Statistical Observations on the Body Weight of Newborn Infants

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(Received May 10, 1968)

INTRODUCTION

It is believed that the body weight of newborn infants has been increasing since the end of the II World War. The purpose of this article is to study the average birth weight of infants in our clinic.

Birth weight varies according to the following factors: physical group, size of the parents, sex of the baby, single or multiple birth, gestation period, parity, age of the mother, and other parental conditions, such as, economic level and social status of the parents. The physical factor of the mother seems to have considerable influence on the birth weight.

MATERIALS AND METHODS

A retrospective statistical study has been conducted on the body weight of 5128 newborn infants which were delivered by 5081 mothers, including 47 sets of twins, for the 12 years period from April 1955 through March 1967 in the Yamaguchi University School of Medicine Hospital.

The cases are divided into 2 groups:

Group I — Delivered live, without complications during pregnancy, weighing 2500 grams or more, regardless of prenatal position and delivery method and gestation period.

Group II — All others

For the gestation period the week has been adopted as the median. 39 weeks for example, includes the period from 38 weeks and 4 days to 39 weeks and 3 days.

The age of mothers was divided into 6 groups with 5 years intervals. The group 20–24, includes those just 20 years of age to those 24 years and 11 months.

RESULTS

1. Distribution by Gestation Period

The distribution by gestation period is shown in Table 1.

Table 1. Distribution by Gestation Period

	Group I		Group II		Total	
	No.	per cent	No.	per cent	No.	per cent
32 - 33	143	3.8	87	6.8	230	4.5
34 - 35	32	0.8	42	3.3	74	1.4
36 - 37	115	3.0	55	4.3	170	3.3
38 - 39	153	4.0	104	8.2	257	5.1
40 - 41	1932	50.7	543	42.7	2475	48.7
42 - 43	996	26.1	325	25.6	1321	26.0
44 - 45	366	9.6	81	6.4	447	8.8
46	75	2.0	32	2.5	107	2.2
Total	3812	100.0	1269	100.0	5081	100.0

In this study 1269 cases, 24.9 per cent, belonged to Group II. We found that the shorter the gestation period was the more they belonged to Group II. None survived when born before 32 weeks. Therefore, 32 weeks which has been long cited as the borderline of viability was confirmed as that borderline.

The period 32 to 35 weeks, included an unusually high percentage, 10.1 per cent, of eminabire infants.

The great majority of births occurred in the normal gestation period, 38 to 43 weeks, with 76.5 per cent of the births occurring in this period. There was a sharp decline for the period begining at the 44 th week.

2. Distribution by Mother's Age and Parity

As shown in Table 2 approximately one third of all cases were primipara. This may be because more of the multiparas were delivered by midwives except when risk was involved. From para 7, the cases decreased rapidly, though there were still 10 cases of para 10 or more.

3. Birth Weight of Group I

This group includes 3812 infants (2018 male and 1794 female). Average birth weight compared with the series of Shapiro[1] is shown in Table 3.

Table 2. Distribution by Mother's Age and Parity

Age / Para	- 19	20 - 24	25 - 29	30 - 34	35 - 39	40 -	Total
1	63	581	607	259	33	1	1544
2	24	346	556	330	155	23	1434
3	2	89	214	212	164	26	707
4		24	160	185	169	41	579
5		8	78	134	125	51	396
6		2	13	85	84	42	226
7		1	1	25	43	30	100
8				12	25	19	56
9				2	12	15	29
10 or more				2	4	4	10
Total	89	1051	1629	1246	814	252	5081

Table 3. Average Birth Weight Compared with the Series of Shapiro

	Male	Female	Total
Shapiro	3390.0	3260.0	3320.0
Yao Tung Lin	3184.5	3075.3	3129.9

a) Birth Weight According to Gestation Period

The gestation period represents the age of the fetus. The longer period of gestation, the heavier body weight at birth, Eastmann[2], Dunham[3] and Anderson[4] have all discussed the increase of birth weight with longer gestation periods.

In this group the birth weight is shown in Table 4 according to gestation period. Birth weight of fetus increases by gestation period until it reaches 41 weeks, after which no significant increase is observed. For females, from the 37 th to the 38 th week there is a slight decrease. While these figures represent averages, still no reasons could be found for this decrease.

Table 4. Birth Weight by Gestation Period

	Male	Female
36	3008.5	2972.4
37	3131.2	3084.1
38	3134.1	3035.2
39	3249.5	3157.3
40	3322.4	3228.6
41	3393.7	3262.7
42	3395.2	3364.5
43	3391.8	3211.8
44	3393.2	3270.9

b) Birth Weight According to Age Group of Mother

Average birth weight by mother's age group is shown on Table 5 and its distribution in Table 6.

