

SPECIAL ARTICLES

EFFECT OF CALCIUM LACTATE ON CHILDREN IN A NURSERY SCHOOL

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In a previous investigation (Aykroyd and Krishnan 1937a, Krishnan 1938) we showed that skimmed milk is of great value as an addition to typical South Indian diets based on rice and millet and containing no meat or whole milk and very small quantities of vegetables. Children given skimmed milk showed increased growth and an improvement in general condition and these results were confirmed by growth experiments in rats. In a later investigation (Aykroyd and Krishnan 1937b) we found that the addition of calcium lactate enhanced the nutritive value of the "poor South Indian diet" for rats. Rats on this diet supplemented by calcium lactate showed a weekly increase of weight of 7-9 g., compared with only 2-3 g. on the diet alone.

On these findings it was suggested that "one of the most serious defects of the South Indian diet is its relative lack of calcium, and that the value of milk is due in large measure to its high calcium content. In all probability controlled experiments on children using calcium lactate instead of milk would show results resembling those obtained in our skimmed milk experiments." Dietary surveys (Aykroyd and Krishnan 1936) have shown that the calcium content of the diet of the poorer classes is usually below conventional standards; for example, the daily intake per consumption unit in a group of 29 village families was found to be 0.31 g., which is about half Sherman's standard (0.68 g.).

In the present investigation we have studied the effect of giving calcium lactate to children in a nursery school.

THE EXPERIMENT

The school chosen for the investigation was a day school in a South Indian city attended by some 130 children between the ages of 2½ and 7, not all in regular attendance. The average age was about 4½, and the majority were between 3 and 6. The proportion of boys to girls was about two to one. The children belonged to middle-class and lower middle-class families with an income in most cases exceeding forty rupees per month. It may be assumed that the diet of the children in their homes consisted largely of milled rice and that their intake of milk and vegetables was low. The state of nutrition of the children, while superior to that of children of the poorest classes, obviously left much to be desired.

The children were divided into two groups of 56, random selection being assured by assigning alternate children on the school list to either group. The sexes were equally represented in each group. Height and weight measurements were taken at the beginning of the experiment. To one group 0.5 g. of calcium lactate was then given daily in paper packets containing this amount. The children swallowed the powder, which was washed down by a drink of water,

without demur. The control group received no supplement.

The experiment continued from July 26th to Nov. 15th. During this period there were a number of short holidays, not exceeding 4 days in length, and the number of actual school days was 84. Some children left the school, or attended very irregularly during the experiment, and these had to be eliminated. When the children were weighed and measured at the end of the experiment 48 who had consumed calcium regularly were available, and 39 in the control group. The results are given in Table I.

TABLE I—ANALYSIS OF STATISTICAL CONSTANTS OBTAINED FROM INCREMENTS OF HEIGHT AND WEIGHT IN TWO GROUPS AT CONCLUSION OF EXPERIMENT

	Increment of weight (lb.).		Increment of height (in.).	
	Calcium lactate group.	Con-trols.	Calcium lactate group.	Con-trols.
Number in sample	48	39	48	39
Mean of sample.. ..	2.19	0.98	0.86	0.72
Standard deviation of sample..	1.24	1.22	0.368	0.20
Difference between two means	1.21		0.14	
Standard error of difference ..	0.26		0.06	
Difference	4.6		2.3	
Standard error of difference				
Significance	Significant.		Significant.	

Height and weight increments in the groups receiving calcium lactate were significantly greater than in the control group.

Mean heights and weights at the beginning of the experiment, with statistical constants, are given in Table II. While mean initial height and weight were

TABLE II—ANALYSIS OF THE STATISTICAL CONSTANTS OBTAINED FROM THE GROUPING OF THE INITIAL HEIGHTS AND WEIGHTS

	Weight (lb.).		Height (in.).	
	Calcium lactate group.	Con-trols.	Calcium lactate group.	Con-trols.
Number in sample	48	39	48	39
Mean of sample.. ..	33.26	33.90	40.17	40.75
Standard deviation of sample..	5.67	5.32	4.21	3.63
Difference between two means	0.64		0.58	
Standard error of difference ..	1.18		0.84	
Difference	0.54		0.69	
Standard error of difference				
Significance	Not significant.		Not significant.	

slightly greater in the control group, the differences are not statistically significant. The greater increments in the group receiving calcium lactate cannot be accounted for by a difference in initial height and weight.

REVERSAL OF GROUPS

In our previous experiments with skimmed milk we reversed the groups after a three months' experi-

mental period ; during a second period of three months which followed the first after a brief interval, the controls of the first period received milk, while those previously taking milk went without. This is not really good practice in experiments of this nature, because it is doubtful whether the children who have previously been given an efficient dietary supplement are satisfactory controls. Conceivably they may have "exhausted their growth impulse," or, conversely, the effect of the supplement may not cease immediately after it is withdrawn. Nevertheless, there is something to be said in favour of reversal. First, dietary experiments in schools are not easy to organise ; a suitable school must be found and tactful arrangements made. When the staff of a school has become used to the experimental procedure, it is relatively easy to extend an experiment in that school, whereas further laborious arrangements would be necessary to start work in another school. Secondly, the idea of reversal appeals both to the staff and the children. A selected group of children has been getting something which does them good ; others now clamour for and feel entitled to share in the benefits.

