pneumothorax treatment, and by no means well to conservative measures. Collapse should be produced as soon as this type is recognizable, however slight the changes and however good the patient's general condition. Recent cavities, mainly necrotic, in a toxæmic case, should be collapsed at once. According to Fowler,⁴ a mortality rate of 90 per cent. in five years in these cases is reduced by collapse therapy to 33 per cent. Here again delay reduces the chances of success. Middle and lower zone cavities are usually more collapsible than apical cavities, and are more urgently in need of collapse. Chronic cavities are not well treated by any form of collapse therapy; they may close partially, or almost completely, but rarely heal. In cases with fibrous apical cavities a pneumothorax may do more harm than good.

(5) *The Case with Haemoptysis*.—Collapse is often the best treatment for severe or recurrent bleeding from an artery exposed in a cavity, but it is essential that the cause and the site of the bleeding should have been correctly diagnosed. A large haemoptysis in a previously healthy young adult is probably of venous origin; collapse is unnecessary, for simpler measures suffice, and it introduces a grave risk of bronchopneumonia from retention of infected blood in the lung.

REFERENCES

- ¹ Ameuillé: *Bull. et Mém. Soc. Méd. de Paris*, 1924, xlviii, 791.
² Eloesser: *Amer. Rev. of Tuberculosis*, xxx, ii, 123.
³ Burrell: *Lancet*, 1933, i, 356.
⁴ Fowler: *Tubercle*, xv, 4, 178.

DIET IN RELATION TO PHYSICAL EFFICIENCY*

BY

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In regarding school and institutional diets in relation to efficiency the problem is not only one of the amount and balance of the foods consumed, but is vitally concerned with the quality of the raw material, its purchase and storage, its preparation for the table, and its proper service; further than this, the time allowed for the various meals, the number and the time spacing of these meals, and the amenities of the table must be considered, and lastly a factor that is often lost sight of, but is of equal importance, time and opportunity for proper evacuation of the waste products of digestion. That is, besides the construction of the dietary, the purchase, preparation, and ingestion of the food, and its proper absorption and disposal all require careful thought and careful control. Leaving the detailed consideration of the dietary for the moment, let me underline the commoner faults in institutional feeding. It will suffice to repeat the list I gave when writing on the subject of Public School Feeding in *Science Progress* in April, 1925.

1. The basis of diet tables is too often purely empirical.
2. Too short a time is allowed for meals.
3. Early school and chapel before breakfast are harmful.
4. Lack of variety in the daily menu.
5. Lack of proper service of meals.
6. Lack of adaptability of the diet scheme.
7. Lack of proper supervision of meals and too little regard for the amenities of the table and appurtenances.
8. Bad cooking.
9. Insufficient free time after meals, especially after breakfast and dinner.

The importance of the subsidiary factors in right feeding is, even to-day, not sufficiently recognized, and though it

* Read in the Section of Medical Sociology at the Annual Meeting of the British Medical Association, Oxford, 1936.

is right to acknowledge the increasing interest that is now being taken in many schools, both in the construction of diets and in the essentials of the dietary, these important aspects of the problem are not yet in all quarters sufficiently allowed for in practice even where they may be accepted in theory. To get the best results in education, mental or physical, you must first ensure good health, yet many people, including some school masters and more parents, would appear from their practice to regard good health as automatic, and ill-health as an unfortunate but inevitable accompaniment of school life. Children of school age, especially boarding school children, are animals in a state of physiological captivity, and like Sir Robert McCarrison's rats will pay equally the penalty for insanitary or ill-balanced conditions of either housing or food. After giving in clear and convincing detail his evidence on these points in his first Cantor Lecture, McCarrison says:

"It may, therefore, be taken as a law of life, infringement of which will surely bring its own penalties, that the greatest single factor in the acquisition and maintenance of good health is perfectly constituted food."

