OBSERVATIONS ON THE VITAMIN B_2 COMPLEX DEFICIENCY SYNDROME IN WEST AFRICAN SOLDIERS[1]

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Introduction

During the summer of 1948 several medical officers in the Gold Coast District of West Africa Command reported the finding of cases of scrotal dermatitis among the African soldiers under their care. The present survey was carried out as part of a Command survey initiated by Lieut.-Colonel R. Boyd, R.A.M.C., the Assistant Director of Army Health, West Africa Command, on behalf of the Deputy Director of Medical Services.

929 African soldiers stationed in Accra were examined for evidence of vitamin B_2 complex deficiency. The main signs looked for were: (1) Cheilosis, (2) Angular stomatitis; (3) Glossitis; (4) Scrotal dermatitis; (5) A follicular rash.

Table I (pp. 294, 295) represents the findings in this investigation.

Clinical Picture

The severity of the symptoms in these cases varied independently of the severity of the physical signs. Several men with marked scrotal dermatitis and sore-looking tongues admitted to suffering any inconvenience only on direct questioning. On the other hand others appeared to be seriously troubled by these lesions. Only about 10 men reported sick of their own accord with symptoms relating to the condition under discussion.

A. *Rapidity of Onset and Duration of Symptoms.*—Many of the patients did not know or failed to remember how long their tongues or scrota had been sore and some had not noticed the condition at all. Altogether 22 men could

[1] This paper is based on a report submitted to the Deputy Director of Medical Services, West Africa Command, in October 1948.

TABLE I

Case number	*Unit and No. of men examined*	*Physical signs*					*Duration in weeks*	*Weeks between last change of environment and onset of symptoms*	*Country of origin*	*Draws rations*	*Ration allowance*	*Comments*
		Cracked lips	*Angular stomatitis*	*Sore tongue*	*Scrotal dermatitis*	*Follicular rash*						
1		—	—	x	—	—	?	?	NT	x	—	
2		—	—	x	—	—	?	?	T	x	—	
3		—	x	xx	—	—	?	?	GC	x	—	
4	HQ. Coy.	—	—	x	—	—	?	?	GC	x	—	? syphilis
5		—	—	x	—	—	?	?	GC	x	—	
6	112	—	—	x	—	—	?	?	GC	x	—	
7		—	—	x	—	—	?	?	NT	x	—	
8		—	—	x	—	—	?	?	NT	x	—	
9		—	x	x	x	—	?	?	T	x	—	
10		—	xx	x	x	—	?	?	NT	x	—	
11		—	—	x	xxx	—	?	?	T	x	—	
12		—	x	xxx	xxx	—	?	?	T	x	—	
13	A. Coy.	—	x	x	x	—	?	?	NT	x	—	
14		—	x	xxx	—	—	?	?	NT	x	—	Syphilis Kahn +
15		—	x	x	x	—	?	?	NT	x	—	
16	46	—	xx	xx	xxx	—	?	?	NT	x	—	
17		—	x	x	—	—	?	?	NT	x	—	
18		—	—	—	xxx	—	?	?	GC	x	—	
19		x	—	—	—	—	?	?	NT	x	—	
20		—	—	—	xx	—	?	?	NT	x	—	
21		—	—	xxx	—	—	?	?	NT	x	—	Kahn —
22	B. Coy.	—	x	xx	—	—	?	?	NT	x	—	Kahn —
23		—	—	x	x	—	?	?	NT	x	—	
24	64	—	—	—	x	x	?	?	GC	x	—	
25		—	—	x	—	—	?	?	NT	x	—	
26		—	—	xxx	—	—	?	?	GC	x	—	
27		—	—	x	xx	—	?	?	GC	x	—	
28		—	—	x	x	—	?	?	T	x	—	
29		—	—	xxx	—	—	?	?	NT	x	—	Kahn —
30	C. Coy.	—	—	x	x	—	?	?	T	x	—	
31		—	x	xx	—	—	?	?	GC	x	—	Syphilis Kahn +
32	64	—	x	xxx	xxx	—	?	?	NT	x	—	
33		—	—	x	x	—	?	?	NT	x	—	
34		—	—	xx	x	—	?	?	T	x	—	
35		—	x	xxx	xxx	—	?	?	GC	x	—	
36		—	—	xxx	xx	—	?	?	GC	x	—	
37		—	—	x	x	—	?	?	T	x	—	
38		—	—	x	—	—	?	?	NT	x	—	
39	D. Coy.	—	—	—	xx	—	?	?	T	x	—	
40		x	—	xx	xxx	xx	2	8	T	x	—	
41	63	—	—	—	x	—	?	?	NT	x	—	
42		—	—	xx	x	—	?	?	NT	x	—	
43		—	—	—	x	—	?	?	GC	x	—	? tinea