Table 5. Birth Weight According to Age Group of Mother

Age	Male	Female
- 19	3186.5	3052.6
- 20	3265.8	3186.5
- 25	3313.4	3191.4
- 30	3383.5	3282.4
- 35	3472.3	3283.5
- 40	3353.1	3105.2

Table 6. Distribution by Age of Mother

Age	No.	per cent
- 19	89	1.8
20 - 24	1051	20.7
25 - 29	1629	32.1
30 - 34	1246	24.5
35 - 39	814	16.0
40 -	252	4.9

c) Average Birth Weight According to Parity Group is shown in Table 7

Table 7. Birth Weight According to Parity

	Male	Female
1	3178.5	3079.7
2	3245.6	3203.3
3	3318.5	3237.2
4	3394.1	3308.9
5	3412.9	3299.2
6	3517.2	3264.3
7	3399.3	3264.5
8	3376.8	3278.3
9	3416.6	3299.5
10	3369.7	3185.6

4. Birth Weight of Group II

a) Birth Weight of Infants from Mothers with Toxemia

Gestation period in cases of mother's with toxemia was somewhat shortened either spontaneously or by obstetrical interference. Average birth weight is shown in Table 8. Birth weight is much smaller as compared with the Table 4, even with subgrouping of gestation period respectively.

Table 8. The Average Birth Weight of Infants from Mothers with Toxemia

Week	Male	Female
36	2275.5	2087.8
37	2213.2	2623.3
38	2921.6	2726.4
39	3155.4	3001.2
40	3178.3	2920.0
41	3363.7	3056.4
42	3404.8	3192.5
43	3308.9	3081.8

b) Twin Pregnancy

There were 47 sets of twins with 16 perinatal sets, 34 per cent, dying after birth. In this group 64 infants, 68.1 per cent, weighed less than 2500 grams.

31 cases were complicated by toxemin, 19 cases with breech presentation, 14 cases of postpartum hemorrhage and 10 cases of perineal laceration.

5. Prematurity

Various criteria have been suggested for determining whether or not an infant is premature, such as gestational age, the infant's length or weight, and combinations of these factors. Since menstrual histories are often indefinite or unreliable, estimation of gestational age is frequently erroneous. For instance, in this study, there were many premature babies of less than 38 weeks gestational age, but maturity may be attained in as short, a period as 28 weeks. The infant may weigh as much as 4100 grams in a gestational period of only 34 weeks. Likewise, measurement of the infant's length may be inaccurate. Consequently, birth weight has been adopted as a more practical criterion for the determination of prematurity.

In 1950 the Expert Group on Prematurity of the WHO submitted a final report which recommended two criteria for the determination of prematurity. It recommended that either 2500 grams weight at birth or a 36 weeks period of gestation be considered the borderline of prematurity. So far as the 2500 grams for birth weight is concerned the report recognizes this figure may not be applicable in some countries due to hereditary and physical or environmental

differences. The report also takes note of the difficulties of accurately determining the period of gestation.

As birth weight has been adopted as the criterion for prematurity, the factors influencing birth weight such as race, sex, gestation period, parity, multiple pregnancy and other maternal conditions, have a consequent influence on the incidence of prematurity. Distribution by birth weight is shown in Table 9.

Table 9. Distribution of Birth Weight

Birth Weight	Male		Female		Total	
	No.	per cent	No.	per cent	No.	per cent
under 1500	28	1.0	12	0.5	40	0.8
1501 - 2000	42	1.5	43	1.7	85	1.7
2001 - 2499	181	6.8	227	9.2	408	8.1
2500 - 3999	2296	86.5	2133	86.2	4429	86.3
over 4000	108	4.2	58	2.4	166	3.1
Total	2655	100.0	2473	100.0	5128	100.0

6. Infant Mortality

Infant mortality for this article is nearly equal to periperinatal loss reported by Peller as given in Shapiro's[1] report. Infant mortality is shown in Table 10 by weight group.

Table 10. Infant Mortality According to Body Weight Group

Birth Weight	Male						Female						Total	
	Living		Died		Total		Living		Died		Total		No.	%
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%		
under 1500	12	0.24	16	0.32	28	0.56	3	0.06	9	0.18	12	0.24	40	0.80
1501 - 2000	30	0.60	12	0.24	42	0.84	29	0.57	14	0.29	43	0.86	85	1.70
2001 - 2499	172	3.32	9	0.18	181	3.50	210	4.08	17	0.32	227	4.40	408	8.10
2500 - 3999	2233	43.5	63	1.3	2296	44.8	2095	40.8	38	0.8	2133	41.6	4429	86.30
over 4000	103	2.0	5	0.10	108	2.10	56	1.01	2	0.04	58	1.10	166	3.10

7. Large Infants

3.86 per cent of the infants reported here weighed over 4000 grams at birth.

