

letters are written in a racy literary style, effervesce with good spirits, and are stamped by a broad humanity. These extracts have been chosen with a fine discrimination, and show the writer to have been a man of varied attainments, who combined a strong sense of his duty to his fellow men with a healthy determination to get the very best out of life. By remaining anonymous D. F. has artistically contrived that all the light is shed upon the one central arresting figure of this admirable memoir. Copies (price 3s. 6d., postage 5d.) may be obtained from Messrs. Douglas and Foulis, 9, Castle Street, Edinburgh, or from Messrs. Macniven and Wallace, 138, Princes Street, Edinburgh.

INFLUENCE OF AMOUNT OF MILK CONSUMPTION ON THE RATE OF GROWTH OF SCHOOL CHILDREN.

PRELIMINARY REPORT BY

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DURING the past few years a number of tests have been carried out in America^{1 2 3} to determine the nutritive value of milk for children. More recently a test under exact conditions in a labour colony for boys, where the whole diet was controlled, was carried out by Dr. Corry Mann⁴ for the Medical Research Council. The results of all these tests, which are in general agreement, have demonstrated the high nutritive value of milk for growth.

In 1926-27 a large-scale test was carried out in schools in seven cities and towns in Scotland and in Belfast to determine whether the results obtained by Corry Mann under the rather special conditions of an institutional school would be obtained in children attending elementary schools and receiving the varied and changing diet of the ordinary working class household.

The tests were conducted under the auspices of a committee appointed by the Scottish Board of Health, with Sir Leslie Mackenzie as chairman. The committee consisted of the school medical officers for the cities and towns where the work was carried out. The collection of data was undertaken by four women medical officers. The clinical examination of the children was made by the late Dr. Cruickshank of the Scottish Board of Health and the school medical officers. A repeat test is at present being undertaken under the supervision of Dr. Gerald Leighton, Scottish Board of Health, and a full report will be issued when the new test is completed. The results obtained to date, however, so strongly confirm those of Corry Mann and previous workers, which are of such importance in public health, that it has been thought advisable to issue the present interim report.

Method.

At each centre four groups of children were taken, each numbering from forty to fifty, according to the size of the classes in the school. One group received whole milk, a second separated milk, and a third a biscuit of the same energy-yielding value as the separated milk. The fourth group, which acted as control, received no supplementary feeding. The test began at the end of November and finished at the end of June. The Belfast test did not begin till the end of January; it is, therefore, not included in the results of the seven months' experiment.

At Peterhead and Greenock the children were between 5 and 6 years of age, at Dundee and Edinburgh between 8 and 9 years, and at Aberdeen and Paisley between 13 and 14 years. Glasgow and Belfast had a series of groups of each of the three ages. There were thus under test children at the beginning, the middle, and the end of school life.

The 5- to 6-year-old children received three-quarters of a pint of milk per school day, the 8 to 9 one pint, and the 13 to 14 one and a quarter pints. The milk was given at school.

* The Chairman of the Investigation Committee is Sir Leslie Mackenzie, M.D., LL.D., of the Scottish Board of Health to whom we are indebted for the report.

Owing to unforeseen difficulties the tests in Glasgow had to be rearranged about three months after they had begun, and the whole milk group was dropped. The Glasgow data, therefore, are limited to the control, biscuit, and separated milk groups.

Weights and Heights.

It was intended to weigh the children with only one layer of underclothing. This was found to be impracticable. The children were therefore weighed in indoor clothing, without shoes, and there are considerable fluctuations in the weight figures, even those taken on successive days. The average weight of clothing was ascertained month by month and the necessary addition or deduction made in the final weight figure. Owing to these circumstances the records of individual weights are not so reliable an indication of the influence of milk as the figures showing the increase in height.

The weights were recorded to the nearest quarter-pound. The heights were recorded to the nearest quarter-inch, the children being measured without shoes. The measurements were taken on three consecutive days at the beginning and end of the test, and at intervals of about one month during its progress.

