 1 with dry and rough skin, and 1 with gross and fine motor abnormalities. Dental development and bone ages were within normal limits. No rise in serum cholesterol and changes in NTR (Normalized Thyroxine Ratio) were found. T4 (thyroxine) values were within normal limits. Radioactive iodine uptake and scanning of 42 subjects showed hyperplasia in 32 and euthyroidism in 5 subjects. Three subjects suggested a possible iodine contamination, 2 subjects with uptake of more than 50%, one of them showed adenoma (toxic?) on scanning; on the other one scanning was not done. Hypothyroidism was not found; 32 subjects which showed hyperplasia were suggestive of active thyroid. Further studies should be done in another sample of population to trace the problems of hypothyroidism in childhood.*

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### Introduction

Hypothyroidism is one of the most frequent endocrine disorders during childhood (Hutchinson, 1967; Wilroy and Camacho, 1971; Wilkins, 1965). It results from deficient production of the thyroid hormone. This disorder may manifest itself very early in life as congenital hypothyroidism or the symptoms may appear after a period of apparently normal thyroid function. The disorder may either be truly 'acquired' as juvenile hypothyroidism or only appear so as a result of one of a variety of congenital defects, in which the manifestation of the deficiency is delayed (Di George, 1975; Medeiros-Neto et al., 1965; Wilkins, 1965; Silver and Gotlin, 1972; Wilroy and Camacho, 1971; Van Wyk, 1972).

Hypothyroidism if detected early and treated promptly can prevent physical and mental sequelae (Hutchinson, 1967; Wilkins, 1965; Wilroy and Camacho, 1971; Dussault, et al., 1975; Van Wyk, 1972). The prognosis depends on whether the deficiency manifests as a congenital or acquired case, and upon the age of onset and the adequate treatment started (Wilkins, 1965).

Studies on hypothyroidism in childhood in Indonesia are rarely reported, possibly because of lack of diagnostic facilities. Most of the studies were joint studies, concerning endemic goiter and cretinism (Choufoer et al., 1965; Adams et al., 1968; Djokomoeljanto, 1974). The purpose of this study is to find out

the incidence of hypothyroidism among pupils of a school for the mentally retarded children in Bandung, and further to find out a simple diagnostic procedure for early diagnosis which preferably can be carried out in institutions with limited laboratory facilities.

### Materials and methods

The subjects of this study comprised 114 out of 129 pupils of a school for the mentally retarded in Bandung, one of several such schools in Indonesia. This school consists only of trainable children (debils and imbecils without the presence of idiots). The pupils of this school do not only originate from the Bandung area but also from other places in Indonesia.

The method of investigation is as follows :

#### I. *Clinical examination*

a). Anthropometric measurements — All subjects were screened for evidences of hypothyroidism through anthropometric measurements, weight, height, and ratio of the upper to lower skeletal segment. For this purpose all subjects were :

1. weighed using Detecto Medic scales
2. measured their height :
  - total height using a measuring staff attached to Detecto Medic scales;
  - the lower segment, the distance from the top of the symphysis

pubis to the ground (using a measuring staff/tape);

- the upper segment was obtained by subtracting the lower segment from the total height.

As evidence for a possible hypothyroid subject the following criteria were taken into account :

1. Short stature — height below the 10th height percentiles for healthy Indonesian school children and youth (Djumadias et al., 1964).
2. Overweight — weight 20% above the 90th weight percentiles for healthy Indonesian school children and youth (Djumadias et al., 1964).
3. The ratio of upper to lower skeletal segment is more than 1 (infantile proportion) (Wilkins, 1965; Hutchinson, 1967).

Subjects showing one or more of the above evidences were examined further for :

b). Intelligence quotient — The examination was done to confirm the presence of mental retardation, using the following criteria: imbecile for an I.Q. between 25 - 50 and debil for I.Q. of 50 - 70.

c) Physical examination — This examination was directed to find out the clinical picture of hypothyroidism such as dry and scanty hair and low hair line, infantile naso-orbital configuration, dry and rough skin, myxoedema, etc. (Medeiros-Neto et al., 1965; Wilkins, 1965; Hutchinson, 1967; Van Wyk, 1972).

d) Motor and dental development — Examination of motor development was directed according to the Denver Developmental Screening Test (Frankenburg and Dodds 1967; Frankenburg et al., 1971) to find out abnormalities in gross motor (e.g. unable to throw and catch a ball, inability in jumping in place or in walking backward) and fine motor adaptive development (e.g. unable to copy or to draw parts of the human body). While examination of dental development was directed to the delayed eruption or permanent teeth.