There were 3 excessively large infants. One male, primipara, weighing 4981 grams, was born to a 23 years mother after a 40 weeks gestation period. Another male baby, weighing 4851 grams, was born to a 38 years mother after a 43 weeks gestation period on para 5. The third was a female baby, weighing

4743 grams, born to a mother of 39 years and 9 months after 43 weeks gestation period on 8th parity. No diabetic history was noted for any of these 3 mothers.

With the exception of the three excessively large infants noted above, there is no significant differences in the birth weight of infants born from the 40 th to the 43 rd week of gestation.

The incidence of large infants increased with the age of mother till 40 years. The three excessively large infants noted above were, para 1, para 5 and para 8 respectably.

DISCUSSION

Live births increased when the mother's age reached 20 years, the highest being in the 25 – 29 years group. Live births gradually decreasing from 30 to about 40 years. There were 3 primipara to mothers over 40 years of age, one of whom was married when she was 18 years old.

Eastmann[2] stated that male babies are usually 100 grams heavier than female. It is obvious that male babies are usually heavier than female on account of sex difference. It may be due to endocrine differences.

In this study the males on an average were 10.9 grams heavier than the females.

Birth weight varies according to national groups. Shapiro[1] in his studies reported the average birth weight of American infants as 2650 grams; Dunham[3] has reported a birth weight of 2823 grams for a group of English infants, 3242 grams for French infants, 2800 grams for Okinawa infants, and 3318 grams for a group of German infants. From studies by Anderson and Brown[4] and Simpson and Geppert[5] it appears that caucasian infants are often heavier than negro infants.

Birth weight increased with the age of the mother. West[6] reported that more premature infants were born to mothers of less than 20 years old. Shapiro[1] suggested the birth weight increased when the age of mother was be tween 28 to 35 years.

In this study, it has been found that birth weight increased until the mother's reached 40 years of age.

There were 441 cases, 6.7 per cent, of toxemia in this study. This incidence is not higher than that of other countries since Eastmann[2] reported 6 – 7 per cent incidence for his series though Simpson and Geppert[5] reported only 4.23 per cent in Brooke Army Hospital.

Some authors[7] have reported disturbance of the metabolism of protein in the blood of the umbilical cord. Some have also reported poor development of thymus in autopsy cases.

The incidence of multiple births in this report seems higher than that of other countries. However, it must be noted that the figures derived in our hospital should be higher, on account of the local custom that midwives usually handle the easy deliveries and send the difficult cases to hospital.

The sex ratio in this study is not identical with that of Dunham[3] for in this report there are only 17.6 per cent more males than females.

The incidence of premature infants in this study is 10.5 per cent, slightly lower than the 11.7 per cent reported by Eastmann.[2]

West[6] reported 5.9 per cent, of the 13, 819 live births in his study were premature. For this study, it is 7.81 of the live births.

As for infant mortality Shapiro[1] and Schoeneck[8] reported that the lighter the weight, the more unfavovable the prognosis was. This study has confirmed that finding.

Shapiro[1] has stated that the incidence of excessively large infants increased with gestation periods of 40 weeks or more. Again, the findings of this study confirm Shapiro[1] findings.

SUMMARY

A statistical study has been conducted of the birth weight of infants born in the Yamaguchi University School of Medicine Hospital for the period April 1955 to March 1967. The results were as follows:

1) 5128 infants, including 47 sets of twins, were born of 5081 mothers.

2) Average birth weight was 3129.9 grams; 3184.5 grams for males and 3075.3 grams for females.

3) The weight of newborn infants was under 1500 grams in 40 cases, 1501–2000 grams in 85 cases, 2001 – 2499 grams in 408 cases, 2500 – 3999 grams in 4429 cases, and over 4000 grams in 166 cases. Infant mortality was 62.5 per cent, 30.5 per cent, 6.1 per cent, 2.3 per cent and 4.2 per cent, respectively. The lighter the weight, the more unfavorable was the prognosis.

4) An infant born of a toxemia mother and twins were smaller than single birth infants. This is especially true for twins, which were approximately 1000 grams lighter than the ordinary infant.

5) I am obliged to recommend that the criterion of prematurity for female infants be lowered by 100 grams in our clinic.

6) An infant weighing less than 1500 grams has approximately a 30 per cent chance of survival.

ACKNOWLEDGMENTS

Grateful acknowledgment is made to Prof. Taro Fujiu for his guidance and

suggestions in this study.

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