THE AFTER-HISTORY OF PREMATURE INFANTS

WITH SPECIAL REFERENCE TO THE EFFECT OF THE BIRTH WEIGHT ON THE WEIGHT CHART

BY

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The literature contains numerous studies of the weight of children from infancy onwards, and of the factors, social and environmental, which may affect that weight. One highly important factor, however, which seems to affect the weight throughout childhood, appears to have been omitted from these studies, and that is the weight at birth.

Hess (1934) in an extensive and careful study of the development of prematurely-born children (which he defines as weighing five and a half pounds or less at birth, irrespective of the duration of gestation) compares the weight of prematurely-born children at various age periods with that of their full-term siblings, and comes to the conclusion that the former consistently weigh less than the latter until the age of four, after which they conform fairly closely to the weight curves of the full-term brothers. He also showed that those babies in the series which are very small at birth gain weight relatively less rapidly than larger babies in the series of the same sex. He also states that the curve for increase in height in the premature series lags behind the curve of the full-term siblings in the same way as the weight curve. How far the present figures agree with these results will be seen in the tables to follow.

Present study

Records have been kept of a hundred and fifty-two consecutive children above the age of one year who at birth weighed five and a half pounds or less, irrespective of the duration of gestation, and the record compared with that of a control series of a hundred and fifty-two consecutive children above the age of one year who at birth weighed eight and a half pounds or more. The children had a wide variety of ailments and irrespective of ailment, with four exceptions to be mentioned, all were included in the two series: all were attending the Out-Patient Department of the Hospital for Sick Children at Great Ormond Street for medical conditions.

For convenience the series of children which at birth weighed five and a half pounds or less will henceforward be termed the 'premature series,' and the series of those which weighed eight and a half pounds or over at birth will be termed the 'control series.'

Four cases were excluded from the series on account of the fact that they were suffering from conditions which might be expected to have a gross effect on the weight chart : two of those were in the premature series, two in the control series. The following are the details of the cases :

PREMATURE SERIES

1. 1 case of congenital pulmonary stenosis ; aged six years five months ; birth weight three pounds ; sixteen pounds underweight ; mental defect.
2. 1 case of gross obesity in a girl aged eleven years six months. Birth weight two-and-a-half pounds ; thirty-eight pounds overweight ; precocious menstruation.

CONTROL SERIES

1. 1 case of congenital morbus cordis in a girl aged five years eight months. Birth weight ten pounds ; nine pounds underweight.
2. Case of congenital morbus cordis in boy aged six years one month. Birth weight eight-and-a-half pounds ; $1\frac{1}{2}$ pounds overweight.

It is emphasized that apart from these four cases the cases were taken consecutively regardless of diagnosis.

The weights were taken with the children naked, or with a vest only : one reading only was used for the study, and that was the reading taken at the first attendance in the case of new patients, or in the case of patients who had attended previously before seeing the writer, the reading taken on the first attendance at which he saw the patient.

A source of error lies in the fact that it was necessary and inevitable that the mother's word should be taken with regard to the birth weight, period of gestation, presence of toxaemia during the pregnancy, and the incidence of infectious fevers. Any case in which the parents were doubtful about the birth weight was discarded from the series. It is unlikely that in a series of 150 cases with controls the error arising in this way would be an appreciable one.

Presentation of results

The study is in no way an attempt to give the average weight of children of varying birth weights : it is a comparison only, and by comparison it is intended to show that the weight at birth has a considerable effect on the weight in later childhood. All figures of weights therefore are given in terms of the number of pounds more or less than the normal for the age and sex, using Holt's figures for the normal. The figures are based on those figures of Holt's which are appropriate to the sex of the children studied, and hence it is possible

on the graph (fig. 1) to give one line of normality for a study which includes children of both sexes. In other words, supposing that there are ten children of the same age, of which six are female all six pounds below the normal for the age, as judged by Holt's figures for female children at that age, and four are males, all two pounds underweight, as judged from the figures for male children, the figure on the graph for variation from normal would be $\frac{4 \times 4}{10} = 4.44$ pounds, below normal, which is represented as a single point on the graph.