Before the results were calculated such cards were rejected as showed absence due to serious illness, about 25 per cent. of missed feeds, doubtful increases in weight or height, etc. This accounts for the decreased number of children available for the final analysis.

The average increase in height and weight has been worked out per group at each age and in each centre, giving the following results.

TABLE I.—Average Increase in Height (Inches).

	Controls.	Biscuit.	Separated Milk.	Whole Milk.
Age 5-6:				
Peterhead	1.425	1.392	1.568	1.550
Greenock	1.470	1.455	1.625	1.543
Glasgow	1.267	1.101	1.500	—
Age 8-9:				
Edinburgh	1.224	1.286	1.457	1.483
Dundee	0.972	0.931	1.209	1.105
Glasgow	1.125	1.089	1.297	—
Age 13-14:				
Aberdeen	1.395	1.263	1.602	1.622
Paisley	0.889	0.841	1.292	1.365
Glasgow	1.143	1.265	1.734	—

TABLE II.—Average Increase in Weight (lb.).

	Controls.	Biscuit.	Separated Milk.	Whole Milk.
Age 5-6:				
Peterhead	1.773	1.973	2.983	2.741
Greenock	1.595	1.200	1.969	1.994
Glasgow	2.784	2.234	2.407	—
Age 8-9:				
Edinburgh	2.132	2.972	3.238	3.330
Dundee	2.433	2.404	2.659	2.556
Glasgow	2.292	2.266	3.471	—
Age 13-14:				
Aberdeen	5.212	4.939	4.790	5.837
Paisley	3.986	3.934	5.242	4.821
Glasgow	3.855	4.869	5.959	—

The height increases when all the groups at one age, irrespective of locality, are combined, show very strikingly the influence of the milk supplement in aiding growth, and the failure of the biscuit supplement.

At every age the increase in height of the whole milk or the separated milk groups is significantly greater than that of the biscuit or control groups, while the difference in increase in height between the two milk groups is insignificant. The supplementary biscuit, on the other hand, fails to exercise any significant stimulus in the 8-year-old group, and in the 13- and 5-year-old groups has an almost significantly retarding effect.

As the milk groups (whether separated or whole) showed a distinct improvement in growth over the non-milk (that is, biscuit and control) groups, the figures of

TABLE III.—Showing the Mean Increase (in Inches) in Each Group at Each Age, with the Probable Error. Age 13.

Group I.	Group II.	Mean I.	Mean II.	M. I - M. II.	Probable Error.	Remarks.
Biscuits	Controls	1.1279	1.2175	- 0.0896	= 0.0401	Biscuits almost significantly worse.
Whole milk	Controls	1.5122	1.2175	- 0.2947	= 0.0469	Whole milk significantly better.
Separated milk	Controls	1.5524	1.2175	- 0.3349	= 0.0417	Separated milk significantly better.
Separated milk	Biscuits	1.5524	1.1279	- 0.4245	= 0.0444	Separated milk significantly better.
Whole milk	Biscuits	1.5122	1.1279	- 0.3843	= 0.0493	Whole milk significantly better.
Whole milk	Separated milk	1.5122	1.5524	- 0.0402	= 0.0507	No significant difference.

Age 8.

Biscuits	Controls	1.1160	1.1000	- 0.0160	= 0.0278	No significant difference.
Whole milk	Controls	1.3233	1.1000	- 0.2233	= 0.0318	Whole milk significantly better.
Separated milk	Controls	1.3355	1.1000	- 0.2355	= 0.0254	Separated milk significantly better.
Separated milk	Biscuits	1.3355	1.1160	- 0.2195	= 0.0281	Separated milk significantly better.
Whole milk	Biscuits	1.3233	1.1160	- 0.2073	= 0.0340	Whole milk significantly better.
Whole milk	Separated milk	1.3233	1.3355	- 0.0122	= 0.0321	No significant difference.

Age 5.

