OCULAR MANIFESTATIONS OF VITAMIN B-COMPLEX DEFICIENCY*†

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VERMA (1942) saw several hundred cases of nutritional amblyopia and blepharo-conjunctivitis in Madras, and reports from the prisoner of war camps in the Far East showed that blindness can occur as a result of vitamin B-complex deficiency. The use of rice mills instead of the primitive hand-pounding method, by which only the husk was removed, and the decreased consumption of millet in urban areas have caused a high incidence of B-complex deficiency among rice-eating Indians. The white bread produced in India also lacks vitamin B.

With few exceptions the resulting ocular lesions cannot be definitely ascribed to a deficiency of any particular vitamin, and in most cases all the B-complex factors are deficient.

(1) Angular Conjunctivitis and Blepharo-conjunctivitis

Lesions of the lid margin similar to those of the lips in riboflavin deficiency are common. In early cases the lesions appear in the medial and lateral canthi and extend over the whole thickness of the intermarginal strip and some portion of the skin near it. In moderately severe cases where angular stomatitis is associated with cheilosis, the whole length of the lid margins is ulcerated, producing typical blepharo-conjunctivitis which extends over the intermarginal strip of both eyelids and the surface of the skin and conjunctiva and even over the naso-labial folds; the lesion may be 0.5 to 1.0 cm. deep with raised and pigmented edges sometimes resembling a rodent ulcer. A case of riboflavin deficiency is shown in Fig. 1.

FIG. 1.—Blepharo-conjunctivitis with angular stomatitis and cheilosis due to ariboflavinosis.

* Received for publication April 12, 1966.

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The administration of riboflavin orally and parenterally is followed by total healing of these lesions with no residual scar, but they reappear if the patients go back to their old feeding habits.

(2) Corneal Vascularization

Bessey and Wolbach (1939) drew attention to the occurrence of corneal vascularization in riboflavin-deprived rats. Kruse, Sydenstricker, Sebrell, and Cleckley (1940) reported its occurrence in man.

Lyle, Macrae, and Gardiner (1944) examined 4,000 R.A.F. personnel and found that corneal vascularity is not necessarily evidence of dietary deficiency. Hills, Liebert, Steinberg, and Horwitt (1951), Youmans, Patton, Robinson, and Kern (1942), Scarborough (1942), Boehrer, Stanford, and Ryan (1943), Williams, Mason, Kusick, and Wilder (1943), and Anderson and Milam (1945) found no correlation between corneal vascularization and riboflavin intake.

Tisdall, McCreary, and Pearce (1943), however, found that riboflavin deficiency always produced corneal vascularization, and Sebrell (1953) reported a case in which the administration of riboflavin caused regression of corneal vascularization and in which the capillaries reappeared when the riboflavin was stopped.

Present Investigations

Cases of riboflavin deficiency are frequently seen in the Ophthalmic Department attached to Madurai Medical College. The incidence of corneal vascularization has been studied in these patients by means of the slit-lamp microscope.

Method.—Vascularization was graded as follows:

- (1) Normal limbic plexus with no corneal vessels.
- (2) Engorgement of limbic plexus with no corneal vessels.
- (3) Appearance of stray corneal vessels in the cornea with or without engorgement of limbic plexus.
- (4) Engorgement of limbic plexus with capillaries extending into the cornea all round the circumference and forming primary and secondary loops.

Material

SERIES 1.—266 patients with signs of ariboflavinosis, such as angular stomatitis and cheilosis, were examined initially. Conditions like trachoma and acute or chronic conjunctivitis and cases of angular stomatitis due to badly-fitting dentures were excluded. Urinary riboflavin estimation and the correction of angular stomatitis and conjunctivitis by the administration of riboflavin (Venkataswamy, 1960) enabled us to select those with well-established clinical signs of riboflavin deficiency (Table I).

TABLE I
RIBOFLAVIN DEFICIENCY WITH CORNEAL VASCULARIZATION IN 266 CASES, BY AGE GROUP

Age Group (yrs)	Corneal Vessels			
	None	Few	All round Cornea	Total
0-10	22	10	1	33
11-20	70	29	26	125
21-30	33	25	20	78
31-40	15	3	4	22
41-50	3	2	1	6
51 and Over	0	1	1	2
Total	143	70	53	266

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SERIES 2.—In the first series of cases the severity of the clinical signs was not noted, and a further study was undertaken of 210 patients in whom the angular stomatitis was graded as mild, moderate, and severe:

Grade 1.—At the mucous junction of the skin and lips at the angle of the mouth.

Grade 2.—Extending on to the skin at the angle of the mouth.

Grade 3.—At the angle of the mouth with cheilosis.

The results of slit-lamp observations of the corneal vessels in these patients are given in Table II.