It will be noted from table 1 that there is a difference in the age distribution of the two series. In the premature series the largest number of cases falls into the first three age groups one to two, two to three, three to four, giving a total

FIG. 1. Graph showing mean variation from normal (using Holt's figures) of children of both sexes, from the age of 1 to 12 which (1) weighed $8\frac{1}{2}$ lb. or more at birth, (2) weighed $5\frac{1}{2}$ lb. or under at birth.

— children which weighed $8\frac{1}{2}$ lb. or more at birth.
 - - - children which weighed $5\frac{1}{2}$ lb. or less at birth.
 normal weight for appropriate age and sex.

of sixty-two cases, whereas in the control series there are only thirty-five cases in these age groups: in the control group the largest number falls into the age period of five to eight, with a total of sixty-four cases, as compared with a total of thirty-nine in the same group of the premature series. The significance of this difference is not easy to understand, but may lie in a greater delicacy of the prematurely born child in the earlier years of childhood. A study of incidence of infectious fevers in the two series, however, does not support this idea. Certain other records of the two series of cases were kept, and these are included in the tables.

TABLE 1
EFFECT OF BIRTH WEIGHT ON WEIGHT LATER IN CHILDHOOD
TABLE 1A. VARIATION FROM NORMAL WEIGHT OF CHILDREN WHICH AT BIRTH WEIGHED LESS THAN 5½ LB.

AGE	NUMBER OF CASES	WEIGHT NORMAL OR 0-5 LB. ABOVE NORMAL	5-10 LB. ABOVE NORMAL	10-20 LB. ABOVE NORMAL	MORE THAN 20 LB. ABOVE NORMAL	WEIGHT SUB-NORMAL 0-5 LB. BELOW NORMAL	5-10 LB. BELOW NORMAL	10-20 LB. BELOW NORMAL	MORE THAN 20 LB. BELOW NORMAL
1-2	17	2	0	0	0	12	3	0	0
2-3	21	4	0	0	0	12	2	3	0
3-4	24	7	0	0	0	9	7	1	0
4-5	12	1	0	0	0	4	3	4	0
5-6	17	0	0	0	0	3	11	3	0
6-7	16	2	0	0	0	4	6	4	0
7-8	6	0	1	0	0	2	2	0	1
8-9	13	1	0	0	0	3	2	6	1
9-10	9	2	0	0	0	2	4	1	0
10-11	6	1	0	0	0	2	1	2	0
11-12	9	0	0	0	0	0	3	4	2
TOTAL	150	20	1	0	0	53	44	28	4

TABLE 1B. VARIATION FROM NORMAL WEIGHT OF CHILDREN WHICH AT BIRTH WEIGHED MORE THAN 8½ LB.

AGE	NUMBER OF CASES	7	10	20	63	10	6	31	18	2	0
1-2	9	7	1	1	0	0	0	1	0	0	0
2-3	13	10	1	2	0	0	0	2	0	0	0
3-4	13	7	2	4	0	0	0	4	0	0	0
4-5	11	5	4	0	0	0	0	1	0	0	0
5-6	22	10	1	1	1	1	3	5	0	0	0
6-7	23	8	2	2	0	0	8	3	2	0	0
7-8	18	4	4	4	1	1	3	4	0	0	0
8-9	16	6	1	1	0	0	3	5	0	0	0
9-10	6	1	1	1	0	0	2	1	0	0	0
10-11	12	4	2	2	2	2	2	1	0	0	0
11-12	7	1	1	1	1	1	0	2	1	0	0
TOTAL	150	63	20	10	6	31	18	2	0		

1. The effect of birth weight on the weight in later childhood

Fig. 1 shows at a glance that the prematurely born child, that is the child weighing five and a half pounds or less at birth, weighs on the average far less throughout childhood than the child weighing eight and a half pounds or more at birth. Irregularities in the curve are inevitable in a small series and are readily understood when reference is made to table 1, based on a table from which the graph was prepared. It will be seen that the reason for the fact that the curve for the control group at one point drops below normal is due chiefly to the fact that in the age group of 8-9 there happen to be five children weighing from five to ten pounds below normal—a higher figure than in any other age group of the series. These irregularities would disappear in a larger series.

Table 2 is a summary of table 1.

