Original Articles.

THE NUTRITION OF ANEMIC AND TUBERCULOUS CHILDREN.*

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PECULIAR importance attaches itself to our knowledge of the nutritive needs of children in the case of those affected with tuberculosis in early years, for at this period, even more than in adults, nutrition of the individual is of paramount importance. In the case of tuberculous and anemic children we have to deal not alone with an impoverished condition but must also furnish material for a growing organism. Moreover the nutritive needs vary to a far greater degree than in adult life in accordance with many factors. The first essential then is the selection of a diet appropriate to the age and dis-

* Read by title at the Fourth International Congress on School Hygiene, held in Buffalo, August 25-30, 1913.

eased condition. In order to exercise precise control over the diet in such cases it is obviously necessary to have a very definite idea of the requirements of the normal child.

NORMAL REQUIREMENTS IN CHILDHOOD.

Unfortunately there is no accepted dietary standard for this period either with respect to the total twenty-four hour needs, or the proportion of individual constituents. Medical literature contains surprisingly few reports of exact investigations in this field and practical experience has given extremely variable results.

Among the available figures giving the total food values and grams of the several nutrients according to the age period Camerer's (Camerer: *Der Stoffwechsel des Kindes*, Tübingen, 1894, s. 60) classical table is probably the most reliable, as it is based on most careful observations made on his own children for a long period. It is arranged to show the total grams of each type of food in twenty-four hours according to age periods.

TABLE I.

AGES.	GIRLS.					
	2-4	5-7	8-10	11-14	15-18	21-24
Average weight in kilos	12.7	16.6	22.3	31.9	41.0	44.5
Total grams food	1183	1402	1638	1723	1612	1990
Grams protein	46	50	60	68	60	67
Grams fat	39	30	30	44	35	71
Grams carbohydrate	117	182	221	270	219	242
Grams water	957	1120	1315	1322	1273	1586

AGES.	BOYS.				
	5-6	7-10	11-14	15-16	17-18
Average weight in kilos	18.0	24.0	34.0	52.8	59.4
Total grams food	1517	1699	1909	2314	2378
Grams protein	64	67	86	102	100
Grams fat	46	32	34	73	83
Grams carbohydrate	197	251	262	287	302
Grams water	1200	1333	1510	1810	1850

Observations by Hasse (Sophie Hasse: *Untersuchungen über die Ernährung von Kindern im Alter von 2 bis 11 Jahren, Zeitschr. f. Biologie, B. 18, 1882, s. 553*) show:—

TABLE II.

AGES.	Protein. Grams.	Fat. Grams.	Carbohydrate. Grams.	Total. Calories.
2 years 6 mos.— 3 years 5 mos.	56.45	46.13	134.44	1211.7
3 years 6 mos.— 4 years 5 mos.	50.76	37.52	204.96	1397.4
4 years 9 mos.— 5 years 6 mos.	64.64	58.61	171.88	1514.8
8 years 9 mos.— 9 years 4 mos.	81.77	86.07	218.82	2037.9
10 years 6 mos.— 11 years 3 mos.	87.75	108.72	255.96	2420.3

Uffelman (Uffelman: quoted by Hasse, *loc. cit.*) combined his own figures with those of Camerer and gives the following as normal requirements:

TABLE III.

AGES.	Protein. Grams.	Fat. Grams.	Carbohydrate. Grams.	Total. Calories.
1 year 6 mos.	42.5	35.0	100.0	909.8
2 years	45.5	36.0	110.0	972.4
3 years	50.0	38.0	120.0	1050.4
4 years	53.0	41.5	135.0	1156.8
5 years	56.0	43.0	145.0	1224.0
8-9 years	60.0	44.0	150.0	1270.2
12-13 years	72.0	47.0	245.0	1736.8
14-15 years	79.0	48.0	270.0	1877.8

Herbst (Herbst: Beiträge zur Kenntniss normaler Nahrungs mengebei Kindern, *Jahrb. f. Kinderheilkund.*, N. F. 46, 1898, s. 245) pub-

lishes the following averages as the results of a study of six children between the ages of two and fourteen years.

