BIRTH WEIGHT AND SUBSEQUENT WEIGHT

BY

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The relation of the weight at birth to subsequent growth of weight and height in children of school age has been shown elsewhere (Illingworth and co-workers, 1949). It was demonstrated that the birth weight has a constant and very important relationship to subsequent weight and a less marked relationship to height at all ages studied (4-13 years). Throughout childhood the average child who was a small baby at birth weighs considerably less than the average child who at birth was a large baby, weighing $8\frac{1}{2}$ lb. (3.85 kg.) or more. Attention was drawn to the absence of reference in the literature to this relationship.

Present Study

This paper is a study of the same relationship in children attending the child welfare clinics in the city of Sheffield. The investigation covers all children born between 1941 and 1945 attending the child welfare clinics whose birth weight we could satisfactorily determine and who fell into the following birth-weight groups:

- Group A .. 5 lb. 8 oz. (2.5 kg.) or less.
 " B .. 7 lb. 2 oz. to 7 lb. 6 oz. (3.23-3.35 kg.).
 " C .. 8 lb. 8 oz. to 9 lb. 7 oz. (3.85-4.28 kg.).
 " D .. 9 lb. 8 oz. (4.31 kg.) or more.

There were 276 children in Group A, 275 in Group B, 601 in Group C, and 191 in Group D. The sex distribution was approximately equal. The birth weights of children born on district were obtained from the midwives' antenatal charts, and of those born in hospital from the infant welfare charts. The birth weight on the latter charts is obtained from a note brought by the mother from the hospital to the child welfare clinic. The weights given subsequently are those recorded by the child welfare staff. It is possible that there are certain small errors in these figures, owing, for instance, to inaccuracy of scales, but these errors would apply equally to the four groups studied.

Results

Table I shows the mean weight at various ages of children who belonged to the four birth-weight groups. Some of the records showed the weight at more than one age. All the figures have been utilized for working out the means given. The gaps in the tables are due to an insufficiency of records of the weight of children at certain ages. The maximum error in the age recorded is one month. For example, a child recorded as being 3 years of age would be within one month of his third birthday, but no more. It will be seen that with a very occasional exception, which is explained by the smallness of numbers, there is a constant gradation of weight in relation to weight at birth. The average male child at the age of 1 who weighed $9\frac{1}{2}$ lb. (4.31 kg.) or more at birth (Group D) weighed more (24 lb. 7 oz.—11.08 kg.) than the Group A child at 2 (24 lb. 3 oz.—10.97 kg.), and more at 2 (29 lb. 1 oz.—13.18 kg.) than the Group A child at 2 (28 lb. 9 oz.—12.96 kg.). The average female child in Group D weighed more at 2 (29 lb. 9 oz.—13.41 kg.) than the Group A child at 3 (28 lb. 1 oz.—12.73 kg.).

It is interesting to note that 19 (37.3%) of the male children in Group A weighed less than 20 lb. (9.07 kg.) at

TABLE I.—*Relation of Birth Weight to Subsequent Weight. Mean Weight at Various Ages. (The figures in parentheses indicate the number of children in each group)*