TABLE 2
EFFECT OF BIRTH WEIGHT ON SUBSEQUENT WEIGHT

IN THE PREMATURE SERIES				CONTROL SERIES (OVER 8½ LB. AT BIRTH)		
Normal or overweight	21	14 per cent.		99	66	per cent.
Underweight	129	86 per cent.		51	34	per cent.
More than 5 lb. overweight	1	0.66 per cent.		36	24	per cent.
„ „ 5 lb. underweight	76	50.66 per cent.		20	13.3	per cent.
„ „ 10 lb. underweight	32	21.33 per cent.		2	1.33	per cent.

The points to note are that eighty-six per cent. of all premature children in the series of a hundred and fifty cases are underweight at the various ages seen : that only one child in this series falls into the five pounds or more overweight group—and this child was actually five pounds above the normal for the age : and the most important point of all is to note how many grossly underweight children there are in the premature series—21.33 per cent. being more than ten pounds underweight compared with 1.33 per cent. in the control group. These children are in actual fact dwarfed, and prematurity can be seen to be a very common cause of dwarfism.

It is regretted that the heights of the children were not taken regularly. Owing to paucity of records of heights it is not proposed to present the figures— which only cover 35 per cent. of the children studied : but it can be stated that the heights of the children in the premature series were considerably less than the heights of those in the control group—and this tallies with the more careful study of Hess (1934) on the subject.

Table 3 is merely a further explanation of the graph and shows the mean difference in the weight of the premature baby in later childhood compared with that of the child which at birth weighed eight and a half pounds or over.

When it is seen that in a series of three hundred cases the mean difference in weight between the two groups varies from 4.2 to 17.1 pounds, it will be realized that if these figures are confirmed by subsequent workers, all weight charts which attempt to give a range of normality for children are of no use at all as a comparison for any individual case unless they take into account the weight of the children at birth.

An analysis of the smaller variations of birth weight within the two series was made to decide whether with the limited numbers available it could be demonstrated that the smaller variations in birth weight also showed a demonstrable difference in the weight in later childhood. The figures are presented for what they are worth, but the series is too small to be of any real value in this connexion.

TABLE 3

EFFECT OF BIRTH WEIGHT ON SUBSEQUENT WEIGHT

MEAN DIFFERENCE IN WEIGHT BETWEEN CHILDREN IN THE PREMATURE SERIES AND THE CONTROL SERIES AT THE VARIOUS AGE PERIODS

AGE (YEARS)	MEAN DIFFERENCE (POUNDS)	TOTAL CASES ON WHICH FIGURES ARE BASED
1-2	4.9	26
2-3	5.2	34
3-4	4.2	37
4-5	9.4	23
5-6	9.2	39
6-7	7.1	39
7-8	9.2	24
8-9	8.8	29
9-10	7.0	15
10-11	13.0	18
11-12	17.1	16
		300

Tables 4 and 5 give the analysis of the relevant figures in the premature series, and table 6 the relevant figures in the control series.

TABLE 4

EFFECT OF BIRTH WEIGHT ON SUBSEQUENT WEIGHT

BIRTH WEIGHT OF CHILDREN IN THE PREMATURE SERIES WHICH WERE MORE THAN 10 LB. UNDERWEIGHT

TOTAL 32 CASES. Birth weight 4-5½ lb. 26 cases 81.2 per cent.
Less than 4 lb. 6 cases 18.8 per cent.

Compare with 21 cases in the premature series now of normal weight or above normal weight :

Birth weight 4-5½ lb. 17 cases 80.9 per cent.
Less than 4 lb. 4 cases 19.1 per cent.

THE AFTER-HISTORY OF PREMATURE INFANTS 127

TABLE 5

EFFECT OF BIRTH WEIGHT ON SUBSEQUENT WEIGHT

STUDY OF THE PRESENT WEIGHT OF THOSE WHICH WERE UNDER 4 LB. AT BIRTH, COMPARED WITH THOSE WHICH WEIGHED OVER 4 LB. AT BIRTH. (PREMATURE SERIES ONLY)

Total cases weighing 4-5½ lb. at birth	312 cases
Total cases weighing under 4 lb. at birth	27 cases
Of those weighing under 4 lb. at birth (27 cases)	
Now normal weight or above normal	4 14.9 per cent.
0-5 lb. underweight	7 25.9 per cent.
5-10 lb. underweight	12 44.4 per cent.
More than 10 lb. underweight	4 14.8 per cent.
Those weighing over 4-5½ lb. at birth (123 cases)	
Now normal or above normal	17 13.8 per cent.
0-5 lb. underweight	46 37.3 per cent.
5-10 lb. underweight	32 26.0 per cent.
More than 10 lb. underweight	28 22.9 per cent.

