THE INFLUENCE OF AVITAMINOSIS ON THE COURSE OF TRYPANOSOME INFECTION

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Recent research has shown that the term "anti-infective" applied to vitamin A is misleading and inaccurate. Harris (1933) has discussed the evidence which shows that vitamin A cannot be regarded as a general anti-infective agent: the actual relation of the vitamin to infection has been well defined by Cramer, who states (1930) that "an adequate supply of vitamin A is a powerful prophylactic against infections *entering by mucous membranes*, but there is no evidence that it can prevent or cure those infections which enter by the blood stream or by subcutaneous tissues."

Cramer (1923) showed that in avitaminosis A there was an atrophy of mucus-secreting cells, the latter then allowing penetration by bacteria.

This view is borne out by numerous investigations.

Green and Mellanby (1928) found infections to appear in 97 per cent. of their vitamin A deficient animals, the avenue of infections being in all cases mucous membrane. The lesions described were abscess at base of tongue, broncho-pneumonia, inflammation of alimentary canal. Drummond (1919) also found increased susceptibility to lung inflammation in avitaminosis A.

Cramer (1923) found an increase in the protozoal flora—particularly *Lamblia intestinalis*—in the vitamin A deficient gut.

On the other hand Burton and Balmain (1930) showed that vitamin A has no prophylactic action against streptococcal infection, while Harris and Griffiths (1932) showed that it has no influence on the course of experimental tuberculosis.

In the investigation described below rats exhausted of their vitamin A reserves were inoculated subcutaneously with *Trypanosoma brucei* infected blood, and the course of infection compared with that in rats adequately provided with vitamin A but otherwise receiving a similar diet.

Technique

The following two diets were prepared, amounts indicating the daily rations:

	Diet I	Diet II
Casein	3 g.	3 g.
Hydrogenated cotton-seed oil	2 ,,	2 ,,
Starch	10 ,,	10 ,,
Salts	1 ,,	1 ,,
Dried yeast	1 ,,	1 ,,
Cod-liver oil	1/20 c.c.	—
Irradiated cholesterol	5 mg. (in liquid paraffin)	5 mg. (in liquid paraffin)

https://doi.org/10.1017/S0022172400034483 Published online by Cambridge University Press

Nine rats were put on Diet I, six on Diet II. The rats were pure-bred Wister, and prior to receiving the above diets had been fed on ground oats, Glaxo and milk. Their ages varied, but they were all of the growing age (none exceeding 144 g. in weight). The irradiated cholesterol (I.C.) was dissolved in liquid paraffin and administered daily by pipette, 0·1 c.c. of a 5 per cent. solution containing 5 mg. I.C. In the case of Diet I the I.C. solution and cod-liver oil were combined so that 0·1 c.c. of the mixture contained 1/20 c.c. cod-liver oil and 5 mg. I.C. The salt mixture had the following composition, and was obtained from a formula given by Pryde (1928):

NaCl	4·7
$MgSO_4$	7·1
NaH_2PO_4, H_2O	9·4
K_2HPO_4	25·8
$CaH_4(PO_4)_2H_2O$	14·6
Ca lactate	35·2
Fe citrate	3·2
KI	Trace (0·003 %)
	100

The rats on Diet II were not inoculated with trypanosomes until there was definite evidence of exhaustion of reserves of vitamin A, as shown by xerophthalmia or stationary or falling weight. This involved a period of about 12 weeks.

Tabular summary of results

A. Rats on Diet II (vitamin A free).

No. of rat	Weight at commencement (g.)	Period on diet (weeks)	Condition when inoculated with *T. brucei*	Tryps. + in blood (days after inoculation)	Tryps. + + + in blood (days after inoculation)	Death of rat (days after inoculation)
8	84	8	Marked xerophthalmia,	3	5	6
34	66	12	Weight stationary	3	5	8
35	77	12	Weight stationary	3	5	11
37	122	12	Slight xerophthalmia, weight declining	3	5	10
38	127	12	Weight declining	3	7	9
40	144	12	Weight stationary	3	7	9
			B. Rats on Diet I after 6 weeks on Diet II.			
1	125	2½	Weight increasing slightly	—	5	8
2	109	2½	Weight increasing slightly	—	5	7
4	68	14	Weight increasing rapidly	—	7	10
			C. Rats on Diet I.			
22	41	13	Rapid increase in weight, health normal	3	6	10
23	43	13	Do.	3	6	8
24	43	13	Do.	3	6	10
33	44	12	Do.	3	5	8
36	108	12	Do.	3	7	10
39	120	12	Do.	3	7	10

RESULTS

The accompanying tables indicate the results of the experiments and show that:

(1) Irrespective of the diet the trypanosomes appeared in the blood 3 days after inoculations in all rats examined.

(2) The average survival period for the rats receiving vitamin A (Groups B and C) was 9 days; that for the rats deprived of vitamin A (Group A) 8·8 days.

(3) Apart from the two rats showing xerophthalmia (one giving the shortest survival period and the other the longest), the variation in survival period was very slight (7–10 days).

Conclusion

There is no significant difference between the course of *Trypanosoma brucei* infection in the rat exhausted of vitamin A and that in the rat adequately supplied with this vitamin.

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(*MS. received for publication* 16. i. 1934.—Ed.)