TABLE IV.

AGES. Boys.	Body. Weight in Kilograms.	Protein. Grams.	Fat. Grams.	Carbohydrates. Grams.	Total. Grams.
2 years 3½ mos.	150.0	54.4	62.2	134.2	1352
4 years 4 mos.	15.5	58.1	58.1	133.8	1347
9 years 10 mos.	27.5	62.2	68.7	227.0	1860
Girls.					
10 years 9 mos.	43.15	61.4	70.4	250.9	1973
12 years 6½ mos.	47.5	69.3	85.8	211.8	1951
14 years 6 mos.	49.87	70.7	71.4	225.5	1878

Steffin (Steffin: Ueber Ernährung in kindlichen Alter jenseits der Säuglingsperiode, *Jahrb. f. Kinderheilkunde*, N. F. 46, 1898, s. 332) gives a child of from four to seven years a diet containing an average of 95.49 grams protein, 92.55 grams fat and 197.99 grams carbohydrate, representing a total of 2061 calories.

Baginsky's (Baginsky: *Lehrbuch der Kinderkrankheiten*, 1902, s. 53) figures for afebrile children between the ages four and nine are 102.81 grams protein, 75.59 grams fat, and 363.46 grams carbohydrates or 2615 calories; for those from nine to fourteen, 122.43 grams protein, 88.45 grams fat, and 451.74 grams carbohydrates, or 3176.68 calories.

The averages given in the above tables on the whole show fairly constant and uniform results, that is, a gradually increasing number of calories as well as grams of protein, carbohydrate and fat, proportional to the age. Individual cases, however, present striking deviations from the average. All authorities agree that these variations are largely due to the difference in body weight, and it has been conclusively shown that the physiological requirements vary according to the body weight and not necessarily in accordance with the age. Children of different ages, but of the same body weight require approximately the same quantity of nutriment, while children of the same age but of varying size necessitate different standards. Figures then for the nutritive needs according to age are of value only when taken in relation to the body weight. Values are usually expressed as so many grams or calories per kilogram of body weight at different ages.

For convenience in comparison I have combined in a single table such averages obtained by some of the best observers on children of nearly uniform ages:

TABLE V.

Author	AGES.	Protein Grams per Kilo.	Fats. Grams per Kilo.	Carbo- hydrate Grams per Kilo.	Calories.
Camerer	1½ to 2¼ yrs.	4.4	4.0	8.9	91.7
	3 to 4 yrs.	3.4	3.1	7.7	74.3
	5 to 5½ yrs.	3.5	2.5	11.0	82.7
	8½ to 9¼ yrs.	2.7	2.1	9.2	68.3
	10½ to 11¼ yrs.	2.9	2.0	11.5	77.6
Hasse	2¼ yrs.	3.9	2.8	15.5	105.6
	2½ to 3¼ yrs.	3.6	2.9	8.5	76.6
	3½ yrs.	2.9	2.2	11.8	80.7
	4¾ to 5½ yrs.	3.8	3.5	10.2	90.0
	8¾ to 9 1-3 yrs.	2.6	2.8	7.0	65.4
Herbst	10½ to 11¼ yrs.	2.2	2.7	6.5	60.8
	2¼ yrs.	3.6	4.2	9.0	90.7
	4 1-3 yrs.	3.8	3.8	9.0	87.8
	9¾ yrs.	2.3	2.5	8.3	66.7
	10¾ yrs.	1.4	1.6	5.8	44.4
Steffen	12½ yrs.	1.5	1.8	4.5	41.3
	14½ yrs.	1.4	1.4	4.5	37.2
	1 yr.	6.6	6.0	5.9	107.1
	2 yrs.	5.6	5.5	6.5	100.8
	3 yrs.	5.6	5.3	8.8	108.3
Uffelman	4 to 7 yrs.	5.3	5.1	11.0	114.3
	2¼ yrs.	4.1	3.0	8.8	80.8
	4¼ yrs.	3.6	2.9	8.9	78.2
	10½ yrs.	2.6	1.8	8.2	61.0
	14¾ yrs.	2.0	1.2	7.1	48.5