## II. Laboratory examination :

a). Biochemical — examination of serum cholesterol, using the Zarkowski methods. The normal value for serum cholesterol level using this method is 150 - 240 mg.%.

b). Radiological — Radiological examinations of X-Ray photo on carpals and meta-carpals are performed for the assessment of bone age. Subject who showed suspected delays in carpal and/or metacarpals ossification centers were further examined for their X-ray photo of the pelvis (with or without X-ray photo on tarsal and talocrural bone) to find out the presence of epiphyseal dysgenesis which forms one of the most characteristic evidences of hypothyroidism (Wilkins, 1965; Hutchinson, 1967; Caffey, 1972).

c). Radioactive examinations. This consisted of :

1. T<sub>4</sub> (thyroxine)
2. N.T.R. (Normalized Thyroxine Ratio)
3. Radioactive iodine uptake
4. Thyroid scanning.

Examination of T<sub>4</sub> and N.T.R. was done according to Thyopac 5, Radiochemical Centre, Amersham, Buckinghamshire, England. For this purpose 5 ml. of blood were withdrawn from the veins of the subjects. Normal values for T<sub>4</sub> is 3.5 - 12.5 ug.% and for N.T.R. 0.88 - 1.11 (Thyopac 5). Radioactive iodine uptake was examined 2, 24 and 48 hours after the ingestion of a capsule containing radioactive iodine; later, scanning on thyroid gland was performed.

The examination of serum cholesterol was done by the Department of Clinical Pathology of the Dr. Hasan Sadi-kin General Hospital, Bandung. X-ray examinations of the bones were done

by the Department of Radiology of the same hospital, radioactive examinations by the Department of Nuclear Medicine also of the same hospital and Determination of the Intelligence Quotient by the Child Guidance Clinic of the Department of Psychology of the University of Padjadjaran, Bandung. Other examinations were done by 2 of the authors.

### Results

One hundred and fourteen out of 129 pupils were examined from March 1975 through March 1976 with 15 drop-outs due to difficulty in contacting them. Children with mental retardation and infantile body proportions were further examined for evidences of hypothyroidism. In this study 50 out of 114 subjects showed infantile anthropometric evidences, but only 44 could be further examined for the possibility of hypothyroidism with 6 drop outs.

TABLE 1: *Anthropometric data of 44 out of 114 subjects*

Age (years)	Sex		Height		Weight		Infantile skelet (ratio > 1)
	Female	Male	Normal	Short stature	Normal	Overweight	
6 - 14	10	16	24	2	24	2	26
14 - 18	4	9	12	1	13	—	13
18	—	5	5	—	5	—	5
Total	14	30	41	5	42	2	44

Table 1 shows 3 subjects of short stature, that is height below the 10th percentiles for healthy Indonesian school children and youth (Djumadias et al., 1964). Also 2 subjects were overweight, that is weight 20% above the 90th weight percentiles for healthy Indonesian school children and youth (Djumadias et al., 1964). Table 1 also shows 44 subjects with infantile body proportion, that is the ratio of the upper to lower

skeletal segment of more than 1 (Wilkins, 1965; Hutchinson, 1967).

Physical findings showed 3 subjects with abnormalities, 2 of them with hypertelorism, and the other with dry and rough skin (Table 3). Motor development showed 4 subjects with abnormalities, 3 with fine motor abnormalities, and 1 with gross and fine motor abnormalities (Table 3).

TABLE 2: *Intelligence Quotient of the 44 subjects*

I n t e l l i g e n c e			
Debil (I.Q. 50 - 70)	Imbecile (I.Q. 25 - 50)	Borderline debil imbecile	Total
32	11	1	44

TABLE 3: *Physical findings, motor and dental development*

Examination	Normal	Abnormal
Physical findings	41	3
Motor development	40	4
Dental development	44	—

TABLE 4: *Serum cholesterol, T4 and N.T.R.*

Examination	Normal	Above normal	Below normal
Cholesterol (150 - 240 mg.%)	44	—	—
T4 (3.5 - 12.5 ug.%)	41	2	1
N.T.R. (0.88 - 1.11)	43	1	—

TABLE 5: Bone age

X-ray photo	Normal	Delayed ossification center	Epiphyseal dysgenesis	Total
Carpal and metacarpal	32	12	—	44
Pelvis	12	—	—	12
Tarsal and talocrural	3	—	—	3

As revealed in Table 4 :

- All 44 subjects showed normal serum cholesterol (values between 117-220 mg.%).
- Two subjects with T4 just a little above normal (13.8 ug.% and 14.2 ug.%) and 1 subject with T4 just a little below normal (2 ug.%), but they were still considered within normal limits.
- One subject with N.T.R. just a little above normal (1.17), but still considered within normal limits.
- 12 subjects showed suspected delays

in ossification centers on X-ray photos of carpal and metacarpal, but none showed epiphyseal dysgenesis.

- X-ray photos of the pelvis of these 12 subjects and X-ray photos of the tarsal and talocrural bones of 3 out of these 12 subjects showed no epiphyseal dysgenesis (Table 5). Thus, all showed normal bone ages.

The results of radioactive iodine uptake and scanning of 42 out of 44 subjects are shown in Table 6. Two subjects were not examined due to lack of cooperation.