TABLE II
RELATIONSHIP OF SEVERITY OF RIBOFLAVIN DEFICIENCY SYMPTOMS TO CORNEAL VASCULARIZATION IN 210 CASES

Angular Stomatitis	Corneal Vessels			
	None	Few	All round Cornea	Total
Mild	22	21	14	57
Moderate	21	29	15	65
Severe	29	24	35	88
Total	72	74	64	210

CONTROLS.—447 normal healthy persons, mainly medical students, nurses, and police constables, were examined (Table III).

TABLE III
CORNEAL VASCULARIZATION IN 447 NORMAL SUBJECTS, BY AGE GROUP

Age Group (yrs)	Corneal Vessels			
	None	Few	All round Cornea	Total
0-10	1	0	0	1
11-20	37	42	9	88
21-30	53	47	12	112
31-40	42	49	14	105
41-50	34	42	10	86
51 and Over	21	32	2	55
Total	188	212	47	447

Results.—In the 447 normal healthy persons, 47 (10 per cent.) had capillaries extending into cornea forming loops.

In the 476 patients with riboflavin deficiency (Tables I and II), there were 117 patients showing corneal loops all round and extending into the cornea. The 88 severe cases (Table II) included 35 with extensive corneal loops extending into the cornea. The incidence of corneal vascularization was 39.77 per cent. of the Grade 3 cases. These results suggest that corneal vascularization is related to B-complex deficiency, but some severe cases with marked cheilosis and angular stomatitis showed no corneal vessels, while some mild cases of angular stomatitis and some normal subjects showed extensive corneal vascularization with loop formation. Thus there may be other factors producing corneal vascularization apart from vitamin B₂ deficiency.

(3) Epithelial Keratitis

Aykroyd and Verma (1942) described superficial keratitis with riboflavin deficiency in India and Métivier (1941) found this condition in Trinidad. It is often seen in the

FIG. 2.—Moderate riboflavin deficiency with superficial corneal ulcer in the right eye.

FIG. 3.—Riboflavin deficiency with epithelial keratitis in the right eye and corneal ulceration leading to hypopyon.

Ophthalmic Department, Erskine Hospital, in the form of thin opacities occurring in the centre of the cornea in the superficial layers (Fig. 2). The patients complain of defective vision and photophobia, and corneal opacities of 2 to 3 mm. in diameter may be seen. There is no circumcorneal congestion and there is no association with the severity of the ariboflavinosis.

In some of these cases the opacity becomes ulcerated and a hypopyon may develop (Fig. 3). In the early stages the lesions heal with vitamin B-complex injections, but

FIG. 4.—Riboflavin deficiency with erosion of medial canthus and epithelial keratitis.

in the advanced stage the corneal opacity is permanent. There was no associated loss of corneal sensitivity. This does not appear to be a form of epidemic keratoconjunctivitis as suggested by McLaren (1963). Numerous case reports and photographs can be produced to support the idea that it is due to vitamin B-complex deficiency. Keratitis leading to ulceration is shown in Fig. 4.

(4) Nutritional Amblyopia

The incidence and importance of nutritional amblyopia have not always been appreciated by ophthalmologists in India, but we found over forty cases in 2 months in the Ophthalmic Department of Madurai Medical College. In some the visual acuity was 6/24 or 6/36, but in a few it was as low as 2/60 or even less. This degree of defect was seen mainly in expectant and nursing mothers; there was no superficial keratitis or refractive errors and fundus examination showed slight temporal pallor of the optic disc.

The vision improved to almost normal when injections of vitamin B-complex were given. In some cases the improvement was very rapid and a few improved with vitamin B₁ and B₂ in massive doses. In others, however, only partial improvement was obtained. It was difficult to estimate the number of people who had poor distance vision or field defect or colour vision defect.

(5) Night Blindness

According to Davson (1949) the normal retina contains a very high concentration of riboflavin, deficiency of which is associated in man with a form of night blindness.

We have seen a few cases of ariboflavinosis with a history of night blindness but some showed no conjunctival changes. They were given injections of only 10 mg. riboflavin a day, and after 10 days there was a marked improvement. Kimble and Gordon (1939) stressed the value of riboflavin in improving dark adaptation. Pollak (1945) showed dark-adaptation curves which left little doubt that riboflavin alone can improve dark adaptation, though he did not state whether this was due to a direct action on the retina or to an indirect action through raising the blood level of vitamin A in the blood. This needs further study.

Conclusion

The ocular lesions of vitamin B-complex deficiency are not as dramatic as those which occur in keratomalacia, but the number of persons involved is greater. In many patients the symptoms of irritation, photophobia, and lacrimation make them unable to do their normal work. The incidence in children of school age was about 6 per cent. in our survey. The full impact on working efficiency has not been fully assessed, but these conditions cause much absenteeism in industry and hamper work in the fields and in the home.

Summary

The ocular manifestations of vitamin B-complex deficiency include blepharoconjunctivitis, epithelial keratitis, nutritional amblyopia, corneal vascularization, night blindness, and general blindness. The first three are definite manifestations of vitamin B-complex deficiency. Corneal vascularization is seen in a number of cases, but in this condition other factors may be involved.

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