A comparison of table 5 with tables 1 to 4 demonstrates at once the fallacy of expressing the nutritive needs according to age without reference to the weight. Whereas the absolute number of calories as well as the quantity of protein, fats and carbohydrates increase rapidly from the younger to the older, as shown in tables 1 to 4, reference to table 5 shows a nearly constant relative decrease in all. This relative decrease in each case will be discussed in detail later.

In attempting to establish a dietary standard, whether for the child or the adult, it should always be emphasized particularly that we can only determine rather wide limits between which there is a considerable margin of safety. This applies to the total fuel value of the diet as

well as to the relative amounts of the various kinds of food. Individual factors, such as the amount of body activity, state of nutrition, demands for heat, sex, age, and others, necessitate a wide latitude in the choice of an appropriate diet for the individual. Experience proves that especially in children there is a high degree of adaptability on the part of the organism to variations in the quantity and kind of food. Our concern is largely by the application of the standard diets or averages, as it were, to make sure that the individual is not under nourished, and on the other hand, that a burden is not put on the organism by a diet of too high value or one improperly balanced as to the proportion of the several constituents. More care is often necessary in the selection of a diet in disease than in health.

With the exception of Steffin, all the authors quoted in table 5 present figures for the calories per kilogram of body weight, which decrease steadily from infancy on. This is in accordance with the law of Rubner, that animal metabolism is directly proportional to the size of the body surface. In other words, the calorie needs expressed in accordance with the unit of weight is proportional to the body surface. Smaller children have a surface area which in proportion to the weight is greater than that of larger ones. Rubner proved that increased requirements in those with relatively large surface area is due to the increased loss of heat on the surface. His results are based on the results of careful metabolism experiments on two boys of approximately the same age and height, but one thin and the other fat. Because of the relatively greater body surface the thin boy required 52 calories per kilo, the fat boy only 43.6 calories to maintain normal nutrition. The apparent deviations from Rubner's law sometimes seen are due to conditions of general nutrition, amount of work and so forth, which independently influence the needs for nutriment.

No absolute standard of calories per kilo for the different ages can be established, but probably the combined averages for approximately the same ages given in table 5 are a safe general standard.

Age.	Calories per Kilo.
2 years	94
4 years	82
8 years	67
10 years	61
14 years	43

The question of the percentages of protein, fats and carbohydrates constituting a normal diet for the child, according to age and weight, is much more difficult to settle than the total calories, and is unquestionably subject to far greater variations which may be considered within normal limits. Equally good results may be observed in the dietary of children from the use of widely different combinations of the three types of nutrients. Such variations as are shown in table 5 may be partially explained by the dif-

ference in the places where the observations were made, the social condition of the families studied and the general development of the children.

Nearly all authors find that the ratio of animal to vegetable food decreases from the younger to older children (see table 5), that is, with the development of the child, the diet becomes richer in vegetable food and poorer in total protein. Camerer's ratio of 1:2.2 for younger children is generally accepted.

Since the functioning body tissues are nitrogenous, it is obvious that during the period of growth the protein foods are the most essential, because the protein of the food must not only repair tissue waste, as in adults, but in addition, answer the demands for tissue growth also. Protein is of both animal and vegetable origin and can be supplied to the body from either source, though in childhood not with good results if derived solely or largely from the latter. Meat contains roughly 15 to 25 per cent. protein, fish 17 to 20 per cent., milk 3.3 per cent., eggs 13 per cent., cheese 20 to 30 per cent., bread of various kinds from 5 to 10 per cent., crackers 9 to 12 per cent., beans 7 to 22 per cent., peas and lentils 25 per cent., nuts 6 to 30 per cent., and chocolate 13 per cent.