One might point out that of those weighing under four pounds at birth 59.2 per cent. are five or more pounds underweight later : of those weighing four to five and a half pounds at birth 48.9 per cent. are five or more pounds underweight when examined. The lowest birth weight was one pound eight ounces.

TABLE 6

EFFECT OF BIRTH WEIGHT ON SUBSEQUENT WEIGHT

WEIGHT OF BABIES OVER 10 LB. AT BIRTH COMPARED WITH WEIGHT OF THOSE WEIGHING 8½-10 LB. AT BIRTH

OVER 10 LB. AT BIRTH (24 CASES)				OTHERS (126). BIRTH WEIGHT 8½-10 LB.	
More than 10 lb. underweight	0			2	1.6 per cent.
5-10 lb. underweight	4	16.7 per cent.		14	11.1 per cent.
0-5 lb. underweight	5	20.8 per cent.		26	20.7 per cent.
Normal or up to 5 lb. overweight ..	10	41.6 per cent.		53	42.1 per cent.
5-10 lb. overweight	1	4.2 per cent.		19	15.1 per cent.
10-20 lb. overweight	4	16.7 per cent.		6	4.7 per cent.
20 lb. overweight	0			6	4.7 per cent.

2. Effect of breast feeding on subsequent weight

Tables 7-10 show the effect of breast feeding in infancy on the weight in later childhood.

TABLE 7

EFFECT OF BREAST FEEDING ON WEIGHT (I)

Of those children which are more than 10 lb. underweight (32 cases) in the premature series :

Breast fed less than 2 months	16	50 per cent.
2-6 months	10	31.2 per cent.
6-9 months	6	18.8 per cent.

Total prematures not breast fed for 2 months, 60.

Compare with 21 cases in the premature series which are of normal weight or over :

Breast fed less than 2 months	9	42.8 per cent.
2-6 months	7	33.3 per cent.
6-9 months	5	23.9 per cent.

TABLE 8

EFFECT OF BREAST FEEDING ON WEIGHT (II)

PRESENT WEIGHT OF CHILDREN IN PREMATURE SERIES NOT BREAST FED FOR 2 MONTHS.
(TOTAL 60)

More than 20 lb. underweight	2	3.33 per cent.
10-20 lb. underweight	14	23.33 per cent.
5-10 lb. underweight	15	25.00 per cent.
0-5 lb. underweight	20	33.33 per cent.
Normal or up to 5 lb. over	9	15.00 per cent.
More than 5 lb. over	0	

PRESENT WEIGHT OF CHILDREN IN PREMATURE SERIES BREAST FED FOR 6 MONTHS OR MORE
(TOTAL 52)

More than 20 lb. underweight	2	3.8 per cent.
10-20 lb. underweight	6	11.6 per cent.
5-10 lb. underweight	16	30.8 per cent.
0-5 lb. underweight	22	42.3 per cent.
Normal or up to 5 lb. over	5	9.6 per cent.
5-10 lb. over	1	1.9 per cent.
More than 10 lb. over	0	

TABLE 9

EFFECT OF BREAST FEEDING ON WEIGHT (III)

DURATION OF BREAST FEEDING IN THOSE OF THE CONTROL SERIES WHICH ARE UNDERWEIGHT
(TOTAL 49)

(No mention of duration of breast feeding made in two cases in the series now underweight)

Not breast fed for 2 months	17	34.7 per cent.
2-6 months	12	24.5 per cent.
6 months or over	20	40.8 per cent.

THE AFTER-HISTORY OF PREMATURE INFANTS 129

TABLE 9—continued

EFFECT OF BREAST FEEDING ON WEIGHT (III)

DURATION OF BREAST FEEDING IN THE CONTROLS NOW OF NORMAL WEIGHT (TOTAL 99)

Breast fed less than 2 months	27	27.28 per cent.
2-6 months	11	11.11 per cent.
6 months or more	61	61.61 per cent.