TABLE I—*continued*

Case number	*Unit and No. of men examined*	*Physical signs*					*Duration in weeks*	*Weeks between last change of environment and onset of symptoms*	*Country of origin*	*Draws rations*	*Ration allowance*	*Comments*
		Cracked lips	*Angular stomatitis*	*Sore tongue*	*Scrotal dermatitis*	*Follicular rash*						
44	Lt.	—	—	xx	—	—	?	?	T	x	—	Syphilis Kahn +
45	Batt.	—	—	—	xxx	xxx	3	8	T	x	—	
46		—	—	x	—	—	1	?	GC	x	—	? syphilis
47	129	—	—	xx	x	—	3	?	GC	x	—	
48		—	—	—	xx	—	?	?	IC	x	—	
49		x	—	—	—	—	?	?	N	x	—	
50		—	—	x	—	—	?	?	NT	x	—	
51	Records 70	—	—	—	x	—	?	?	GC	—	x	
52	HQ. Dist.	—	—	—	x	—	?	?	GC	—	x	
53	80	—	—	xx	—	—	?	?	GC	—	x	
	R.E. 10					No cases				x	—	
	DADOS 16					No cases				x	—	
54	821 Coy. 123	—	—	x	x	—	?	?	GC	x	—	38 draw ration allowance
55		x	x	xx	xx	—	14	0	N	x	—	
56		x	x	xx	xxx	x	3	13	N	x	—	
57		x	x	xxx	xxx	—	8	8	N	x	—	
58		—	x	xxx	—	—	16	?	GC	x	—	Syphilis Kahn +
59		—	x	xxx	xx	—	8	?	GC	x	—	
60		—	—	xxx	xxx	—	26	2	N	x	—	
61		—	x	x	xxx	x	21	3	SL	x	—	
62		x	x	xxx	—	—	12	4	N	x	—	
63		x	x	xxx	xxx	—	14	2	N	x	—	
64	MTTC.	x	x	xx	—	—	3	16	N	x	—	
65		—	x	xx	x	—	13	3	N	x	—	
66	111	—	—	—	x	—	3	13	N	x	—	? tinea
67		—	x	x	x	—	3	13	N	x	—	
68		—	—	xxx	—	—	?	?	GC	x	—	Syphilis Kahn +
69		—	—	xx	x	—	?	?	NT	x	—	
70		—	—	xx	x	—	13	3	N	x	—	
71		—	x	x	xx	xx	13	3	N	x	—	
72		—	—	xxx	—	—	2	34	N	x	—	? tinea
73		—	x	x	xx	—	14	2	N	x	—	
74		—	x	xx	xx	—	14	2	N	x	—	
75		x	xx	xxx	xxx	—	1½ yrs.	2	N	x	—	Most severe case
76		—	x	xxx	—	—	13	3	N	x	—	
77		—	—	—	x	—	14	2	N	x	—	
78	C.S.D.	—	x	xx	—	—	?	?	T	x	—	
79		x	—	x	—	—	?	?	NT	x	—	
80	41	—	—	—	x	—	?	?	GC	x	—	? tinea

Key x Mild case.
xx Moderately severe.
xxx Severe.
NT Northern Territories.
N Nigeria.
GC Gold Coast, Ashanti.
T French and British Togoland.
SL Sierra Leone.
IC Ivory Coast.

give some details of the duration of their symptoms and the majority of these were Nigerians of the M.T.T.C. who had arrived from Nigeria four months previously.

The duration of symptoms is summarized in Table II below.

TABLE II

Case No.	40	45	47	55	56	57	59	60	61	62	63	64
Duration of symptoms (weeks)	2	3	3	14	3	8	8	26	21	12	14	3
No. of weeks from last known change of diet to onset	8	8	?	0	13	8	?	2	3	4	2	16

Case No.	65	67	70	71	72	73	74	75	76	77
Duration of symptoms (weeks)	13	3	13	13	2	14	14	1½ yrs.	13	14
No. of weeks from last known change of diet to onset	3	13	3	3	34	2	2	2	3	2

B. *Physical Signs.*—Table III shows the relative incidence of the signs found in these 70 cases.

TABLE III

	No. of cases	*Percentage of total*
1. Cheilosis	10	14·3
2. Angular stomatitis	26	37·1
3. Glossitis	56	80·0
4. Scrotal dermatitis	48	68·6
5. Follicular rash	6	8·6

(1) *Cheilosis:* The vermilion of the lips was found to be rather dry and sore. The mucous membrane over the inside of the lips was thickened, opaque and whitish.