Under ordinary conditions at least one-half of the protein of the child's diet, and in adults one-third, should be of animal origin. It is doubtful if it will ever be possible to determine exactly the amount of protein necessary to the growing child. If an amount of fats and carbohydrates necessary to meet all the needs for heat and energy is supplied, the growing organism can maintain nitrogen equilibrium on a surprisingly small amount of nitrogenous food. The protein is, however, very readily oxidized in the young (estimated as 90-92 per cent. absorbed) and probably a considerable per cent. of the energy developed should be from this source. On the other hand an excessive quantity of protein food not only may upset the digestion but puts an unreasonable tax on metabolism, especially as a result of the increased work of excretion of the end products of nitrogen metabolism. The figures for protein of Steffin (table 5) are probably too large.

In children of the school age the protein furnished by milk, meat and eggs is to a considerable degree supplemented by vegetable protein. Sommerfeld (Pfannndler and Schlossmann: *The Diseases of Children*, 1908, Vol. I, p. 427) has compiled the following table, giving in percentages the sources from which protein should be derived at different ages:

TABLE VI.				
FROM.	2-4 Yrs.	5-7 Yrs.	8-10 Yrs.	11-14
Milk, per cent.	42	28	18	9
Meat and eggs, per cent.	36	39	42	45
Vegetables and leguminous plants, per cent.	22	33	40	46

The various standards differ widely in the amount of fat given. In general, fats are well

metabolized by children (unless excessive, 92 to 94% being absorbed) and the relative amount to a considerable extent seems to be a matter of indifference. Table 5 shows for all authorities a constantly diminishing number of grams per kilo with increasing years, although the amounts vary within rather wide limits. Fats are less essential to the diet than either of the other food constituents and may be largely or even entirely replaced by an isodynamic amount of carbohydrate (100 grams fat equal 232 grams starch or 234 grams cane sugar) or vice versa. Fat is more essential, however, when the diet is deficient in protein (Rubner) and when a considerable amount of fat is given the protein need is materially lessened.

The ability of the individual to metabolize fats is subject to greater variations than in the case of protein and carbohydrates. This is especially true of children and many can digest and absorb but a small amount. Fortunately the degree to which the fats are digested can readily be determined by examination of the stools. Those forms easiest of digestion are the fluid or those with a low melting point, and the forms best adapted to children from five to fifteen years are butter, milk fat, cheese, meat fat and olive oil.

Few evils as a rule attend even extreme reduction of the fats and they may be classed together as moderate disturbances of general nutrition. The commonest ill effects of an excessive quantity of fats are various disturbances of the gastro-intestinal tract. These more usually occur in delicate individuals or those debilitated by disease, especially in children when, in an effort to improve nutrition, the fats are largely increased.

As a rule then, the fats may be given healthy children in accordance with very flexible standards depending on circumstances, usually not under one or two grams, and seldom over four per kilo. It should always be kept in mind that a gram of fat has more than twice the heat value of either protein or carbohydrates when metabolized, and therefore fat is of immense value when it is desired to increase the total calories.

Tables 1 to 4 all show an almost constant increase in the total grams of carbohydrates with succeeding ages and with few exceptions proportionately greater than in the case of the protein and fats. Table 5 likewise, as in the case of the other two nutrients, shows on the whole a relative decrease, though more irregular and less marked. In the early years (table 5) one-quarter to one-third of the total calories are furnished by the carbohydrates, while in the oldest children at least one-half are derived from this source. The carbohydrates are then a most important element in the diet of children, but like the fats are subject to great variations. They may to a very large extent be replaced by fats and protein, but if reduced too low there is always grave danger of acid intoxication with its attendant serious results. In children it is

usually safe to regard 50 to 80 grams per diem as the minimum carbohydrate requirement. Much less commonly in children than in adults are evil effects observed as a result of a too great increase in the proportion of carbohydrate foods, but if they are present they take the form of gastric disturbances due to the great amount of cellulose ingested or to acid fermentation. For the ages under discussion the best forms are the various kinds of bread, crackers, well cooked cereals, rice, macaroni, thoroughly cooked vegetables and selected fruits.