TABLE 10

EFFECT OF BREAST FEEDING ON WEIGHT (IV)

WEIGHTS OF THOSE IN THE CONTROL SERIES NOT BREAST FED FOR 2 MONTHS COMPARED
WITH THOSE FED 6 MONTHS OR MORE ON THE BREAST

44 controls not breast fed for 2 months

5-10 lb. underweight	7	15.91 per cent.
0-5 lb. underweight	9	20.45 per cent.
Normal or overweight	28	63.64 per cent.

80 controls breast fed for 6 months or more

5-20 lb. underweight	9	11.2 per cent.
0-5 lb. underweight	12	15.0 per cent.
Normal or overweight	59	73.8 per cent.

The numbers when divided into groups are small, but table 7 seems to indicate that breast feeding in infancy has some effect on the weight in later childhood and table 10 tends to confirm it. It will be seen that 25.66 per cent. of those infants in the premature series not breast-fed for two months are more than ten pounds under weight, and that only 15.4 per cent. of those fed on the breast for longer than six months are more than ten pounds underweight. It must be remembered that this difference may be due in part to variations in the birth weight, because a very small baby at birth is less likely to be breast-fed than a baby larger at birth. Tables 9 and 10, which are based on a similar analysis of the control group, confirm the suggestion that breast feeding in infancy has some effect on the ultimate weight of the child.

3. Incidence of infectious diseases in two series

Table 11 was compiled to determine if it was true, as it is often stated, that the premature child is more delicate and more liable to infection in later childhood than the child of normal weight at birth. It might be expected that this would be the case, as it would be reasonable to suppose that the small underweight child would have less resistance than the larger overweight child. For this purpose the incidence of infectious fevers in two age groups is given, the first two to four years and the second nine to twelve years. It will be seen that there is no difference between the two groups. This is in accordance with the finding of Hess in his series.

TABLE 11

INCIDENCE OF INFECTIOUS DISEASES IN PREMATURE SERIES COMPARED WITH THAT IN CONTROL SERIES

Two age groups used : 2-4 years and 9-12 years.

PREMATURES			CONTROLS		
Age 2-4 31 cases with record			20 cases with record		
Number who had had no fever ..	13	(41.9 per cent.)	Number who had had no fever ..	8	(40 per cent.)
who had had	Measles	8	who had had	Measles	4
	Chicken pox	3		Chicken pox	2
	Scarlet fever	2		Scarlet fever	0
	Diphtheria	1		Diphtheria	0
	Whooping cough	6		Whooping cough	6
	Mumps	1		Mumps	2
	Rubella	4		Rubella	1
Age 9-12 20 cases with record			22 cases with record		
Number who had not had any fever ..	0		Number who had not had any fever ..	0	
who had had	Measles	19	who had had	Measles	19
	Chicken pox	10		Chicken pox	14
	Scarlet fever	5		Scarlet fever	2
	Diphtheria	5		Diphtheria	3
	Whooping cough	11		Whooping cough	14
	Mumps	10		Mumps	10
	Rubella	1		Rubella	5

4. Sex incidence in the two groups

TABLE 12

SEX INCIDENCE IN PREMATURE AND CONTROL SERIES

PREMATURES			CONTROLS		
Males	79	52.6 per cent.	Males	107	71.3 per cent.
Females	71	47.4 per cent.	Females	43	28.7 per cent.

Cases 10 lb. or more underweight

PREMATURES			CONTROLS		
Males	15	46.9 per cent.	Males	2	
Females	17	53.1 per cent.	Females	0	

Cases 10 lb. or more overweight

PREMATURES			CONTROLS		
Males	0		Males	5	
Females	0		Females	11	

THE AFTER-HISTORY OF PREMATURE INFANTS 131

The difference in the sex incidence of the two groups is difficult to understand. It is to be noted that in the premature series fewer males are more than ten pounds underweight than females, while in the control group more females are more than ten pounds overweight than males. This again is one of the points which only a much larger series could make clear.

