ELECTRORETINOGRAPHIC CHANGES IN UNDERNOURISHED CHILDREN*†

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MALNUTRITION is still widely prevalent in children in many underdeveloped countries of the world, and a certain number show manifestations of vitamin A deficiency. Electroretinography in cases of vitamin A deficiency in children and adults has been extensively studied by Dhanda (1952–1956). As vitamin A deficiency occurs mainly in children with severe malnutrition, it was considered desirable to study the retinal electrical potential in severely undernourished children so as to assess whether the features reported earlier could be considered as specific of avitaminosis A or not.

The apparatus and the method employed in the present study were the same as used by Karpe (1945), except that the amplifier used here had a sensitivity of one millivolt = 1 cm., instead of one millivolt = 2 cm. In each case a minimum of ten stimuli were given and mean b-potentials were noted.

Material

Forty children with malnutrition aged between 7 and 12 years were studied. Younger children could not be included, because of the difficulty in obtaining adequate co-operation from them. All the children weighed less than 65 per cent. of the expected body weight (using charts of healthy English children for comparison—Sheldon, 1955). Fifteen showed clinical manifestations of vitamin A deficiency (Xerosis, Bitôt's spots, and night blindness) in different combinations. A detailed clinical and dietetic history was taken. Weight was accurately recorded. A complete physical and ophthalmic examination preceded the electroretinography.

Observations

Table I (opposite) shows that lower mean b-potentials were recorded in undernourished children manifesting vitamin A deficiency (Group A) than in those showing no evidence of vitamin A deficiency (Group B). Extinguished electroretinograms were observed in three cases in Group A only.

Lower values were observed in children with more marked weight loss in Group B (Table II, opposite). No such relationship was evident in Group A.

Table III (opposite) shows that very low mean b-potentials were recorded in five cases with night blindness, in three of which the electroretinogram was extinguished.

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ELECTRORETINOGRAPHIC CHANGES IN UNDERNOURISHED CHILDREN 155**TABLE I****ERG POTENTIALS IN UNDERNOURISHED CHILDREN WITH AND WITHOUT VITAMIN A DEFICIENCY**

Vitamin A Deficiency		No. of Cases	Electroretinogram			Range (mV.)	Average b-potential (mV.)
			Normal and Supernormal (More than 0.250 mV.)	Subnormal (Less than 0.250 mV.)	Extinguished		
Group A	Present	15	1	11	3	zero -0.252	0.119
Group B	Absent	25	1	24	—	0.100 0.262	0.191
All Cases	No.	40	2	35	3		
	Per cent.		5	(87.5)	(7.5)		0.164

TABLE II**INFLUENCE OF WEIGHT LOSS ON ERG POTENTIALS**

Group	Percentage of Expected Bodyweight	No. of Cases	Electroretinogram			Average b-potential (mV.)
			Normal and Supernormal (More than 0.250 mV.)	Subnormal (Less than 0.250 mV.)	Extinguished	
A	60-65	9	1	6	2	0.122
	55-60	3	—	2	1	0.098
	50-55	3	—	3	—	0.133
B	60-65	15	1	14	—	0.199
	55-60	8	—	8	—	0.182
	50-55	2	—	2	—	0.171

TABLE III**ELECTRORETINOGRAM IN RELATION TO SYMPTOMS OF VITAMIN A DEFICIENCY**

Signs and Symptoms of Vitamin A Deficiency	No. of Cases	No. of Cases showing Extinguished ERG	Average b-potential (mV.)
Xerosis	6	—	0.166
Bitôt's spots with or without xerosis	4	—	0.154
Night blindness with other ocular signs of vitamin A deficiency	5	3	0.035

The graphs were all so calibrated that 1 cm. amplitude (10 small squares)=1 mV., therefore each small square represented a voltage of 0.1 mV.

Discussion

Severity of weight loss has been shown to be the most practical index of malnutrition (Gómez, Galvan, Cravioto, and Frenk, 1955) and has been taken as the main criterion for inclusion of cases in this study; our cases would correspond with their second and third degree malnutrition.

Low mean b-potentials (0.191 mV.) were observed in 25 malnourished children, none of whom showed overt evidence of vitamin A deficiency (Figs 2 and 4). Our values for the b-potential in a comparable healthy group range between 0.100 and 0.400 mV. (mean 0.265) (Khetarpal, 1963). Furthermore cases with greater weight loss showed smaller amplitudes of the b-waves (Group B, Table II). Though the possibility that this depression of b-potentials may be due to sub-clinical vitamin A deficiency cannot be discounted, they may merely represent depressed functional activity of the retinal cells. Hypofunction of many other cells and tissues is known to occur in malnutrition (Gomez and others, 1955).

Although the mean b-potentials in fifteen children with ocular manifestations of vitamin A deficiency in addition to malnutrition were lower than those observed in cases with malnutrition alone, there was a considerable overlap of values (Figs 4 and 5), and low b-potentials were observed almost as frequently in Group B as in Group A. The ERG in avitaminosis A cannot, therefore, be given any diagnostic or prognostic significance, if the patient has moderate or severe malnutrition (Fig. 3).

The ERG was extinguished in three cases showing nightblindness as well as other ocular manifestations of vitamin A deficiency (*viz.* Bitôt's spots, xerosis, etc.: Fig. 1).

FIG. 1.—Case 3, showing extinguished ERG.

This 10-year-old boy weighed 64.1 per cent. of the expected bodyweight, and showed xerosis and night-blindness (arrow points to the stimulus given).

FIG. 2.—Case 12, showing subnormal electroretinogram, with mean b-potential 0.100 mV.

This 10-year-old boy weighed 59.9 per cent. of the expected bodyweight, but showed no clinical evidence of vitamin A deficiency.

FIG. 3.—Case 10, showing mean b-potential of 0.186 mV.

This 12-year-old boy weighed 58.4 per cent. of the expected bodyweight, and showed clinical xerosis.

FIG. 4.—Case 39, showing mean b-potential of 0.262 mV.

This 11-year-old boy weighed 63 per cent. of the expected bodyweight, and showed no ocular signs of vitamin A deficiency.

None of these children had any fundus abnormality. According to Dhanda (1955), five of 27 cases who presented with xerosis had an extinguished electroretinogram even in the absence of night blindness.

FIG. 5.—Case 35, showing mean b-potential of 0.252 mV.

This 10-year-old boy weighed 61 per cent. of the expected bodyweight, and showed Bitôt's spots.

Summary

- (1) Electroretinography was carried out in forty children with severe malnutrition measured by weight loss.
- (2) The undernourished subjects recorded lower b-potentials than a series of healthy controls.
- (3) Those with more marked weight loss showed more severe depression of the b-potential.
- (4) In children with ocular manifestations of vitamin A deficiency in addition to malnutrition, the mean b-potentials were lower than in those with malnutrition alone, although there was considerable overlap.

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