REQUIREMENTS OF ANEMIC AND TUBERCULOUS CHILDREN.

I shall consider these two conditions as one in discussing the diet indicated since the condition in each is in many respects essentially identical. The tuberculous children usually suffer from more or less anemia and the anemic are frequently tuberculous, though not recognized as such; in both the most important condition is one of impoverished health.

The difficulties in defining strict standards of diet for the normal child, mentioned above, become much greater when the attempt is made to lay down rules governing the nutrition of the sick child. We have to consider in such a task not only the physiologic standard, but also the individual factors and the nature of the disease. The tuberculous child is on the whole less active than the well child, and in so far metabolizes somewhat less food in the form of energy, but other factors combine to far outweigh this slight decrease. The tuberculous child, because of the greater or lesser degree of emaciation, has a surface area proportionately greater than the well nourished, and thus at a given age requires a relatively larger diet. He has more tissue to build besides providing resistance to an exhausting disease. If treated properly he is living in the open air both night and day, and during the winter months especially, thus increasing the expenditure of energy in the form of heat. To further complicate the last, we have to deal in many cases with definite gastro-intestinal disorders or general lowered vitality which limit the powers of digestion and absorption.

In the afebrile, ambulatory cases, who are under a regime of open air treatment, a judicious selection of the food with supervision in eating, makes it possible without serious difficulty to give a very satisfactory diet.

So great is the variation in weight and development in this class that the age is of hardly any significance in many instances, and in my own work I have arranged the diets almost entirely with respect to size. The body weight of the tuberculous child of ten years is frequently the same as that of a well child of six.

A very important guide in regulating the diet is the weight curve, which should follow a steady upward course. In favorable cases the curve shows a much more rapid rise than in

TABLE VII.

Age	Sex.	Body Weight in Kilograms.		Total.	per Kilo.	Calories.	Grams. Protein per Kilo.	Grams. Carbohydrate per Kilo.	Grams. Fat per Kilo.	Average.
		Average.				Average. per Kilo.				
7	M.	19.1		2933	153.5		5.5	19.0	5.7	
7	F.	19.6	21.0	2888	147.3	Average. 140.0	5.2	18.4	5.4	5.1
7	F.	20.9		2830	135.4		4.9	17.4	4.7	
7	M.	24.5		3039	124.0		4.7	14.9	4.7	
8	M.	19.1		2962	155.1		5.8	18.9	5.8	
8	F.	23.6	24.5	2921	123.7	125.9	4.4	15.6	4.5	4.6
8	F.	26.4		3212	121.6		5.0	14.6	4.4	
8	F.	29.1		3007	103.3		3.6	12.8	3.9	
9	F.	25.0		3080	123.2		4.2	15.6	4.5	
9	F.	23.6	26.6	2870	121.6	113.5	4.2	15.4	4.4	4.1
9	F.	29.1		3066	105.3		3.7	13.6	3.7	
9	F.	28.6		2976	104.1		3.9	12.6	3.9	
10	F.	23.2		3132	135.0		4.6	17.8	4.7	
10	M.	27.3		3441	126.0		4.5	15.6	4.7	
10	F.	24.1		2934	121.7		5.0	15.0	4.3	
10	F.	27.7	27.5	3291	119.1	118.1	4.7	15.0	4.1	4.2
10	M.	29.6		3487	117.8		4.0	15.4	4.1	
10	F.	28.6		3058	106.9		4.2	13.1	3.9	
10	F.	31.8		3190	100.3		3.6	12.6	3.6	
11	F.	18.6		3086	165.9		6.3	20.6	6.0	
11	F.	26.4	27.5	2919	110.5	118.5	4.0	13.7	4.1	4.2
11	M.	31.8		3193	100.3		3.6	13.0	3.5	
11	M.	33.2		3230	97.2		3.7	11.8	3.4	
12	F.	17.3		2698	156.0		5.7	19.1	5.7	
12	F.	28.6	31.4	2982	104.2	105.1	3.6	13.7	3.5	3.8
12	F.	38.2		3238	84.6		3.0	10.3	3.0	
12	F.	41.4		3126	75.5		2.6	9.2	2.9	
13	M.	28.6		3874	135.4		4.5	17.3	4.9	
13	F.	24.1		3107	128.9		4.6	16.7	4.4	
13	M.	30.9	33.8	3295	106.6	105.3	4.0	12.6	4.1	3.7
13	F.	36.8		3511	95.4		3.3	12.3	3.4	
13	F.	40.0		3450	86.2		3.1	11.1	3.0	
13	F.	42.3		3355	79.3		2.9	10.3	2.6	
14	F.	40.0	40.0	2983	74.5	74.5	2.6	9.3	2.7	2.7
15	M.	55.5	55.5	3263	58.8	58.8	2.1	7.3	2.2	2.2