5. Incidence of epilepsy and gross cerebral defect in the two series

The following is an analysis of the incidence of the above conditions in the two series :

TABLE 13
INCIDENCE OF SPASTICITY, MENTAL DEFICIENCY, CONVULSIONS AND
ATHETOSIS IN THE TWO SERIES

PREMATURES	CONTROLS
Spastic diplegia 12 (8 per cent.)	1, not forceps delivery No maternal toxæmia
Spasticity alone 7	
With gross mental deficiency 3	1
With fits 1	
With athetosis 1	
Total 12	Total 1.
Gross mental deficiency 14 (9.33 per cent.)	2, one breech delivery. No maternal toxæmia
Mongol 1	
With fits 2	
With spasticity 3	
Others 8	
Total 14	Total 2, as above.
Convulsions 9 (6 per cent.) (Other than neonatal)	7, all non-instrumental deliveries. No maternal toxæmia
True epilepsy 5	6
Fits with mental defect 1	1
Salaams 2	
Fits with spasticity 1	
Total 9	Total 7
Athetosis 2	0
Alone 1	
With spasticity 1	
Total 2	
Total cases with spasticity,	
Mental defects, fits or athetosis 30 (20 per cent.)	10 6.66 per cent.
Above cases excluding epilepsy and salaams without mental defect 24	4

Only cases of gross mental defect were included in the above series. Any case in which the mental defect was not gross, or in which, for instance, the child was merely backward at school and to an observer in the out-patient department appeared to be normal, was not included in the series.

A further analysis of the relation of birth weight to the above conditions is given in table 14.

TABLE 14

RELATION OF BIRTH WEIGHT TO ABOVE CONDITIONS

OF 27 CASES UNDER 4 LB. AT BIRTH :

- 3 are spastic alone,
- 2 are spastic and mentally defective
- 4 are grossly mentally defective without spasticity,
- 1 is spastic and has athetosis,
- 1 has athetosis alone.

Total : 11 with severe cerebral damage (40·7 per cent.). None has fits.

OF 123 CASES WEIGHING 4-5½ LB. AT BIRTH :

- 13 cases (10·5 per cent.) have the above conditions of severe cerebral damage or agenesis.

To put it in another way, of twenty-eight cases of severe cerebral damage or agenesis in the combined series of three hundred cases (excluding epilepsy) :

- 16 (57·1 per cent.) are more than 1 month premature.
- 11 (39·2 per cent.) weighed under 4 lb. at birth.
- 13 (46·4 per cent.) weighed 4-5½ lb. at birth.
- 4 (14·4 per cent.) weighed over 8½ lb. at birth.

In one case only was there a history of maternal toxæmia (taken as renal trouble apart from pyelitis associated with oedema of the legs) : the one case in which there was such a history had spasticity with mental deficiency. Maternal toxæmia was noted in a total of twenty-six cases in the combined series of three hundred.

Table 15 is a study of the weight of children with spastic diplegia in the two series.

TABLE 15

WEIGHT OF THE 13 CASES OF SPASTIC DIPLEGIA IN COMBINED SERIES

- Normal or overweight 2
- Less than 5 lb. underweight 3
- 5-10 lb. underweight 7
- More than 10 lb. underweight 1

6. Incidence of asthma and eczema in the two series

It was noted on looking through the diagnoses of the cases in the two series that there were many cases of asthma in the control group and few in the premature group. On counting these up it was found that of thirty cases of asthma in the combined series of three hundred cases, twenty-seven or ninety per cent. were in the control group, there being only three cases in the premature series.

In order to follow this point up an analysis was made of the birth weight of a hundred and fifty consecutive cases of asthma and fifty consecutive cases of infantile eczema seen at the hospital in the last two years, and for comparison the birth weight of two hundred consecutive children attending the out-patient department for complaints other than asthma and eczema was recorded. The results are shown in table 16.

TABLE 16

BIRTH WEIGHT OF 200 ALLERGIC CASES COMPARED WITH THAT OF 200 CONTROLS

BIRTH WEIGHT	ASTHMA (150 CASES)		ECZEMA (50 CASES)		TOTAL ALLERGY (200 CASES)		CONTROLS (200 CASES)	
Under 5 lb.	6	4 per cent.	1	2 per cent.	7	3.5 per cent.	19	9.5 per cent.
5½–7 lb. ..	21	14 per cent.	9	18 per cent.	30	15 per cent.	72	36 per cent.
7–8 lb. ..	55	36.7 per cent.	13	26 per cent.	68	34 per cent.	69	34.5 per cent.
Over 8 lb. ..	68	45.3 per cent.	27	54 per cent.	95	47.5 per cent.	40	20 per cent.

