A NOTE OF THE INFLUENCE OF THE ADDITION OF CERTAIN SUPPLEMENTS TO THE DIETS OF AFRICAN NATIVES. III.

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(With 1 Figure.)

In the two preceding communications[1] we have discussed the calcium balances and weight increase of natives, both adult and growing, on certain institution diets, with and without additions.

Various considerations pointed to a relative or absolute deficiency of calcium in the above diets. The experimental additions made, therefore, were (1) a mineral mixture reproducing closely the ash of cows' milk; (2) cod-liver oil; (3) cod-liver oil plus the mineral mixture; (4) olive oil plus KI; (5) milk.

Weight curves.

As regards weight, one of the most striking results was that adult subjects on the supplements mentioned showed an increase. Further, on withdrawal of the supplements (particularly of mineral mixture alone) the weight curves showed a distinct fall.

While these results seemed quite definite we felt that, in view of the fact that we had employed groups of 7 men each (with 14 in the basal group), the experiment, as far as weight curves were concerned, might well be repeated with larger numbers. Accordingly from the subjects already employed two groups were formed with 21 men in each. These two groups were as nearly comparable as possible with regard to the previous history of the subjects, *i.e.* their treatment in the first experiment.

The ordinary long term prisoners' diet formed the basal ration for both groups. Group I acted as control while Group II had an addition of minerals plus cod-liver oil as in our first experiment.

At the end of 10 weeks the supplements were withdrawn from Group II and given to Group I. This continued for a further 6 weeks. All subjects were weighed weekly.

Fig. 1 represents the weight curves for 19 men in each group (2 men from each group having dropped out owing to sickness). The following points are noteworthy:

(1) Subjects in Group I while on the basal diet alone showed a definite increase in weight. Comparison with their final weights in our experiment 3 months previously shows that they had not been rising steadily during the

[1] *See* pp. 418–438 of this number of *J. Hygiene.*

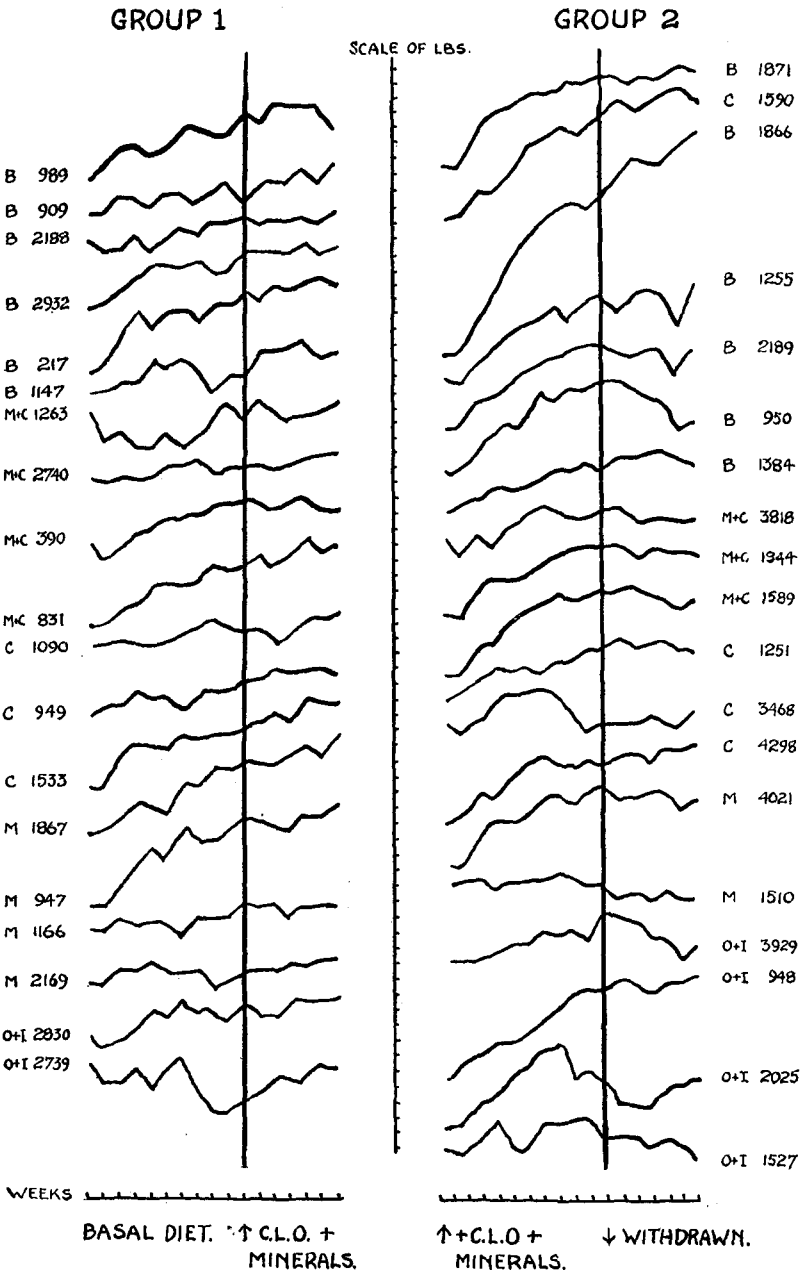

FIG 1

Fig. 1. (The letters refer to treatment in the previous experiment, i.e. B = Basal diet; M = Minerals; C = Cod-liver oil; M + C = Minerals + Cod-liver oil; O + I = Olive oil + Iodine.)