In the present instance we proceeded with a further experiment immediately after the conclusion of the first period. From November to March 28 children, all except 4 of whom belonged to the earlier control group, received calcium lactate. A group of 39 children, who had all been given calcium lactate in the first experiment, acted as control. Average height and weight increases with statistical constants in the two groups during the second period are given in Table III.

TABLE III—ANALYSIS OF THE STATISTICAL CONSTANTS OBTAINED FROM THE INCREMENTS OF HEIGHT AND WEIGHT IN THE REVERSED GROUPS

	Increment of weight (lb.).		Increment of height (in.).	
	Calcium lactate group.	Con-trols.	Calcium lactate group.	Con-trols.
Number in sample	28	39	28	39
Mean of sample	1.96	-0.33	0.95	0.71
Standard deviation of sample ..	1.25	1.34	0.25	0.286
Difference between two means	2.29		0.24	
Standard error of difference ..	0.31		0.066	
Difference	7.4		3.6	
Standard error of difference				
Significance	Significant.		Significant.	

The differences in the mean height and weight increments are statistically significant, the same criterion as before being applied. It is to be observed that the control group lost weight, whereas the same children during the previous four months had put on an average of about 2 lb. Mean initial height and weight were somewhat greater in the control than in the calcium lactate group, as might be expected since the former had grown more in the first period.

While this part of the experiment is open to criticism on the grounds stated above, it does tend to confirm the unquestionably valid results obtained in the first period.

The lady superintendent of the school and the subordinate teachers were convinced that the children were greatly benefited by calcium lactate.

We were told that they appeared brighter and more energetic, and that the health of a number of sickly and delicate children improved. When the experiment was over the giving of calcium lactate was continued by the school authorities. The enthusiasm of the teachers is worth recording in confirmation of objective evidence of improved nutrition in the shape of an increased rate of growth.

DISCUSSION

These results confirm the experiments on rats previously recorded (Aykroyd and Krishnan 1937b). The calcium content of Indian diets based on rice is usually far below Sherman's standards, and it is not surprising that extra calcium should produce nutritional improvement.

From the public health point of view these observations are of importance. In the school in which the present experiment was carried out the children were for some time given a daily drink of whole milk ; this practice proved too expensive and had to be stopped. We have recommended the use of skimmed milk in boarding-schools and elsewhere, because it is cheaper than whole milk, but in practice the provision of even the cheapest form of milk is difficult. To supply a child with 8 oz. of reconstituted skimmed milk daily costs about 12 annas per month. We have calculated that in certain poorer-class day schools in South India the cost of supplying skimmed milk would be not much less than the entire cost of education. Any money spent in supplying milk to school-children would be money well spent, but we realise that it is difficult for educational departments and municipalities to double their expenditure on schools.

Calcium lactate can therefore be recommended as a partial milk substitute when milk cannot be supplied. Probably there are other calcium salts which would be of equal or superior value ; in the Coonoor laboratories Pal and Singh (unpublished results) have shown that calcium phosphate is as effective as calcium lactate in improving the nutritive value of the poor South Indian diet for rats. A child could be supplied with 0.5 to 1.0 g. of calcium lactate daily at a cost of $\frac{1}{2}$ to 1 anna per month, and its provision would be feasible even in the poorest schools. The calcium salt could be dispensed rapidly and easily from a tin with a spoon of suitable size. A calcium supplement is naturally inferior to a milk supplement, but it is better than nothing and would help to make good one of the deficiencies in the poor rice-eater's diet. It would probably be very useful as a dietary supplement for children in Africa and many other parts of the world, for whom milk is not available, and whose staple diet is rice or some other food deficient in calcium.

Coward, Kassner, and Waller (1938) have recently produced evidence that a diet resembling that consumed by the poorer classes in Great Britain is deficient in calcium, this being demonstrated by its effect on the calcification of bone in rats. No doubt the regular administration of a calcium salt would benefit children of the poorer classes in Great Britain. Such a measure could not, however, be advocated in a country in which a deficiency in calcium can and should be remedied by increasing milk intake. The giving of a calcium salt to school-children can be recommended only when the provision of milk appears to be absolutely out of the question.

The physiological changes which take place when a child living on a calcium-deficient diet is given extra calcium are presumably of a complex nature. Many bodily functions may be adversely affected by the

continued intake of diets low in calcium. The increase in weight observed in our experiments was presumably due not only to the strengthening of the bones by deposition of calcium salts but to more efficient metabolism, one result of which might be the better utilisation of food. Thus the provision of calcium may help to correct other dietary deficiencies by allowing the organism to make more efficient use of the available supply of other food factors.