	Group A	Group B	Group C	Group D
Boys	lb. oz.	lb. oz.	lb. oz.	lb. oz.
Birth ..	4 14 [2.21 kg.]	7 4 [3.29 kg.]	8 13 [4 kg.]	9 15 [4.51 kg.]
1 year ..	20 12 (51) [9.41 kg.]	22 5 (36) [10.12 kg.]	24 3 (104) [10.97 kg.]	24 7 (44) [11.08 kg.]
1½ years	22 6 (18) [10.15 kg.]	26 2 (23) [11.85 kg.]	25 15 (46) [11.76 kg.]	27 2 (22) [12.3 kg.]
2 "	24 3 (26) [10.97 kg.]	26 8 (26) [12.02 kg.]	28 15 (63) [13.12 kg.]	29 1 (22) [13.12 kg.]
2½ "	28 0 (10) [12.7 kg.]	—	30 14 (15) [14 kg.]	30 11 (10) [13.92 kg.]
3 "	28 9 (10) [12.96 kg.]	—	—	33 10 (18)* [15.25 kg.]
Girls				
Birth ..	5 0 [2.27 kg.]	7 4 [3.29 kg.]	8 13 [4 kg.]	9 14 [4.48 kg.]
1 year ..	19 11 (59) [8.93 kg.]	21 13 (48) [9.89 kg.]	22 8 (73) [10.21 kg.]	23 3 (23) [10.52 kg.]
1½ years	21 15 (23) [9.95 kg.]	24 13 (15) [11.25 kg.]	24 10 (31) [11.17 kg.]	25 4 (9) [11.45 kg.]
2 "	24 12 (31) [11.23 kg.]	27 0 (28) [12.25 kg.]	26 15 (64) [12.22 kg.]	29 9 (19) [13.41 kg.]
3 "	28 1 (15) [12.73 kg.]	—	—	32 8 (20)* [14.74 kg.]

* Groups C and D are combined owing to smallness of numbers.

the age of 1 year, compared with two children (1.3%) in Group C and D combined. Of the female children in Group A 43.6% weighed less than 20 lb. at the age of 1 year, while none of the 23 female children in Group D weighed less than 20 lb. at that age.

Table II shows the range of variation in these children. The table is divided into two parts. The first part concerns children at the age of 1, 1 year 3 months, 1 year 6 months,

TABLE II.—*Range of Variation of Weight at the Ages of 1-3 in Relation to the Birth Weight*

Group	No. of Children	Percentage				
		20% or More Above the Average Weight	10% or More Above the Average Weight	Less than 10% Above or Below the Average Weight	10% or More Below the Average Weight	20% or More Below the Average Weight
Age 1 to 1 1/2 years						
A	202	4	7.9	71.3	14.4	2.5
B	189	13.7	19.6	61.4	4.2	1.1
C	393	23.7	26.9	48.8	0.5	0
D	133	36.8	31.6	31.6	0	0
Age 2 to 3 years						
A	118	1.7	2.5	72.1	12.7	11.0
B	110	3.6	1.8	90	3.6	0.9
C	200	4	17	75.5	3	0.5
D	72	6.9	16.7	75	1.4	0

and 1 year 9 months: the second part concerns children at the age of 2, 2 years 3 months, 2 years 6 months, 2 years 9 months, and 3 years. Where a child attended the clinic more than once, and his weight was therefore recorded at more than one age, only the first of his weight records was used for the table. The "normal" weights used were those given by Paterson (1947). The figures were worked out separately for the two sexes and combined for the purpose of the table. They are shown graphically in the Chart. It will be seen that in the age group 1 to 1 year 9 months 34 (16.8%) of 202 children in Group A were 10% or more below the average weight, as compared with 2 (0.4%) of 526 children in Groups C and D. In Group A 24 (11.9%) children were 10% or more above the average weight, as compared with 199 (50.6%) in Group C and 91 (68.4%) in Group D. Put in another way, of the 46 children in the four birth-weight groups studied who were 10% or more below the average weight 73.9% were children from Group A, and only 4.4% from Group C and D combined. Yet the children in Group A constituted only 22% of the total number.

Chart showing relation of birth weight to weight at 1 year to 1 year 9 months.

Similar differences were found in older children, aged 2 to 3 years. In this age group, for instance, 23.7% of the 118 children in Group A were 10% or more below the average weight, as compared with 1.4% in Group D. In Group A 4.2% were correspondingly overweight, as compared with 23.6% in Group D. Put in another way, of the 70 children in the birth-weight groups studied who were 10% or more above the average weight 7.1% were children from Group A (in which there were 118 children) and 84.3% from Groups C and D (total number of children 272).

Discussion

The investigation shows the great importance of taking the birth weight into account in the assessment of the physical growth of a child. Though some babies who are born prematurely do catch up to the "normal" and sometimes weigh more than the normal for the age, the average weight of a child born prematurely is considerably less than that of a child who was above the average birth weight. That these differences persist throughout childhood has already been shown (Illingworth and co-workers, 1949). The fact that a child is said to be "under weight" is very often a source of great worry to the mother. When due allowance is made for the birth weight it will be found that a considerable number of those so-called under-weight children are of average weight for children of that age, sex, and birth weight.