Provision for Growth

In addition to the demands on the individual for the maintenance of body heat, the production of energy, and the repair of waste, the child of school age has to provide for growth, and for this reason the supply of both animal protein and animal fat required for healthy growth bears a higher ratio to the carbohydrate, and possibly to the vegetable protein and fat, than is either necessary or advisable in the case of the adult. From the early stage of infancy, when the ideal diet is wholly of animal origin, through childhood and adolescence the animal protein and fat should only gradually lessen in proportion to the carbohydrate and the vegetable protein and fat increase. For the production and maintenance of optimum health this change in proportion is often brought about too suddenly. Once full growth is attained and the amount of exercise taken begins to lessen, the great majority of Western peoples probably consume considerably more animal protein than they require. There is some evidence also that the marked rise in the consumption of patent cereal foods and sugar, more especially perhaps in the young, which has become established during the past fifty years, is one of the causes of much malnutrition.

It is, I think, fair to say that since the knowledge of the importance of vitamins and mineral salts as constituents of the diet became available and began to swing the dietetic view-point from the calorie value alone to a consideration of calorie plus balance, the data so far collected from the study of family and institutional diets merely serve to show us how little we really know about the fundamentals. The problem is still too much obscured by the old view, inevitable fifty years ago, of the importance of the calorie.

Until more exact knowledge is available, in the case of the growing human we must at present retain the standards and proportions now recommended as necessary for healthy growth. Indications, however, are not wanting that given more knowledge of this question of balance, especially in the case of the mineral salts and vitamins, the ideal diet will be found to require less protein and more fat in relation to carbohydrates than is at present regarded as necessary. Further, if the child and certainly if the adult could only be educated to eat economically and with that reverence for the function of proper mastication that its importance demands, the total calorie value needed would prove to be much less than is now considered advisable for safety. To attain this, however, school authorities will have to alter their time-tables to allow sufficient time for meals,

and the public will have to be educated to the belief that commercial refinement of foodstuffs, especially of the cereals, is not a criterion of either their usefulness or their completeness as foods.

Construction of the Diet

It is generally accepted that an adult man doing light work requires on an average a total daily intake of 3,400 calories. A boy of 14 to 18 years of age requires just as much, some boys needing more and some less, according to their height, rate of growth, and range of activity. The mean age of the average public school is usually about 15 years, and will vary by some months about this mean from September to July; this variation depending upon admissions and discharges during the school year. The mean age is lowest in September and highest in July. In a school population of from 250 to 500 boys the plus or minus requirements as regards calorie values of individuals will approximately cancel out, and it will therefore be safe to allow one man-value for each boy—that is, 3,400 calories per head. Given proper supervision of meals and proper service those whose individual requirements are more than one man-value will average out with those boys whose requirements are less.

At Christ's Hospital the boys' ages vary from 9 to 19, and the mean age of the school is from twelve to fifteen months less than that of most public schools. During the last six years reasonably satisfactory results have been obtained as regards growth with a diet the average calorie value of which varies from 2,900 to 3,200 calories according to seasonal changes.

The diet should be planned to give the following proportions, which are taken from the table given in the *Report of the British Medical Association Committee on Nutrition*, page 12.

*Daily Requirements of an Adult Male of Calories,
Protein, Fat, and Carbohydrates*

Derived from	Quantity in Grams	Percentage of Total Calories	Number of Calories
First-class protein ...	50	6	205
Second-class protein ...	50	6	205
Fat ...	100	27	930
Carbohydrate ...	500	61	2,050
Totals ...	700	100	3,390

For growing children I would prefer to increase the fat by the inclusion of at least one pint of milk per day and to decrease the carbohydrate proportionally, making the reduction in sugar. The milk should be given as milk, and not in extra milk-puddings. In addition to the correct calorie value and the proportions of protein, fat, and carbohydrate in the diet being maintained, watch must continually be kept to ensure that vitamins and minerals are present in safe amounts.

Vitamins and Minerals

Vitamins A, B complex, C, and D are necessary to maintain health and growth, and an excess supply of one will not compensate for a shortage in another. The best way to guard against possible deficiency is to use as great a variety of foodstuffs as possible, and always to include milk, cheese, Australian or New Zealand butter, fresh vegetables, and fruit. In the average school diet some lack is most likely in the case of B and D.