health, gains of from one to even three pounds in one week sometimes being observed.

Any gastro-intestinal symptoms should always be carefully looked for as they are apt to be the earliest signs indicating over-feeding. Whenever possible the stools should be examined as a routine at regular intervals, for in this procedure we have a very reliable and exact means of measuring how completely the system is utilizing the diet prescribed.

The experience on which the diet given below is based was gained at the Boston Hospital School at Franklin Park (Locke: A Report of Dietary Studies Made at the Franklin Park Hospital School for Tuberculous Children. Proceedings of the Sixth Congress of the American School Hygiene Association, 1912.) The general physical condition of the children was under the constant observation of a trained nurse and the diets under the strict supervision of an expert dietitian. Careful attention was given to every detail regarding the diet and in all cases figures are based on actual weighings of the individual dietaries. Although close attention was given to providing an adequate diet, in every

case the amount eaten was left almost entirely to the appetite of the child, no forced feeding in any sense being undertaken.

The children were to a considerable extent divided into groups to facilitate the study of the effects of various types of diet on the weight and general nutrition. The most exhaustive observations were made on a group of children daily for five months (October to February), thirty-five in all completing the full time with a record of regular attendance. These results have been selected as most fairly representing the average type of diet used in the Hospital School. The children in this group ranged from seven to fifteen years in age and comprised twenty-five girls and ten boys. All were definitely tuberculous but afebrile.

An especial effort was made to furnish food such as can be provided in the homes of the poor and at the lowest possible cost. The dietary was made up chiefly of milk, cocoa, sugar, selected sweets, syrups, dried fruits, bread, crackers, cereals, dried beans, rice, macaroni, spaghetti, simple nutritious puddings, butter, nutritious soups, fish (with simple sauces, chowders, etc.),

meats (mainly the most inexpensive kinds), vegetables and fruits (usually cooked).

A sample day is:

BREAKFAST.

Cocoa, 2 cups.
Bread, 3 slices (3 x 4 x ½ inch.).
Butter, 2 balls.
Stewed prunes, 3 with juice.

DINNER.

Creamed codfish, 3 heaping tablespoonsful.
Mashed potatoes, 2 heaping tablespoonsful.
Milk, 1 glass.
Banana, 1 average size.
Bread, 1½ slices.

SUPPER.

Milk, 2 glasses.
Graham crackers, 5 crackers.
Cream cheese, 1 cubic inch.

This represents roughly 100 grams protein, 100 grams fats, 266 grams carbohydrates, or a total of 2400 calories.

The average results in the group of thirty-five cases mentioned, arranged according to age, is given in Table VIII.

The table at first glance indicates a rather constant decrease in the total number of calo-

ries and calories per kilo of body weight, but closer examination shows many exceptions and on the whole a considerable variation. The grams of protein, fats and carbohydrates fall almost equally with the increasing ages.

