

DIAGNOSIS OF INTRA-UTERINE GROWTH RETARDATION BY GROWTH—PARAMETERS FOR TERM BABIES

by

SHANTI INDRA,* M.B.,B.S. (Cal.), M.R.C.P. (Edin), D.C.H. (Eng.)

A. K. MITRA,** M.O. (Cal.), F.R.C.O.G. (Eng.), Ph.D. (Lond.)

and

KARTICK MITRA,*** M.B.,B.S. (Cal.)

During the past few decades the parameters used for measuring the growth of the new-born were mainly weight at birth and the period of gestation. It has recently been observed that low-birth weight babies may be born before, at or after term irrespective of the period of their gestational age. The clinical behaviour of these low-birth weight babies who are born at term (37-42 weeks) differ from those who are born pre-term. These babies' birth-weight falls below 10th centile or 5th centile or below minus two standard (-2D) deviation of the corresponding weight.

The complication of meconium aspiration syndrome, neonatal hypoglycaemia and the risk of intra-uterine death are common in these babies. The incidence of mental retardation and neurological complications are higher amongst these children.

Lubchenco (1970) in United States and Butler and Alberman (1969) in U.K. during perinatal survey found out that about one third of the low birth weight

babies were born at term (37 to 42 weeks). Lubchenco (1970) classified small for dates babies into three categories such as pre-term, term and post-term.

Lower average birth weight are observed in India, French, Sudan and in other underdeveloped countries. It may be due to racial, socio-economic, nutritional and associated disease condition during pregnancy. To ascertain the growth of the foetus apart from size, length and weight, certain other specific parameters such as head circumference, biparietal diameters, chest circumference, crown rump and crown heel length are essential to measure.

The general health of the mother including height and weight, associated diseases in pregnancy, socio-economic and nutritional status which may influence the growth of the foetus should be recorded.

In this study, an attempt has been made to set a standard for standard average birth weight babies and low birth weight babies at term in West Bengal (Eastern part of India).

*Formerly Associate Professor, Dept. of Paediatrics, Medical College.

**Formerly Associate Professor, Dept. of Obstetrics and Gynaecology, Medical College.

***Late Research Worker, Dept. of Obstetrics and Gynaecology, Medical College.

Accepted for publication on 8-5-81.

Material and Methods of Study

The work was done at the Eden Hospital, Medical College, Calcutta during 1 year period (1974-75) and 983 babies

were included in the study, of which pre-term were 103, post-term 23 and term (37 to 42 weeks) babies were 807. Different parameters were studied, only of 807 term babies. Of these term babies, 217 were low-birth weight babies i.e. weighing 2063 gm. or below in our standard and of all the term babies it consisted of about 25 per cent or little more.

This Medical College Hospital usually serves for mainly Calcutta and its surrounding areas which gives a good average of West Bengal. Detailed antenatal history, approximately accurate date of L.M.P. were noted and the physical examination of the mother was made to assess their nutritional status and were graded accordingly.

Clinical Examination: Thorough Clinical examination of the babies was made and those having congenital abnormality if there was any apparent were excluded from the study.

Weight

Nine hundred and thirty-three babies were weighed, including 103 pre-term, 23 post-term and 807 term babies and they were grouped according to 10th, 50th and 90th percentiles.

Only 807 term babies were considered for further study to determine other parameters of growth. The 10th percentile in this group varied from 2018 to 2098 gms., the average being 2063 gm. The 50th percentile which were considered to be appropriate for dates ranged from 2460 to 2733 gms., the average being 2660 gms., whereas 90th percentile varied between 3100 to 3380 gms, the average was 3266 gms.

The average of the 50th percentile weight was considered as the standard birth weight of term babies in our series and the average of the 10th percentile was considered as the upper limit of low-birth weight, so that the babies weighing

TABLE I
10th, 50th and 90th Percentile Weight at Different Gestational Period

Period of Gestation in weeks	No. of cases	Weight in grams		
		10th percentile	50th percentile	90th percentile
Pre-term:				
33	22	1150	1750	2350
34	13	1575	2291	2337
35	18	1990	2320	2900
36	50	2000	2350	2960
Post-term				
43	16	2106	2733	3385
44	7	2100	2730	3386
Term: (37-42 weeks)				
37	84	2018	2460	3100
38	188	2019	2530	3187
39	187	2075	2607	3280
40	231	2081	2690	3311
41	77	2089	2700	3340
42	40	2098	2733	3380

2063 gms. or below were considered low-birth weight babies. Other parameters such as head circumference, chest circumference, biparietal diameter, crown rump and crown heel length were measured only in 807 term babies. They were divided into two groups: (a) 590 babies were of average standard birth weight babies weighing 2660 gms. or above and (b) other 217 babies of low-birth weight, weighed 2063 gms. or less.