SUMMARY

Children in a nursery school in South India were given 0.5 g. of calcium lactate daily and showed greater increases in height and weight during a 4-5 month period than children not receiving the supplement. The acceleration in growth was evidence of, and was accompanied by, an improvement in general condition.

Supplements of calcium salts are recommended as a milk substitute when milk cannot be supplied. Calcium lactate could be given regularly to school-children at very low cost.

We wish to express our indebtedness to Mrs. W. H. Theobald of Mysore for her coöperation in these experiments, and to the Indian Research Fund Association, under which this investigation was carried out.

REFERENCES

- Aykroyd, W. R., and Krishnan, B. G. (1936) *Indian J. med. Res.* **24**, 667.
 — — (1937a) *Ibid.*, p. 1093.
 — — (1937b) *Ibid.*, **25**, 367.
 Coward, K. H., Kassner, E. W., and Waller, L. (1938) *Brit. med. J.* **1**, 59.
 Krishnan, B. G. (1938) *Indian J. med. Res.* **25**, 647.

MEDICINE AND THE LAW

Lord Atkin on the Coroner's Court

At the annual dinner of the Coroners' Society last week Lord Atkin made some interesting observations on the need of publicity at inquests. He had noticed with surprise, he said, that in inquiries into accidents on railways or in air navigation there was a tendency at a certain stage to announce that the remainder of the inquiry would be held in private. He did not think this was right. The public had a strong interest in ascertaining how and by whose fault these accidents occurred. Lord Atkin hoped that, when death resulted, the coroner would always conduct the whole inquiry in public and insist on the full disclosure of all facts. Possibly the public does not clearly discriminate between the coroner's inquest on these occasions and the formal investigations which the Board of Trade or Home Office may institute into fatalities occurring in boiler explosions, mine and factory disasters, and accidents due to petroleum-spirit or (under a recent extension) hydrogen cyanide fumigation. Parliament usually insists that these departmental investigations shall be held in open court, whereas the coroner has an acknowledged right to sit in private. When the Coroners (Amendment) Act was passing through the House of Commons in 1926, the Home Secretary observed that there might be cases where privacy was desirable. He cited with approval the 1910 report of the Departmental Committee on Coroners which stated that the coroner has the same right to exclude the public as is possessed by examining magistrates under Section 19 of the Indictable Offences Act, 1848. The more recent report of Lord Wright's committee (in 1936) said that the advantages of publicity far outweighed the

disadvantages, but that there should be restrictions in the case of inquests on suicides. The 1936 report cited the decision in *Garnett v. Ferrand* (1827) that for special reasons—e.g., in the interests of justice, decency, and order and to spare the feelings of the family of the deceased—the coroner is justified in excluding the public during the whole or any part of the proceedings. On the whole Lord Wright's committee thought that on this point no change in the law was required. It is perhaps worth mentioning that, in inquests on industrial fatalities, statutes like the Factories Act allow representatives of trades-unions and employers' associations to attend and to cross-examine witnesses in the coroner's court. Conceivably this may lead to an excess of publicity and a warmth of controversy which encourage the coroner to see special virtue and advantage in a private hearing.

The natural tendency of British justice is to look with suspicion upon proceedings held in camera. Not many days ago the Nottingham magistrates somewhat surprisingly excluded the public and the press while investigating a case of alleged dangerous driving. Using the powers which the 1910 report said were possessed by coroners, the magistrates heard the allegations in camera on the ground that publicity might be unfair to the accused whom they committed for trial. The Home Secretary, questioned in the House of Commons about this incident, said that the magistrates, when making a preliminary investigation of an indictable case, need not sit in open court; it would be wrong for him, as a member of the executive, to give directions to a court of justice, but he made plain his view that magistrates should not sit in private save in those exceptional cases where they were satisfied that publicity would prejudice the ends of justice. Legal opinion is against the action of the Nottingham magistrates. It would doubtless equally oppose similar action by a coroner.

Lord Atkin, it may be added, was evidently not in entire agreement with the rather impatient conclusions of the Wright committee on other aspects of the coroner's inquest. Some of the restrictions recommended, he is reported to have said, were ill-advised and unnecessary in the public interest.

"Consolidated World Research"

Under the modest title of the Consolidated World Research Society a company sells an encyclopædia and offers a special research service. Medical practitioners, like members of other professions, are canvassed by the society's representatives. Like other purchasers, they probably pay more attention to what the canvasser says than to the printed contract which is subsequently produced for their signature. What the canvasser says, however, does not matter. The company seems to be aware that he may be inconveniently laudatory in pushing its goods. A clause in the contract runs as follows: "I have entered into this contract solely upon the terms and conditions hereunder contained and irrespective of any representations made to me by any of your representatives." The canvasser may say what he likes by way of inducing a customer to sign; the company repudiates its agent's eloquence as soon as the signature is obtained. If the prospective purchaser is a medical man it would be only natural that the canvasser should tell him that the encyclopædia is of special medical value and that the research service is uniquely helpful to doctors. Medical practitioners are said to have signed the contract with the company in the belief that the encyclopædia is a medical work. It is nothing of the kind. Whatever