Vitamin A is safeguarded if butter, milk, cheese, egg-yolk, and liver are included; the vitamin B complex by

the use of whole cereals, yeast, peas, beans, lentils, vegetables (both root and green), fruits, milk, cheese, egg-yolk and meat offals such as liver or kidney; D, especially liable to be short or even almost absent in winter, is ensured by the use of Australian or New Zealand butter; C, by fresh vegetables and fruits, potatoes, carrots, etc. Cod-liver or halibut-liver oil is a potent source of A and D, and can be used to help out any unavoidable shortage of these vitamins, but it is obviously better to ensure their inclusion in the diet. Probably the B group is that most likely to be short in school diets, depending as it does mainly on the inclusion of whole grain cereals. The vitamin and mineral content of whole-meal flour depends on the amount of coarse bran and middlings removed, and on the amount of white flour admixed for the purpose of producing an economic texture in the loaf. Consequently there may be much less vitamin and mineral salts present than the term "whole-meal" leads one to expect. The term whole-meal does not necessarily imply "whole grain." Of the eleven inorganic elements required for growth and the maintenance of health the more important deficiencies are likely to occur in calcium, phosphorus, iron, and iodine.

Given adequacy in all the above directions, the daily food is best divided between three meals only—breakfast, dinner, and tea. The stomach requires rest as much as any organ, and for this reason alone extra meals such as a light tea, before the high tea or supper, and the mid-morning or ante-breakfast snacks are better avoided. A five or five-and-a-half hour interval between meals is not too long, and conduces to a sharpened appetite and to the avoidance of waste.

Clinical Malnutrition

It is difficult to produce lists of cases of illness that conform strictly to textbook description or that correlate with alterations in diet or school routine as closely as will satisfy either the critical clinician or the statistician, but taking the wide view and looking at the dietetic, physical, and clinical picture shown by the twenty years' survey of the boys at Christ's Hospital it is impossible to avoid the conclusion that the provision of a more perfectly balanced diet, as soon as knowledge and opportunity allow, would go far to remedy much of the minor invalidism that at present handicaps and reduces the efficiency of the modern school child. The more striking features in this survey are:

1. The attack rate of fractures went up markedly with the substitution of vegetable margarine for butter, and returned to normal when butter was reintroduced into the diet.
2. A progressive fall in the incidence of acute and subacute rheumatism was coincident with an increase of animal fat in the diet.
3. During the war an increasing number of boys showed an inability to cope adequately with the ordinary school routine, coincidently with a physical regression.
4. Gastro-intestinal disorders of various kinds have shown a decline with improved conditions of feeding.
5. While cases of pyrexia of unknown origin have markedly decreased, catarrhal conditions and colds have increased, even if the factors of increased care, etc., be allowed for, with an increased diet.
6. Minor sepsis, boils, and whitlows since 1923 have increased almost coincidently with an increase in sugar, again even after allowing for increased care, notification of cases, etc.
7. There has been an increased frequency of complications in influenza since the diet has been increased.
8. Finally, the height and weight records show increases corresponding to improvements (or increases) in the diet, but apparently though this increase in diet has been enough to re-establish the normality of bodily growth, it is not yet enough to ensure a proper resistance to infection. I believe this to be a matter of right and wrong balance.

Conclusion

The diet at Christ's Hospital, though much improved in amount and quality, is still far from perfect. Sugar is too plentiful, fresh fruit and vegetable too scarce. Milk is now over one pint per head per day, and many of the younger boys have raw milk at tea. The bread, though reputed whole-meal, has a 20 per cent. admixture of white flour to allow of a finer texture, while the 80 or 90 per cent. flour used is itself only 82 or 92 per cent. of the whole grain. There is thus here a possibility of B complex shortage.

If the various requirements I have outlined in this paper could be adequately dealt with, and the balance of the diet be improved and corrected by means of the knowledge that is now being acquired through research, there is little doubt that both the health and the efficiency of the school child would soon present a much less disquieting picture than it has up to the present time.