Table VIII, in which the same results are grouped according to the body weight in kilograms presents a much more regular picture and emphasizes the importance of the principle laid down earlier in this paper, namely, that the diet of the child should be chosen with reference to the body weight rather than to the age. The average number of calories per kilo of body weight fall with extraordinary regularity from 155.5 for the child of seventeen to nineteen kilos, to 58.8 at 55.5 kilos. These figures are so much larger than those for the normal child that they appear to need justification. In the first place a diet of this strength was found necessary to bring about the desired improvement in general nutrition and increase in body weight, and the children ate only as much as their appetites prompted. Furthermore, it must be remembered that the group was made up of tuberculous children, suffering from marked general debility in most instances, many much under weight, and all were living constantly in the open air with

TABLE VIII.

Body Weight in Kilograms.	Age.	Average.	Sex.	Calories per Kilo.	Average.	Grams. Protein. Per Kilo.	Average.	Grams. Carbohydrate. per Kilo.	Average.	Grams. Fat per Kilo.	Average.
17.3	12		F.	156.0		5.7		19.1		5.7	
18.6	11		F.	165.9		6.3	5.7	20.6		6.0	
19.1	17-19	8	M.	155.1	155.5	5.8		18.9	19.2	5.8	5.7
19.1		7	M.	153.5		5.5		19.0		5.7	
19.6		7	F.	147.3		5.2		18.4		5.4	
20.9	7		F.	135.4		4.9		17.4		4.7	
23.2	10		F.	135.0		4.6		17.8		4.7	
23.6	8		F.	123.7		4.4		15.6		4.5	
23.6	20-24	9	F.	121.6	127.2	4.2	4.6	15.4	16.1	4.4	4.5
24.1	10		F.	121.7		5.0		15.0		4.3	
24.1	13		F.	128.9		4.6		16.7		4.4	
24.5	7		M.	124.0		4.7		14.9		4.7	
25.0	9		F.	123.2		4.2		15.6		4.5	
26.4	11		F.	110.5		4.0		13.7		4.1	
26.4	8		F.	121.6		5.0		14.6		4.4	
27.3	10		M.	126.0		4.5		15.6		4.7	
27.7	10		F.	119.1		4.7	4.2	15.0	14.4	4.1	4.1
28.6	25-29	13	M.	135.4	114.8	4.5		17.3		4.9	
28.6	10		F.	106.9		4.2		13.1		3.9	
28.6	9		F.	104.1		3.9		12.6		3.9	
28.6	12		F.	104.2		3.6		13.7		3.5	
29.1	9		F.	105.3		3.7		13.6		3.7	
29.1	8		F.	103.3		3.6		12.8		3.9	
29.6	10		M.	117.8		4.0		15.4		4.1	
30.9	13		M.	106.6		4.0		12.6		4.1	
31.8	30-34	10	F.	100.3	101.1	3.6	3.7	12.6	12.5	3.6	3.7
31.8	11		M.	100.3		3.6		13.0		3.5	
33.2	11		M.	97.2		3.7		11.8		3.4	
36.8	35-39	13	F.	95.4	90.0	3.3	3.2	12.3	11.5	3.4	3.2
38.2	12		F.	84.6		3.0		10.8		3.0	
40.0	13		F.	86.2		3.1		11.1		3.0	
40.0	40-44	14	F.	74.5	78.9	2.6	2.8	9.3	9.9	2.7	2.8
41.4	12		F.	75.5		2.6		9.2		2.9	
42.3	13		F.	79.3		2.9		10.3		2.6	
55.5	55.5	15	M.	58.8	58.8	2.1	2.1	7.3	7.3	2.2	2.2

several periods daily of active exercise. We saw no reason to consider the diet too large. There were no gastro-intestinal or other symptoms suggesting over-feeding. Neither did we see any ill effects from the rather high protein content of the diet. The ratio of the nitrogenous to the non-nitrogenous food was almost the same in all groups, ranging from a minimum of 1:4.37 in the first to a maximum of 1:4.59 in the fifth. This high ratio for the ages five to fifteen was found to give better results than a diet with a lower one.