The table shows at a glance that the heavy baby at birth is very much more liable to be allergic than the small baby. The reason for this at the moment does not appear clear.

Discussion

The figures given in this communication suggest that the weight of the pre-school and the school-child is greatly influenced by the birth weight, and the effect of the birth weight on subsequent weight is so great that every weight chart which attempts to give a range of normality for children should take this factor into account. It seems reasonable to suggest that those who study the weight and height of children should go even further back than the birth weight to the factors which affect the weight at birth—factors racial, hereditary, environmental and pathological in the mother, possibly to pathological conditions of the foetus.

Several authors have suggested that there is a relationship between the mother's state of nutrition in pregnancy and the weight of the new-born infant.

Sison and Calang (1931), working among Filipino women, demonstrated the connexion between financial status, the nutritional condition of the mother and the weight of the child at birth : the average birth weight of the child born of the well nourished mother was more than 300 grammes greater than that of the child born of the ill-nourished woman. E. V. Davis (1928) in America is so convinced of the effect of the diet of the mother in pregnancy on the ultimate weight of the child at birth that she prescribes a special diet as an obstetrical measure to keep down the size of the foetus and so make delivery easy. Letournier as far back as 1897 showed that mothers with heavy occupations bore children which weighed considerably less than those born to mothers who had light occupations. Matthews Duncan (1866) showed the effect of the age of the mother on the birth weight of the foetus, and Ingerslev (1876) demonstrated the difference in the birth weight of foetuses born from multiparous and primiparous women.

Many other factors have been stated to influence the birth weight, and if the birth weight has as great an influence on the weight in subsequent childhood as the figures in this communication suggest, it will be seen that quite remote factors may have a considerable ultimate effect on the weight and height of children. One possibility, however, must be mentioned. The failure of the premature baby to gain weight in infancy and in later childhood may be due to inadequate feeding in the early weeks of life. The premature babies studied by Hess (1934) in America apparently caught up to their full term siblings in weight and height after four years, and it is possible that this is due to the special care which the children received in Hess's clinic from the earliest days onward. The children whose weights were used for the present study had had no such special care : it is true that a number had been attending Maternity and Child Welfare Centres and School Clinics, but it is certain that a minority of the children in the series received in infancy the care given to children in the American series.

Summary

The after-history of a hundred and fifty children who weighed five and a half pounds or less at birth is compared with that of a hundred and fifty children who weighed eight and a half pounds or more at birth. The children were taken consecutively irrespective of diagnosis. It is found that :

1. 86 per cent. of the premature series at the various ages of childhood are underweight, using Holt's figures as a standard, whereas only 34 per cent. of the control series are underweight.
2. 21·33 per cent. of the premature series are more than ten pounds underweight, compared with 1·33 per cent. in the control group.
3. 0·66 per cent. of the premature series are five pounds overweight and none more than five pounds overweight. 24 per cent. of the control series are more than five pounds above the average weight for the age.
4. The mean difference between the weight of the two groups at the various ages varies from 4·2 pounds to 17·1 pounds, with a tendency to increase as age increases.
5. Prematurity at birth is presented as a common cause of dwarfism in children.
6. The duration of breast feeding appeared to have some effect on the ultimate weight of the child, those breast fed more than six months appearing to weigh more later than those breast fed for less than two months.
7. There was no difference in the incidence of infectious diseases in the two groups.
8. The sex incidence in the two groups is discussed.
9. The high incidence of spasticity and other cerebral defects in the premature group is discussed and analysed.
10. The fact that the premature or small baby is less likely to be an allergic subject than the baby large at birth is shown by figures given. 54 per cent. of children with infantile eczema weighed more than eight pounds at birth compared with 20 per cent. of a control series of children attending the out-patient department for other complaints.
11. It is suggested that the weight of the pre-school and the school child may well depend on factors quite remote—the financial status of the mother, the diet she takes in pregnancy, the occupation of the mother, hereditary factors and pathological conditions of the mother.

The paper is based on a small series of cases but it is hoped that others who have access to a large series of figures such as Maternity and Child Welfare Officers and School Medical Officers will supplement these results in order to show whether or not they are applicable in general.

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