The effect of diet in West Africa on the pH of human urine

It is well known that the pH of urine can have pronounced effects on the excretion of partially ionized drugs (Beckett & Tucker, 1967). In the Western world, in subjects receiving a normal balanced diet, urinary pH varies between subjects as well as within subjects throughout the day but the average pH is about 6·0 (Yarbro, 1956; Elliot, Sharp & Lewis, 1959; Beckett, unpublished observations).

In Ghana, 12 men aged 20–30 years were selected at random from each of two classes of persons: (i) students in Halls of Residence at the University who were receiving their usual balanced diet, the carbohydrates consisting of bread, cakes, yams, cassava, rice and maize; (ii) laboratory assistants living at home on their usual low-protein diet, their carbohydrate intake consisting of rice, gari, maize, yam, plantain and cassava. Urine was collected from the subjects at 2 h intervals from 7 a.m. to 1 p.m. on two successive days and the pH of each collection measured immediately. Also all urine samples were collected for a period of 36 h starting from 7 a.m. on one day and the pH of the pooled urine of each subject over this period was measured.

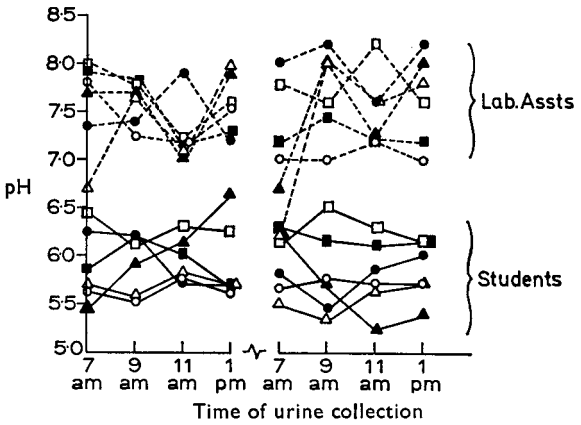

FIG. 1. Urinary pH in subjects on their normal different diets. ———, students on balanced protein diet. – – – –, laboratory assistants on low protein diet.

Typical results for the pH of separate samples of urine of students and laboratory assistants are given in Fig. 1. There is virtually no overlap in the pH profile in the two classes of subjects. Very few laboratory assistants had urine collections more acidic than pH 7 whereas none of the students had urine collections more alkaline than pH 7.

For the pooled urines, the pH values were: students, 5·9 $\pm$ 0·56 (s.e., n = 12), range, 5·45–6·3; laboratory assistants, 7·5 $\pm$ 0·25 (s.e., n = 12), range, 7·3–7·7.

The two classes of subjects must inevitably excrete partially ionized drugs to a different extent, e.g. basic drugs would be expected to be excreted much less rapidly by laboratory assistants than by students. Preliminary investigations with amphetamine support this conclusion.

Since the pH of the urine can alter the excretion of partially ionized drugs and the ratio of metabolites to parent drugs in the body, the present results indicate that it may be unwise to extrapolate from the observed effects and side-effects of drugs in clinical trials in developed countries to predict the effect of these drugs in communities with different dietary customs. Also the effect of diet should not be overlooked

when clinical trials of partially ionized drugs are being considered for different countries.

I thank the subjects for their co-operation in this study and Prof. A. H. Beckett, University of London, for suggesting the project.

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January 4, 1969

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Effect of actinomycin D on the recovery of cardiac noradrenaline after depletion with guanethidine

It has been suggested that the recovery of tissue noradrenaline levels after reserpine depletion is dependent upon the synthesis of new storage vesicles in the cell body and their subsequent transport down the axons to the nerve terminals (Dahlström, 1965; Dahlström & Haggendal, 1966). Evidence for such a suggestion comes from studies showing that fresh vesicles begin to reach the nerve terminals within 24 h after reserpine administration (Dahlström, 1967). Prolongation of the recovery of tissue noradrenaline in reserpine-treated animals by agents which inhibit protein synthesis, such as actinomycin D or SKF-525A (β-diethylaminoethyldiphenylpropyl acetate), is consistent with this hypothesis (Mueller & Shideman, 1968). Guanethidine in addition to producing pharmacological effects different from those of reserpine, has been shown to produce depletion of noradrenaline stores by a mechanism that appears to be, at least in part, similar to the one mediated by reserpine, i.e. by blocking of the granular pump (Shore & Giachetti, 1966). It was therefore of interest to determine the effect of actinomycin D on the recovery of cardiac noradrenaline after depletion with guanethidine.

Male Sprague-Dawley rats weighing 125 to 150 g were injected i.p. with 20 mg/kg of guanethidine, a dose which has been shown to produce over 90% depletion of cardiac noradrenaline (Westfall & Osada, 1968), and 48 h later half of these rats were treated with actinomycin D (100 μg/kg,i.p.). The animals not receiving actinomycin D were injected with a comparable volume of saline. Since actinomycin D has been shown to reduce food consumption, a paired feeding technique similar to that of Mueller & Shideman (1968) was used. The quantity of food eaten by each experimental animal on one day was given to its control on the following day. Animals were killed by decapitation at 6 h, 3 days, 4 days and 6 days after guanethidine. The hearts were removed and analysed for endogenous noradrenaline according to the trihydroxyindole procedure of Euler & Lishajko (1961).