ACETYLATION IN THE LABORATORY DIAGNOSIS OF "BURNING FEET SYNDROME" (PANTOTHENIC ACID DEFICIENCY)

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LIPMANN and his co-workers have shown that coenzyme A, which is concerned with the *in vitro* acetylations of sulfanilamide and choline contains large amounts of pantothenic acid.[1, 2, 3] Riggs and Hegsted[4] found subsequently that acetylation in rats depended on an adequate intake of pantothenic acid. Normal rats acetylated 70% of the amount excreted in 24 hours after a 1 mgm. or 2·5 mgm. dose of para-amino benzoic acid (PAB) given intraperitoneally. On the other hand, rats which were pantothenic acid deficient, acetylated only 50% of a 1 mgm. dose and 37% of a 2.5 mgm. dose of PAB. Simultaneous injections of one mgm. of calcium pantothenate to the deficirnt animale caused a return of their acetylation values to normal.

The 'burning feet syndrome' in humans has been investigated by Gopalan.[5] He has attributed the syndrome to the deficiency of pantothenic acid and has obtained remarkable improvement by the administration of calcium pantothenate. Glusman has also described this syndrome of burning feet as a manifestation of nutritional deficiency.[6] The present investigation deals with acetylation of PAB in humans both normal and those suffering from 'burning feet syndrome'.

The diagnosis of 'burning feet syndrome' is based on the description of the symptoms given by the patients. All the patients examined, complained of a burning sensation of the soles of the feet, which was comparable to that of keeping the feet on red hot coal. The burning sensation increased after walking and also after covering the feet with a blanket. Some cases complained of tingling and numbness of the toes. Dryness of the skin, angular stomatitis, cheilosis and fissured tongue were also frequently found in association with burning feet. The tendon reflexes were brisk; there were no sensory changes or muscular wasting. Treatment with riboflavin did not give any relief as far as burning feet was concerned, though manifestations of riboflavin deficiency disappeared. Thiamin and nicotinic acid were ineffective. With intramuscular injections of 50 mgm. of pantothenol daily,[7] mild cases of 'burning feet syndrome' obtained relief after a week's therapy, whereas in more severe cases, complete cure was obtained after similar treatment for a period of two to three weeks.

Acetylation was determined by the administration of either 100 mgm. or 200 mgm. of PAB to patients, collecting their 24 hours' urine immediately thereafter, and determining the free and total content of PAB in the urine by the method of Bratton and Marshall.[8] The results are presented in Table I along with the acetylation values obtained after treatment with either riboflavin or pantothenol. Eleven normal persons had an acetylation value of 91·5% when 100 mgm. PAB was given, while eight had 91% when 200 mgm. PAB was administered orally. Intramuscular injections of either riboflavin or pantothenol did not change the acetylation values, when determined on some of these normal persons. However, in patients, who were suffering from 'burning feet syndrome', the acetylation value was found to have decreased to 84·9%, when 100 mgm. PAB was given and to 78·9% when 200 mgm. PAB was the dosage employed. Treatment with riboflavin, thiamin or niacin did not raise the acetylation value, whereas administration of pantothenol brought it to very nearly the normal figure with a simultaneous relief of the subjective symptoms of burning feet. These results show for the first time, the biochemical function of pantothenic acid in humans as significantly affecting acetylation processes in the body.

As objective signs in the diagnosis of 'burning feet syndrome' were lacking, acetylation values served as a useful aid in the routine examination of this syndrome. However, a few cases have been met with, who complained of burning feet, but who had normal acetylation values and who did not improve after treatment with pantothenol. It is possible that other factors may be involved in these cases. But, by and large, acetylation values determined with a dosage

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of 200 mgm. of PAB should prove invaluable in detecting genuine cases of pantothenic

TABLE I

Percent acetylation of PAB in normal and deficient persons

Dosage of PAB	Treatment		Normal subjects		Patients with burning feet	
	Riboflavin	Phantothenol	No.	Acetylation value	No.	Acetylation value
mgm.	mgm.	mgm.				
100	..	..	11	89·5–93·8 (Ave. 91·5)	3	84·6–85·6 (Ave. 84·9)
200	..	..	8	89·7–92·4 (Ave. 91·0)	4	77·7–79·9 (Ave. 78·5)
100	125	..	1	92	1	84·2
100	..	350	1	90·7	1	87·6
200	..	350–750	2	91·6	6	86·9–90·3) (Ave. 88·8

acid deficiency among the various patients complaining of 'burning feet'. Acetylation would thus serve as a useful laboratory diagnosis in detecting cases of 'burning feet syndrome'. Treatment with sulfa drugs or an attack of malaria during the acetylation determinations have been found to vitiate the results and hence care must be taken to exclude these conditions during the test. Other conditions likely to interfere with acetylation in the laboratory diagnosis of this nutritional deficiency are under investigation and full details will be published later in the *Indian Journal of Medical Research*.

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THE LIFE-HISTORY OF A TYPICAL FUNNEL CLOUD

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TORNADOES, Waterspouts and Funnel Clouds (Elephant's Trunks) indicative of violent whirling motion in the atmosphere, are quite frequent in some parts of North America. The frequency, for instance, of destructive tornadoes is as high as a dozen per year in Kansas State in the U.S.A.[1,4,6,7] Other principal tornado regions of the world are North Africa, Southern and Western Europe, China, parts of Central Asia and Australia. In India (and in the Tropics in general)[6] it is a rare phenomenon, only few instances being on record.[3] The tornado that occurred on the 5th April 1933 at Peshawar,[8] the group of three waterspouts that were observed over the North Bay of Bengal[2] on the 14th February 1936 and the tornado cloud recently observed at Madras[5] on the 8th October 1945 are, perhaps, the only examples that have been well recorded. It is the purpose of this note to put on record one more typical instance of a Funnel Cloud that was observed by the author on the 26th June 1946 at Dum Dum (about 10 miles NE of Calcutta).

In the afternoon of 26th June 1946 the sky at Dum Dum was overcast (8-9/10ths sky covered with Cu, Fb, and Ns) and slight intermittent rain was falling; when suddenly at about 1510 hours I.S.T. the author noticed a protuberance of a very unusual form at the base of a cloud in the SW portion of the sky. It soon developed into a tube like appendage obliquely hanging from the base of the cloud (see Plate I, Fig. 1). Even at this stage it showed a whirling motion about its axis which obviously indicated the cause of its formation. Further development then continued rapidly and simultaneously in two directions;—