(2) *Angular stomatitis :* The membrane at the angles of the mouth was desquamating, sodden and white. In case 77 this was so to a marked degree and caused the patient considerable discomfort in spite of which he had not reported sick of his own accord.

(3) *Glossitis :* The tongue presented a swollen, pale appearance. The mucous membrane in the milder cases was opaque and the epithelium at the edge of the tongue was flattened. In the more severe cases the epithelium had peeled in patches leaving a smooth, tender, pale area beneath. In these, the remaining fungiform papillæ were prominent and hyperæmic and were usually on the sides of the tongue. This was sometimes indented by the teeth. Short narrow fissures were fairly common in the advanced cases. The mouth tended generally to be more moist than usual.

(4) *Scrotal dermatitis :* Frankland (1948) describes four stages in the production of scrotal dermatitis which was the second commonest sign in the syndrome seen in this survey (68·6 per cent of the cases).

(i) Mild acute dry form.
(ii) Severe chronic dry form.
(iii) Chronic wet form.
(iv) Ulcerated and œdematous form.

All the cases observed in this investigation were of the mild acute or severe chronic dry forms, i.e. in groups (i) and (ii). Glossitis was associated with the dermatitis in most cases.

The skin of the scrotum was affected mainly where it was overlain by the penis. The skin of the lower shaft of the penis was sometimes involved. A slight dryness of the skin was the first sign in mild cases, being increased both in extent and severity in others until in the most marked cases seen the skin was dry, thickened and scaly, the rugæ hypertrophied and the dermatitis spread to the adjacent area of the thighs.

(5) *Follicular Rash :* A follicular rash was seen in 6 cases but was widespread in 2 only. In these 2 the onset of the rash seemed to coincide roughly with the time of onset of the scrotal dermatitis. It was a non-suppurating folliculosis (distinct from the follicular keratosis of vitamin A deficiency (Platt, 1945), in one case covering the whole lower trunk and in the other the upper trunk and arms. The rash in all these cases is of doubtful significance and may have been a form of prickly heat.

These physical signs were not all necessarily found together in one person and this did not seem to depend just on the severity of the case. However, a marked glossitis unassociated with scrotal dermatitis was regarded as possibly of spirochætal origin and not accepted by itself as due to hypovitaminosis unless a blood Kahn test had proved to be negative.

Differential Diagnosis

The conditions found to simulate this syndrome were :

(i) " Geographical tongue " due to syphilis.
(ii) Congenital fissured tongue.
(iii) Tinea cruris.

The first two caused confusion in several cases but tinea was easily differentiated by its clear spreading edge and intense irritation even in mild cases.

Blood Kahn tests were performed in several cases who exhibited sore tongues but little else. 5 were positive, 2 doubtful and 4 negative.

Incidence

Reference to table I gives us the following incidence of cases in the series :

Number of men examined	929
Number of cases with significant signs	80
Number of cases excluding those with a positive Kahn or scrotal lesions attributable to Tinea	70
Percentage incidence in 929 men	7·53

These may be classified as follows :

Mild cases	(x)	3·12 per cent
Moderate	(xx)	1·94 per cent
Severe	(xxx)	2·47 per cent

Relation to Diet

At the time of this survey the majority of African troops stationed in Accra were drawing cooked rations according to a scale revised in 1946 and calculated to cover their requirements of calories, proteins, vitamins, etc. The following figures for the average daily intake of riboflavin and nicotinic acid have been calculated from the consumption over a theoretical specimen month. As this has been done with the aid of various published scales of food vitamin contents,[1] and not by direct analysis of specimen meals, the results can only be taken as a rough indication of the vitamin intake.

Table IV

	Riboflavin mg.	*Nicotinic acid* mg.
Normal daily requirements	3*	10–20†
Calculated average ..	1·61–3·33	34·35–47·14

(In each case the lower number is based on the lowest published food vitamin contents found and the higher on the maximum contents.)

* Sebrell *et al.* (1941).

† Bicknell and Prescott (1946).

Of the 70 men showing some signs of hypovitaminosis 67 were drawing cooked rations and only 3 were drawing a monetary ration allowance. Of the 176 men drawing ration allowance only these three showed signs of deficiency and then to a mild degree. All three were inhabitants of the Ashanti provinces (Cases 51, 52 and 53). It was particularly noticeable among the Nigerians that " Groundnut stew " was not eaten because these men found it unpalatable. This food contains a useful quantity of the B_2 complex vitamins, especially nicotinic acid.