RATIONALE OF FREE SCHOOL MEALS*

BY

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M.O.H.Glossop

In 1934 school meals to the number of 68,100,000 (including milk meals) were provided free to elementary school children in England and Wales. In Glossop £774 was spent to feed 642 children, and in addition 748 children paid for milk under the Milk Marketing Board's scheme at the rate of $\frac{1}{2}$ d. for one-third of a pint. Our school population is about 2,200. The fact that meals are provided is an admission of deficiencies in the home diet, and also that these deficiencies are likely to cause defects or disease. It will be useful to consider if there is any evidence that deficiencies in the home diets are responsible for any defect or disease, including poor physique, stunted growth, bodily deformity, lack of strength and endurance, or, to use one word to include all these conditions, malnutrition.

In Glossop I made graphs of the W/H ratio of school boys and girls, comparing the children in the very distressed area of Hadfield (between 40 and 50 per cent. unemployed) with the rest of the borough (about 20 per cent. unemployed); I also made graphs of the children of employed and unemployed persons, comparing in all cases these graphs with one compiled from the Board of Education Anthropometric Review of 1927. It will be seen that, generally speaking, the children in the distressed area have a lower graph than the others, and that the children of the unemployed have a lower graph than children of the employed or the Board of Education standard.

In Glossop 13 per cent. were referred for treatment among the Hadfield (distressed area) children compared with 7 per cent. of the other Glossop children, and 15 per cent. were referred for observation from the distressed area as compared with 8.6 from the other area. In carrying out functional strength and endurance tests I found that children of unemployed parents had less strength and endurance than children of employed parents; but I am glad to say that by school feeding things have been improved.

There can be no doubt that disease can be, and is, in a certain manner related to deficiencies in diet (cf. McCarrison, Cantor Lectures, 1936). This is of course admitted by the fact that the feeding of elementary school children to maintain their adequate nutrition is now a duty of the local education authority. The problem before us, then, is to see how the children attending

our elementary schools can be maintained in health by the giving of school meals. To solve that problem two things must be known: (1) What is an adequate dietary to maintain health? (2) How far short of this standard is the home dietary of the children?

First as regards standards:

British Medical Association Standard

	First-class Protein	Total Protein	Fat	Carbo-hydrate	Calories
	grams	grams	grams	grams	
Per unit man-value per day	50	100	100	500	3,400

Diet in Poor Law Children's Homes (Ministry of Health, 1932)

	First-class Protein	Total Protein	Fat	Carbo-hydrate	Calories
	grams	grams	grams	grams	
Per child	42	76	108	349	2,749
Per unit man-value as per M'Gonigle and Kirby	53	101	144	465	3,663

The League of Nations Technical Commission drew up a table (Table I, giving details of the diet recommended for children from 3 to 5 years with 1,400 calories), and pointed out that the amounts of protective foods in this table would be adequate for children of 10 to 15 years with, of course, more energy-producing food to give adequate calories. I give this table and also another (Table II) in which I have adapted it to a school child

TABLE I.—Age 3-5 (1,400 Calories, Daily Quantities)

Food	Amount	Calories	Protein
	grams		grams
A. Protective foods:			
Milk	1,000	660	32
Egg	48	70	6
Meat, fish, or liver	30	40	6
Green leafy vegetables	100	30	3
Potato	150	150	3
Cod-liver oil	3	30	—
A source of vitamin C (raw vegetable or fruit)			
		980	50
B. Supplementary energy-yielding foods:			
Fats (butter if possible)	7	55	—
Cereals (as bread)	125	400	17
Totals		1,435	67

TABLE II.—Age 9½ (adapted from above table)

	Daily Quantities	Calories	Protein (grams)	Cost per week
				s. d.
Milk	1.65 pints	660	32	2 11
Egg	1 (1½ oz.)	70	6	7
Meat, fish, or liver	1½ oz.	50	6.7	9
Green vegetables	3½ oz.	30	3	5
Cod-liver oil	1½ drachms	60	—	1
Potato	12 oz.	340	7	5½
Fat (butter if possible)	1 oz.	220	—	7
Raw vegetable or fruit (as orange)	4 oz.	60	0.8	7
Cereals (as bread)	5 oz.	450	20	4½
Treacle	½ oz.	76	—	1
Totals		2,016	75.5	6 10

* Read in opening a discussion in the Section of Medical Sociology at the Annual Meeting of the British Medical Association, Oxford, 1936.