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interval. Their rise in weight is accordingly to be attributed largely to the more careful supervision during the experiment than while under ordinary prison routine. This forms a striking parallel to an experiment described in detail by McCollum and Simmonds in which school children were employed. In both experimental and control group a sharp rise in weight was observed for the first few weeks of the experiment.

(2) Our second group on minerals and cod-liver oil rose markedly in weight. Even when allowance is made for a rise as described in paragraph (1) above, a margin remains which we attribute to the influence of the supplement.

(3) On the addition of cod-liver oil and minerals to Group I they either maintained the higher weight level they had reached or showed a small but definite increase.

(4) On withdrawal of the supplements from Group II their weight curves showed a decided flattening or a falling off.

(5) In both groups the effect of the addition of the supplement is probably best seen in those subjects who had not in the previous experiment received any supplement, *i.e.* those marked Basal in Fig. 1.

CALCIUM BALANCES.

In the case of the above 38 subjects we conducted on this occasion no balance experiments since results in the two previous investigations had been unambiguous. The present note, however, presents an opportunity of summarising the results of these balance estimations and of discussing them briefly in the light of Sherman and Macleod's paper (1925) which, on account of the inevitable local want of facilities as regards references, only came into our hands after the completion of our second paper. In the first place, however, the following generalisations may be made from a consideration of the balances of our adult subjects[1] and of the growing boys[2].

(1) It would appear that most of the subjects on the basal diet (0·3 grm. Ca per day) received less than a maintenance allowance of calcium. They were in consequence continuously losing calcium from their bodies in varying amounts, occasionally as much as 0·29 grm. per day.

(2) Some subjects, however, were in calcium equilibrium on the above diet, with only occasionally negative balances.

(3) The most striking improvement in calcium balance was obtained when in the experiment on growing boys milk (0·77 grm. Ca) was added to the diet. Subject 2534 passed from a negative balance of − 0·1 grm. Ca per day to a positive balance of 0·5 grm. Ca per day.

(4) A marked improvement in calcium balance was also noted in those subjects who received a supplement of "minerals plus cod-liver oil" (0·68 grm. Ca added).

(5) An improvement almost as marked was observed when minerals alone (0·68 grm. Ca) were added.

[1,2] *Loc. cit.*

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(6) The addition of cod-liver oil (15 c.c. per day) was followed by no appreciable improvement of the calcium balances. Balances, indeed, which were negative remained so.

In discussing some of these findings we stated: "This would emphasise the fact that where the calcium intake is low the most valuable addition that can be made is one of calcium itself. It would further impress the futility of adding a calcium absorption promoting vitamin in the absence of an adequate calcium intake. Indeed, where there is a pressing demand for calcium the furnishing of an adequate amount in the food, with or without an increase in the vitamin content, would seem to meet the needs of the case[1]."

Our results and conclusions strikingly support the findings of Sherman and Macleod (1925) in the paper above referred to. These workers, approaching the subject from a different aspect, estimated the calcium content of the bodies of rats which had been on various experimental diets. Among their findings which are relevant to our present discussion are the following:

(1) Growing rats on a diet deficient only in calcium showed no increase but a slight decrease in the calcium content of their bodies. In similar circumstances we found growing boys to be on negative calcium balances.

(2) Rats allowed to grow to a normal size on a diet adequate in calcium and then transferred to a calcium deficient diet lost relatively large amounts of calcium from their bodies—in some cases as much as one-third of their calcium content. This is paralleled by the fact that we found several adult men receiving a low calcium diet to be on very definitely negative calcium balances.

(3) On low calcium diets the addition of cod-liver oil made no appreciable difference to the calcium content of the rats. Throughout we found that in similar circumstances cod-liver oil was not effective in correcting a negative Ca balance, even when it appeared to stimulate growth.

(4) The addition of calcium lactate to the diet low in calcium increased the calcium content of the rats' bodies to a normal figure. Similarly we found the addition of calcium in a mineral mixture effective in converting negative to positive balances.

The marked agreement between results obtained by two such dissimilar methods of approach to the problem as the estimation of the calcium content of rats' bodies and balance experiments on human subjects calls for comment.

REFERENCES.

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KELLY and HENDERSON. *See* pp. 418–428 of this number of *J. Hygiene.*
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[1] Henderson and Kelly, second paper of this series.

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