The grams of carbohydrate per kilo of body weight, especially for the younger children, although considerably above the figures usually given, diminish in about the same uniform manner. Exactly the same may be said of the fats.

To many the diet prescribed at the Hospital School will seem of unreasonably high value, but our experience with the class of cases treated was very definitely that such a maximum gave the most satisfactory results.

It would easily be possible to discuss many variations of the diet given above and adapted to special conditions, but in this brief paper it does not seem necessary to do more than to lay down general principles of feeding, leaving the choice of the particular type and caloric value to be determined in accordance with the needs of the individual case.

CARCINOMA OF THE RECTUM.*

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THE advance made in the treatment of cancer of the rectum, seems unusually slow, when compared with the treatment of cancer in other regions of the body. This is no doubt due to the difficulties of operative procedures in this region, and to the fact that cases are seen so late in the course of the disease.

In malignant disease, the generally accepted rule is to remove the growth by as wide a margin as possible, and all lymphatics that can be removed. We no longer remove the wedge-shaped piece of lip for epithelioma, but dissect the glands from the neck as well. We not only remove the breast, but dissect the axilla; yet in carcinoma of the rectum, we are told that the disease is only slightly malignant, therefore it is useless to remove the mesentery.

Mr. Edwards¹, before the Royal Medical Society in January, 1911 said, "My chief object is to enter a protest against the performance of an unnecessarily severe operation with a heavy mortality, in cases attended with but little risk to life, and which moreover entail no crippling of the patient." He further says, "I cannot

agree with those who advocate the abdomino-perineal method, any more than with those who for a small and limited carcinoma of the breast, would remove all but the ribs."

Mr. F. T. Paul² of Liverpool, in the *British Medical Journal* for July 27, 1912 said: "Why should we undertake an extensive excision of the mesentery for the removal of glands which in all probability are not infected."

Mr. Edwards says that "so far as he knows" 50% of his 81 cases operated upon are alive, and Mr. Paul says, that of 28 cases operated upon in private practice in ten years, 8, or 28% are alive three years or more after operation. The statements of these gentlemen, as of many others, are very consoling, but their reasoning and statistics are rather difficult to understand, when carefully prepared statistics from many sources and from large clinics, making an aggregate of several hundred cases, show that the average percentage alive after three years, is 16%. Even this percentage gives a false impression, as it is a well recognized fact that only from 25 to 50% of the cases which present themselves to the surgeon are operated upon. In other words, from 4% to 8% of the cases which present themselves to the surgeon, are alive three years after operation. This seems scarcely worth while when it is a well recognized fact that nearly that many patients live for three years without operation.

We are not going to discuss with these gentlemen the question as to whether the abdomino-perineal method is worth while or not, but we do say that in the face of these statistics, it is absurd to speak of carcinoma of the rectum as a condition "which is attended with but little risk to life, and which moreover entails no crippling of the patient." Nor can we see the point of the statement recently made by a prominent New York surgeon, when he said very complaisantly, that he had come to look upon adenocarcinoma of the rectum, as a very benign disease.

Peterson and Colmers³ have shown that a very large percentage of the cases of simple adenocarcinoma live at least three years after operation, even though they have a recurrence. Granted that they do, why should that deter us from attempting to save these patients who are condemned to die, in from one to three years, and with no hope of executive clemency?

The surgeon is the only one at present, who can do anything for these patients, and it is therefore our duty to make some effort in their behalf. We must recognize, to be sure, that in these conditions we shall probably not prolong life very much if we do not cure the patient, unless there is hemorrhage or obstruction.

When we consider the question of comfort of the patient, we must remember that the operation is not comparable to the removal of the breast for carcinoma, for that usually gives the patient from one to three years of comfort, even if it does recur.

* Read before the combined meetings of the Suffolk District Medical Society, and the Boston Medical Library, March 19, 1913.