The maximum and minimum measurements were recorded and their mean was worked out. The range of the mean was noted and the average of the mean was taken as the standard measurement for the particular group.

1. *Head Circumference (Cc.)* of the standard birth weight (SBW) babies varied from 32.7 to 33.0 cm. and the average was 32.0 cm. In case of low-birth

weight babies it varied from 29.7 to 31.9, the average being 31.9 cm.

2. *Chest Circumference (CH. C.)* of the (SBW) babies varied from 30.4 to 31.6 cm. and the average was 31.0 cm., whereas in L.B.W. babies it varied from 27.1 to 28.8 cm. and the average was 28.3 cm.

3. *Biparietal Diameters (B.P.D.)* of Standard Birth Weight babies ranged from 8.8 to 9.8 cm. and average was 9.4 cm. and that of the low-birth weight babies varied from 8.0 to 8.5 cm. and the average was 8.25.

4. *Crown Rump Length (C.R.L.)* in standard birth weight babies varied from 30.5 to 31.6 cm. and the average being 31.0 cm. and in case of low birth weight it varied from 26.68 to 32.3 cm. and average being 28.7 cm.

TABLE II
Head Circumference of Standard Birth Weight and Low Birth Weight Babies at Term

Period of gest.	No. of cases	Standard birth-weight				Low birth-weight				
		Min.	Max.	Mean	S.D.	Min.	Max.	Mean	S.D.	No. of cases
37	47	31.3	33.7	32.15	1.21	27	32.5	32.40	1.57	37
38	118	29.5	34.5	32.35	"	26.9	33.5	30.01	"	70
39	150	29.5	34.5	32.85	"	26.0	33.0	30.54	"	37
40	186	28.9	33.8	32.88	"	28.0	33.0	30.78	"	45
41	65	32.5	34.4	32.93	"	30.0	32.8	30.82	"	12
42	14	32.5	38.8	33.0	"	30.1	32.7	30.86	"	16

TABLE III
Chest Circumference of Standard Birth Weight and Low Birth-Weight Babies at Term

Period of gest.	No. of cases	Standard Birth-weight				Low birth-weight				
		Min.	Max.	Mean	S.D.	Min.	Max.	Mean	S.D.	No. of cases
37	47	28.0	32.6	30.4	2.03	25.8	31.3	27.1	1.57	37
38	118	27.1	33.2	30.6	"	25.6	31.2	27.8	"	70
39	150	28.8	33.9	30.9	"	23.0	32.4	28.5	"	37
40	186	28.7	32.7	30.4	"	26.5	31.5	28.5	"	45
41	65	30.1	34.3	31.6	"	26.0	31.5	28.8	"	12
42	24	27.0	35.2	31.6	"	25.8	30.3	28.8	"	16

TABLE VI
 Crown Heel Length of Standard Birth Weight and Low Birth Weight Babies at Term
 Standard birth-weight
 Low birth-weight

Period of gest.	No. of cases	Min.	Max.	Mean	S.D.	Min.	Max.	Mean	S.D.	No. of cases
37	47	35.5	50.0	46.8	3.46	30.3	50.1	44.0	5.02	37
38	118	33.8	51.6	47.3	"	39.6	48.7	44.5	"	70
39	150	31.8	52.6	47.8	"	36.9	51.7	45.0	"	37
40	186	45.4	52.4	48.8	"	44.4	50.1	45.3	"	45
41	65	45.1	53.0	49.0	"	42.7	52.9	45.5	"	12
42	24	46.1	52.3	49.2	"	38.9	48.9	45.7	"	16

Discussion

Of the total 933 babies weighed, 103 were pre-term, 23 post-term and 807 were term babies (37 to 42 weeks gestation period). They were grouped as 10th, 50th and 90th percentile.