TABLE 6: Radioactive iodine uptake and scanning of 42 subjects

Scanning	Radioactive iodine uptake			
	50%	10-50%	10%	Total
Enlargement of lobus (?) isthmus	24*	5*	—	29
Adenoma (toxic?)	1	—	—	1
Normal/isthmus	3*	5	—	8
Could not be evaluated	—	—	3	3
Not done	1	—	—	1
Total	29	10	3	42

\* = Hyperplasia

### Discussion

Thirty-two out of 42 subjects (Table 6) showed on radioactive iodine uptake and/or scanning a hyperplasia of the thyroid, but T4 and N.T.R. values were all within normal limits. This suggests a possible hyperplasia of the thyroid as a compensation towards a relative iodine deficiency. In 24 out of those 32 subjects, as compensation to the relative iodine deficiency, there was an increase of radioactive iodine uptake of more than 50% and enlargement of the thyroid gland (Lobus/isthmus) as seen on the scan picture.

This hyperplasia and enlargements of the thyroid glands were compatible with the findings of Boyd (1965) and Luhu-lima (1976). Three out of those 32 subjects were still able to compensate the relative iodine deficiency by increasing the radioactive iodine uptake until more than 50%, but without the presence of thyroid enlargement. While in 5 out of those 32 subjects, to compensate the relative iodine deficiency, enlargement of the thyroid gland was found but without increase of the ability to oxidase iodine. Thus, the radioactive iodine uptakes were less than 50% (10 - 50%). Of the 3 subjects with radioactive iodine uptake of less than 10% (0.2%, 0.0%, and 2.8%), their scan pictures could not be evaluated due to those small values of uptake; but T4 and N.T.R. values were within normal limits. It was concluded that those small values of radioactive iodine uptake were not

caused by hypothyroidism, but probably by iodine contamination.

The capacity of thyroid to concentrate iodine (iodine pump) is expressed as thyroidal iodine space. This capacity is modified by many factors including thyroidal size, stimulation of thyrotropic hormone, saturation of iodine stores, and competition by such other anions as thiocyanate and perchlorate. The uptake of radioiodine increases when there is a low level of inorganic iodine in the plasma. On the other hand, an euthyroid person shows a reduced uptake when the plasma inorganic level is raised by a large dietary intake of iodine or by the administration of iodine-containing drugs. A much greater fall is observed in subjects with a selective impairment of their ability to oxidize iodine or in subjects who have been exposed to certain agents which interfere with intrathyroidal oxidation (Davies, 1972; Van Wyk, 1972).

According to Wilkins (1965), there is no single diagnostic sign and test for hypothyroidism, the entire clinical picture manifestations has to be evaluated to determine whether there are physiological and biochemical evidences compatible with disturbed thyroid function. In this study 11 subjects showed one or more anthropometric evidences, beside physical/motor development abnormalities and/or abnormal laboratory findings (Table 7). In this study no clear evidences of hypothyroidism were found among 44 cases. Thus, mental

TABLE 7: Clinical data of 11 out of 44 screened subjects

No.	Age in year	Sex	Weight	Height	Infantile skelet (ratio > 1)	I.Q.	Physical findings	Motor development	Dental development Bone age; Cholesterol	T4	NTR	Uptake	Scanning
1	15	F	N	N	+	Imb.	Dry rough skin.	N	N	N	N	> 50%	> N
2	11	M	> N	N	+	Deb.	N	N	N	N	N	> 50%	N
3	17	F	N	< N	+	Deb.	N	N	N	N	N	> 50%	N
4	10.5	F	N	< N	+	Imb.	Hypertelorism.	N	N	N	N	> 50%	> N
5	9	F	N	N	+	Imb.	N	Fine gross motor abnormality.	N	N	> N	< 10%	Probably due to iodine contamination.
6	13	M	N	N	+	Deb.	N	N	N	N	N	< 10%	Probably due to iodine contamination.
7	8.5	M	N	N	+	Imb.	N	Fine motor abnormality.	N	N	N	< 10%	Probably due to iodine contamination.
8	10.5	M	N	< N	+	Imb.	N	Fine motor abnormality.	N	N	N	Not examined.	Not examined.
9	8	M	> N	N	+	Imb.	N	N	N	< N	N	< 50%	> N
10	17.5	M	N	N	+	Deb.	N	N	N	> N	N	> 50%	> N
11	12.5	F	N	N	+	Deb.	Hypertelorism.	Fine motor abnormality.	N	< N	N	< 50%	> N

N = Normal; M = Male; F = Female; Imb = Imbecile; Deb. = Debil.



retardation with infantile body proportion was probably caused by other factors. The absence of hypothyroidism might be caused by the fact that this school for the mentally retarded children only accept trainable children with an I.Q. ranging from imbecile to debil only, without the presence of idiotic children in whom the possibility of severe congenital hypothyroidism might be found. It seems that even the acquired hypothyroidism with less disturbance of I.Q. was not found in this study either.

Further studies should be done, may be on another sample of population, to trace the problems of hypothyroidism in childhood, and also to find out a possible correlation between positive findings of ordinary laboratory examinations (cholesterol, bone age) with more definite radioactive examinations in hypothyroid cases. Wilkins (1965) and Hutchinson (1967) stated that delay in epiphyseal ossification alone does not establish the

diagnosis of hypothyroidism; but the occurrence of epiphyseal dysgenesis is one of the most characteristic evidence of hypothyroidism, because it is not found in other dwarfs or stunted children eventhough they may have marked retardation on their osseous development.

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