Biscuits	Controls	1.3443	1.4026	- 0.0583	= 0.0291	Biscuits almost significantly worse.
Whole milk	Controls	1.5458	1.4026	- 0.1432	= 0.0298	Whole milk significantly better.
Separated milk	Controls	1.5697	1.4026	- 0.1671	= 0.0295	Separated milk significantly better.
Separated milk	Biscuits	1.5697	1.3443	- 0.2254	= 0.0303	Separated milk significantly better.
Whole milk	Biscuits	1.5458	1.3443	- 0.2015	= 0.0305	Whole milk significantly better.
Whole milk	Separated milk	1.5458	1.5697	- 0.0239	= 0.0309	No significant difference.

the average increase at all ages were arranged into two groups, with the following results.

TABLE IV.—Average Increase (All Ages).

	Milk Groups.	Non-Milk Groups.
Average increase in height ...	1.470 in.	1.212 in.
Average increase in weight ...	3.617 lb.	2.974 lb.

This seven months' experiment thus shows an average monthly increase of 0.17 in. and 0.42 lb. in the non-milk groups, and of 0.21 in. and 0.52 lb. in the milk groups. In the much lengthier experiment by Corry Mann the corresponding figures were 0.15 in. and 0.32 lb. for all boys on the basal diet, and 0.22 in. and 0.58 lb. for all boys receiving the supplement of one pint of pasteurized milk every day; the milk group increases in height in both experiments, thus approximating very closely in spite of the Scottish children receiving the supplement only five days a week.

The children in the different groups at the various centres were examined at the end of the experiment and clinical observations made. Independent reports were also handed in by the headmasters of the schools. These clinical reports, which cannot be expressed in figures, show that at most of the centres the children who had received milk appeared to be in better condition than those receiving no milk. It was noted that, on the whole, they had glossier hair and clearer complexions, and held themselves more erect. At other centres this difference was less marked, and in Glasgow no distinct difference could be detected. The most marked improvement in the children in the milk groups was shown in children who had been in poor condition at the beginning of the test.

From the particulars gathered as to the home dietary of 626 households, it would seem that the average milk consumption in the home was 2.5 pints per head per week. The total milk consumption of the children under test in these homes was then calculated on the assumption that the average consumption per head in the household to which the child belonged was the home consumption of that child, to which was added the amount received at school. The rate of growth of children receiving more than the average of the total milk consumption (home plus school) was compared with that of children receiving less than the average.

TABLE V.—Showing the Average Rate of Increase in Height in the "Over Average" and "Under Average" Milk Consumption Groups.

	Age 5-6.	Age 8-9.	Age 13-14.
Increase in height of "over average" group	1.58 in.	1.37 in.	1.51 in.
Increase in height of "under average" group	1.44 in.	1.19 in.	1.21 in.
Percentage increase of "over average" to "under average" group	9.4	15.5	24.2

Conclusions.

From this survey of the data it seems probable that, in the final report, it will be possible to draw the following conclusions:

1. The addition of the milk to the diet of school children during the seven months' experimental period has been accompanied by a rate of growth as indicated by an increase in both height and weight 20 per cent. greater than that in children not receiving the extra milk.
2. This increase in rate of growth has been accompanied by an improvement in the general condition of many of the children receiving milk.
3. Separated milk is of great value for promoting growth. Its nutritive value for children would appear to be underestimated.

The writer wishes to record his indebtedness to Miss M. L. Clark, who has prepared the above tables, for valuable services in connexion with the supervision of the tests during their progress. Dr. Lewis D. Cruickshank, who superintended the investigation from the administrative side on behalf of the committee, died towards the end of the test period, and we can only record our profound regret that we have not had the continued advantage of his intimate knowledge of school and social conditions.

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- ¹ McCollum (1923): Proc. World's Dairy Congress, p. 421. ² Chaney (1923): Amer. Journ. Dis. Child., 26, 337. ³ Morgan, Hatfield, and Tanner (1926): Ibid., 32, 839. ⁴ Corry Mann (1926): Diets for Boys during the School Age, Medical Research Council Special Reports Series, No. 105.