Only 807 term babies were considered for study to determine different parameters of growth. The 10th percentile ranged from 2018 to 2098 gms. and the average in this group was 2063 gms. only. The 50th percentile considered to be appropriate for dates ranged from 2460 to 2733 gms. and the average being 2660 gm. which is less than that of Ghosh and Daga (1967), Delhi (2793 gms) where the mothers are taller, heavier and of better health, whereas 90th percentile in our series varied from 3100 to 3380 gms. and the average was 3266 gms. The figures were much lower than that of the developed and western countries (where average birth weight is 3400 gms).

The weight curve when superimposed by Lubchenko's (1970) weight curve, showed that our 50th percentile ran parallel to the 10th percentile of Lubchenko's. (Fig. 1). Therefore, the average of our 50th percentile weight (2660 gms) was considered as the standard birth weight for term babies and the average of the 10th percentile was considered the upper limit of low-birth weight, so that

I.U. WT. CURVE OF BENGALEE NEW BORN COMPARED WITH THAT OF LUBCHENCO.

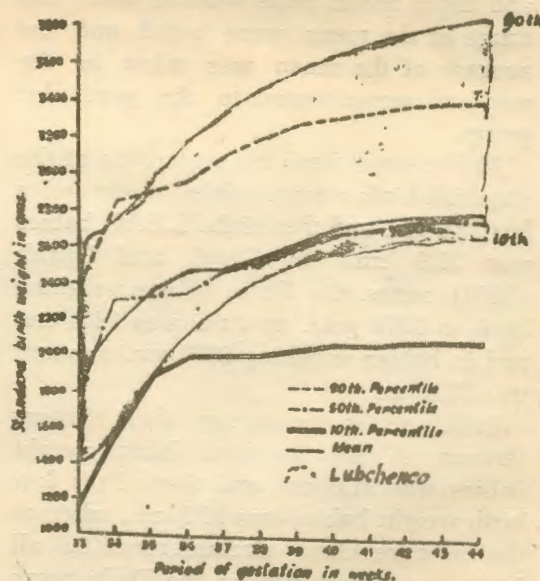


FIG:

the babies weighing 2063 gms. or below considered low-birth weight babies. The average birth weight in our series was less than that of the all western and advanced countries, even was lower than that of other parts of India.

For the other parameters, the 807 terms babies were divided into two groups.

Western countries		India	
Sweden	3400 gms.	Andhra	2788 gms.
France	3242 gms.	Assam	2932 gms.
America	3405 gms.	Delhi	2793 gms.
South Africa	3100 gms.	Gujarat	2875 gms.
(white population)		Calcutta	2610 gms.
		India	2788 gms.
		French Sudan	2833 gms.
		Present series	2660 gms.

Average or standard birth weight, 590 babies weighing 2660 gms. or above and 217 low-birth weight babies weighing 2063 gms. or below. The maximum and minimum measurements were recorded and their mean were worked out. The range of the mean were noted and the average of the mean was taken as the standard measurement to the particular group.

The average head circumference of the standard birth weight babies in our series has 32.0 gm. and that of the L.B.W. babies was 31.9 cm. In Ghosh and Daga's (1967) series, the Hc in babies weighing 1500 to 2000 gms. at term was 31.4 cm. and in babies weighing 2500 gm. or more was 33.8 cm.

In this series, the average chest circumference of the standard birth weight babies was 31.0 cm. and that of the low birth weight babies was 28.3 cm., whereas the average chest circumference in all India series and that of the Delhi were 32.2 and 30.75 cm. respectively.

Madhavan and Tamaskar (1969) made an all India survey to standardise the chest circumferences, and crown heel measurement in male and female infants as follows:

The measurement of chest of small for dates babies accepted by American Academy is 30.0 cm. which is 1.7 cm. more than that of our series. Achar (1962) showed good co-relation between chest circumference and general health and to nutrition and poor socio-economic condition.

The average biparietal diameter of the standard birth weight babies and low birth weight babies were 9.4 and 8.25 cm. respectively.

Once in 1936 in a study of 1010 infants found that biparietal diameter varied from 7.5 to 10 cm. in new born at term. The rate of the growth curve of biparietal diameter was studied by Cambell (1969) and his observation was that the rate was not uniform between 36 weeks to term.