Table V

Place of origin	*Gold Coast NTs*	*Nigeria*	*Gold Coast Ashanti*	*Togoland*	*Sierra Leone*	*Ivory Coast*
No. of patients from the area	23	18	15	12	1	1
Percentage of total (70)	32·9	25·7	21·4	17·1	1·4	1·4

Unfortunately exact figures showing the places of origin of all 929 soldiers are not available but probably about 40 per cent originated in the Northern Territories (NTs), 50 per cent in the Ashanti provinces and 10 per cent in the other areas. Among 111 soldiers examined in the M.T.T.C. there were 23 cases, 17 of whom had recently come from Nigeria to Accra to attend a

[1]References are listed at the end of this paper.

course. In many of these cases their symptoms dated from two to three weeks after their arrival in Accra. The syndrome was so common among Nigerian troops that it was frequently referred to by the African nursing orderlies as the " Nigerian disease."

Discussion

The clinical syndrome of cheilosis, angular stomatitis, glossitis, and scrotal dermatitis in man is now known to be due to deficiency in the diet of vitamins of the B_2 complex, especially riboflavin.

Stannus (1912) first mentioned the occurrence of scrotal dermatitis in describing " pellagra " in Nyasaland and later (Stannus, 1913) lists 19 cases with this sign in a series of 131 cases of " pellagra." Investigation has now shown that riboflavin is the most efficient component of the complex in curing the syndrome. Stannus (1944), however, points out that we cannot so far exclude the possibility of deficiency of other members of the vitamin B_2 complex playing some part in its production.

It is interesting to note that Jones *et al.* (1944) describing stomatitis due to riboflavin deficiency in 1,746 cases state that they found no patient with scrotal dermatitis. Their cases developed when the diet contained 1·0–1·28 mg. of riboflavin daily and no cases were seen when the riboflavin content was increased to 1·6 mg. Rapid cure was achieved by the administration of pure riboflavin or yeast but nicotinic acid or vitamin A were not effective. Similarly, Thompson and Freedman (1947) investigating an epidemic of the riboflavin deficiency syndrome in Indian troops describe only one case in a series of 100, with a " well-marked, scurfy dermatitis of the scrotum." Frankland (1948) on the other hand describes 551 cases of scrotal dermatitis in Allied prisoners of war in the Far East. Many of his cases were far more advanced than any seen in this series and were commonly accompanied by stomatitis, ocular changes and proctitis. They were markedly improved by the addition of Marmite or green vegetable extracts to their diet.

In the present series scrotal dermatitis was common, occurring in 48 out of 70 cases. This might suggest that the diet of many of the African troops in this area was bordering on an insufficiency of the B_2 complex vitamins but Lieut.-Colonel Boyd has pointed out that many of the soldiers miss the evening meal from time to time thus losing a valuable proportion of the vitamins. On the other hand the men commonly buy extra food at the native markets. Previous mention has been made of the fact that many soldiers not indigenous to this area did not partake of foods such as " Groundnut stew " because they found them distasteful and it was among these men that most of the cases were seen.

Table IV shows that the basic diet was adequate in nicotinic acid but possibly on the low side in riboflavin. In 92·47 per cent of the men seen, there was no clinical evidence of vitamin B_2 complex deficiency so that, in general, the deficiences observed cannot justifiably be blamed on the standard ration scale.

Treatment

A proportion of the patients were given 6 " Compound Vitamin Tablets " daily. Each tablet contained : Aneurin 1 mg., riboflavin 1 mg., nicotinamide 10 mg., ascorbic acid 25 mg. Unfortunately we were unable to follow up these cases properly, but during the first week we observed a marked improvement in symptoms and physical signs in those men whom we were able to see again.

Summary

(1) The results are presented of a survey of the vitamin B_2 complex deficiency syndrome in 929 West African soldiers.

(2) The clinical picture of cheilosis, angular stomatitis, glossitis, scrotal dermatitis and folliculosis is described and the differential diagnosis mentioned.

(3) 7·53 per cent of the 929 men examined showed some evidence of deficiency. The appearance of the syndrome is discussed in relation to diet and change of environment.

(4) The frequency of scrotal dermatitis in this series (68·6 per cent of all cases) is discussed in relation to the findings of previous observers. It is suggested that the ration scale for African troops in use in the summer of 1948 was adequate in the B_2 complex vitamins.

(5) Rapid improvement resulted when these patients were given tablets containing aneurin, riboflavin, nicotinamide and ascorbic acid.

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Brigadier Creagh emphasizes that he does not believe that this ration scale which is still in force is so deficient in riboflavin as to lead to a development of the syndrome *per se* and that other Regimental Medical Officers in the Command reported a minimal incidence of it. He does not agree that the syndrome was so common in Nigerian troops.

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