Summary

The growth in weight up to the age of 3 years of 1,343 children of different birth weights was investigated.

The average male child who at birth weighed $5\frac{1}{2}$ lb. (2.5 kg.) or less weighed consistently less than the average child of a larger birth weight. At the age of 1 the mean weight of the child who at birth weighed $5\frac{1}{2}$ lb. or less was 20 lb. 12 oz. (9.41 kg.) (male) and 19 lb. 11 oz. (8.93 kg.) (female). The mean weight of the child who weighed 7 lb. 2 oz. to 7 lb. 6 oz. (3.23 to 3.35 kg.) at birth was 22 lb. 5 oz. (10.12 kg.) (male) and 21 lb. 13 oz. (9.89 kg.) (female). The corresponding figures for the child who weighed $9\frac{1}{2}$ lb. (4.31 kg.) or more at birth were 24 lb. 7 oz. (11.08 kg.) (male) and 23 lb. 3 oz. (10.52 kg.) (female). The same gradation of weight in relation to birth weight was shown in all the age groups studied.

The average male child who at birth weighed $9\frac{1}{2}$ lb. or more weighed more at 1 year than the child whose birth weight was $5\frac{1}{2}$ lb. or less at 2 years. The average male or female child

In contrast, of the 377 children in the groups studied who were 10% or more above the average weight 6.3% were of Group A (in which the total number of children was 202) and 76.9% of Groups C and D (total number of children 526).

who weighed $9\frac{1}{2}$ lb. or more at birth weighed more at 2 than the child whose birth weight was $5\frac{1}{2}$ lb. or less did at 3 years.

Mothers are occasioned a great deal of worry by being told that their child is under weight for its age. A considerable proportion of so-called under-weight children are found to be of average weight when due attention is paid to age, sex, and weight at birth.

My thanks are due to Dr. A. Black, principal maternity and child-welfare officer, City of Sheffield, for her great help and co-operation in making her records available for study; to Dr. Gin for her painstaking study of the records; and to the medical officer of health for Sheffield, Dr. Llewellyn Roberts, for permission to publish the results.

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COMPARISON AND ESTIMATE OF GROUP AND INDIVIDUAL METHODS OF TREATMENT

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The Belmont Hospital practice of allotting cases on admission by a rota system enabled us separately to treat similar clinical material between August, 1946, and December, 1948. It seems a reasonable assumption that the rota system ensures a high degree of similarity in the material allocated. Since group therapy was used by one of us (A.S.T.) and an individual approach by the other (N.C.) we considered a comparison of the results of treatment would prove instructive.

In establishing a diagnosis we took the presenting feature—for instance, anxiety, hysteria, or depression—and applied that as the label for our purpose. Although it was recognized that patients often presented more than one of these syndromes, it was thought that this procedure would facilitate appraisal of the results. The term "schizophrenia" includes paranoid states; mental defect has been used as a diagnosis only when it constituted the most important aspect of the case. The organic cases included epilepsy, post-encephalitis, secondary dementia, toxic confusional state, causalgia, carcinoma of the stomach, and severe head injury. Both physical and psychological methods of treatment are compared.

The clinical results have been assessed by means of a questionnaire sent three months after the patient left hospital. We are indebted to Dr. Louis Minski, who is conducting a follow-up of Belmont patients, for use of the replies. The questionnaire is as follows:

1. Has your general health been good since leaving hospital?
2. What symptoms, if any, still persist?
3. Have you had further treatment since leaving? If so, state whether from your own doctor or as an out-patient or in-patient of any hospital.
- 4a. Are you in regular work? b. If not, is this due to your health?

For the purpose of estimating the results we expressed the replies as "yes" or "no," and have interpreted "yes" to both questions 1 and 4a as being a favourable result.