The average crown rump length in our

	Chest circumference		C.H.L. circumference	
	M	F	M	F
Andhra Pradesh	34.6	34.5	48.1	47.6
Assam	32.4	31.9	48.9	48.2
Delhi	30.8	30.7	49.4	48.8
Gujrat	33.0	33.3	49.5	49.5
West Bengal	32.0	47.5	47.6	47.0
India	32.3	32.1	48.1	47.0

series in standard birth weight babies and low-birth weight babies were 31.0 and 28.7 cm. respectively.

It was also noted the close proximity of chest circumference and crown rump length.

Streater (1920) observed that crown rump length of the term babies was 36.2 cm. and 32.0 cm. was of the premature babies. Arey (1965) noted crown rump length to be 35.0 cm. for standard weight babies and 31.0 cm. for premature babies. In the present series, they were 31.0 and 28.7 cm. so they were less than both the series.

The average crown heel lengths were 48.0 cm. and 45.0 cm. in standard birth weight babies and in low birth weight babies.

In an all India survey Madhavan and Tamaskar (1969) reported crown heel length varying from State to State was on average 48.1 cm. in male and 47.7 for female infants. In western countries the babies weighing 3400 gms. at birth have crown heel length 50 cm., whereas the babies weighing 2378 at birth will have crown heel length of 47.0 cm.

From these data, the standard measurements for appropriate for dates and small for dates for this part of India have been formulated as such:

The average measurements of the Standard Birth at term B.W. 2660 gm. H.C. 32.7 cm. Bi Pariet 9.4 cm. Ch.c. 31.0 cm. CRL. 31.0 cm. CHL 48.1 cm. and that of Low birth weight babies at term (37 to 42 weeks) are BW. 2063 gm., HC. 31.0 cm., B.P.D. 8.3 cm. Ch.c. 28.3 cm. CRL. 28.7 cm. CHL 45.0 cm.

The comparative study of these growth parameters of different countries shows the variability of the data and it indicates that the standard growth parameters are different in different countries in different

gestational period, so the standard set-up for one country may not be suitable to other country.

It is evident that there may be some other factors responsible for intra-uterine growth retardation which are not related to nutritional status of the mothers. It may be due to other factors like genetic predisposition, unknown foetal infection, congenital anomalies which are not obvious, some derangement of internal metabolism of the foetus and local environmental factors leading to impairment of growth.

Conclusions

A standard of growth, weight and measurement of new borns in Eastern India has been presented and criteria of small for dates babies in West Bengal was laid down. The clinical assessment of growth retardation by growth parameters is useful in developing countries where sophisticated antepartum tests and ultra-sonic measurements are not easily available.

The evaluation of maternal factors with growth retardation infants showed high incidence of such babies in teen-aged mother and elderly primigravida over 35 years of age especially associated with toxæmia of pregnancy.

It is also concluded that apart from genetic and socio-economic factor, there are some local and remote environmental factors with some derangement of internal metabolism of the foetus may be responsible for small for dates babies.

It has also been thought that placental insufficiency and intra-uterine hypoxia may also be responsible in certain cases.

References

1. Achar, S. T.: Indian Child Health, 2: 200, 1962.
2. Arey, L. B.: Developmental Anatomy, A text book and Laboratory Manual of

- Embryology, 7th ed. W. B. Saunders Company, Philadelphia and London (1965).
3. Butler, N. R. and Alberman, E. D.— Perinatal Problems, The 2nd Report of the 1958. British Perinatal mortality Survey, E & S Livingstone Limited, Edin. (1969).
 4. Campbell, S.: J. Obstet Gynaec. Brit. C'wealth. 77: 603, 1969.
 5. Ghosh, S. and Daga, S.: Indian Child Health, 77: 173, 1967.
 6. Ince, J. C.: J. Obstet. Gynaec. Brit. Emp. 46: 1003, 1939.
 7. Lubchence, L. D.: Paediatrics, 32: 793, 1963.
 8. Lubchence, L. O.: Paediatric Clinics of North America 17: 134, 1970.
 9. Madhavan, S. N., Tamaskar, A. D.: Indilan Paediat. 36: 193, 1961.
 10. Streeter—quoted from: Potter, E. L. Pathology of featus and infant, 2nd ed. Year Book Medical Publisher, Inc., Chicago, 1961.