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Gestational Age-Specific Birthweights of Twins Versus Singletons

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Abstract. In order to more adequately characterize patterns of intrauterine growth retardation in twins, the mean birthweights of all nonanomalous white or black twins born between 24 and 41 weeks of gestation and surviving until discharge over an 11-year period (547 infants) and all similar singletons (19,072 infants) were compared by completed weeks of gestation. Between 24 and 35 weeks of gestation, the mean birthweights for the 547 twins and the 19,072 singletons were comparable and did not consistently differ statistically. From 36 to 41 weeks gestation, however, the difference became large, consistent, and statistically significant for each week at $P < 0.0001$. This difference was present among all subgroups of twins, ie, in all males, females, blacks, and whites; it was still evident when the sample was further stratified by both race and sex (black males, white males, black females, white females). These data suggest a pattern of growth retardation in twins compared to singletons which is large, consistent, and statistically significant beginning at 36 weeks gestation. Clinically, these data also suggest the need for ultrasonic examination early in gestation (24-32 weeks) to document normal growth and to provide baseline data, and show the importance of such monitoring later in gestation, specifically after 36 weeks.

Key words: Twins, Birthweight, Growth-retardation, Race

Twin births account for only about 2% of total births in the United States, but account for 8-10% of perinatal deaths [1-4]. The neonatal mortality rate of twins has been reported to be 4.5-7 times higher and the fetal mortality rate 3 times higher than for singletons [2,17]. The predominant factors contributing to this excess perinatal mortality include low birthweight (< 2500 at birth) and intrauterine growth retardation (IUGR) (< 10th percentile for gestational age at birth). In one national study, live births in multiple gestations were about 9 times as likely to be of low birthweight as live births from singleton gestations [16]. Although the higher incidence of low birthweight among multiples was accounted for in part by their reduced length of gestation (2½ weeks shorter than for singletons, on the average), at each week of gestation evaluated before term, multiples were at greater risk for being low birthweight than singletons. At term, multiples were 11 times as likely as singletons to be of low birthweight [16]. Another study estimated that IUGR was present in as many as one-third of twins [7]. This same study reported two additional findings: 1) the overall perinatal mortality rate for small-for-gesational-age (SGA) twins vs appropriate-for-gestational age (AGA) twins was 2½ times greater; and 2) the weight-specific perinatal mortality rate was nearly 3½ times greater for SGA vs AGA twins with birthweights between 1000 and 1499 g.

In the past, several investigators have suggested using singleton standards to evaluate the intrauterine growth of twins [3,6,12]. Others have advised the development of twin-specific growth curves [8,15]. Several problems emerge, however, when singleton standards are applied to twins. First, after 30 weeks gestation, birthweight percentiles for multiples rapidly fall below those for singletons, so that by 38 weeks the 50th percentile for multiples falls below the singleton 10th percentile [17]. Second, singleton standards generally are not derived from the same study population, nor are they commonly race- or sex-specific. Third, studies describing growth curves of singletons and twins may not specify whether stillborns of infants who died in the perinatal period were included or excluded [6,9]. Fourth, growth curves often have been based upon births spanning several decades, a consideration which may severely bias the data because environmental, nutritional, and obstetrical influences may have changed significantly over such long periods [1,11]. In order to better characterize patterns of IUGR in twins, the present study has attempted to overcome prior methodological deficiencies by quantifying at what point in gestation twin birthweights deviate from singletons.

METHODS AND MATERIALS

The medical records of all twin births delivering at the Johns Hopkins Hospital between 1 January 1979 and 31 December 1989 were reviewed. Twin and singleton birthweights were obtained from the delivery room records. The absence or presence of anomalies was documented from the newborn nursery records.

Our initial sample included 716 twin infants (358 deliveries). The sample was then limited to maternal race of white or black, to gestations of 24-41 weeks from last menstrual period. All infants with anomalies, stillborns, and perinatal deaths (death before discharge) were also excluded. These exclusions were made because infants with anomalies or who die in utero or shortly after birth may not be representative of normal intrauterine growth. Using these criteria, a total of 169 infants were excluded, of which 45 were stillborn or died during the perinatal period. The resulting final sample size was 547 infants: 278 females (50.8%) and 269 males (49.2%); 336 blacks (61.4%) and 211 whites (38.6%). A summary of stillborns and perinatal deaths excluded from the study is given in Table 1.

Utilizing the Department of Gynecology and Obstetrics' computerized data base, we then established a gestational age-specific birthweight standard for singleton births from our institution. The singleton infants included in our birthweight standard were delivered between 1979 and 1987, inclusive, and had no anomalies identified by the time of their discharge from the nursery. Their gestational ages at delivery were established by best obstetrical estimate, which incorporates data from the last known menstrual period, ultrasound examination(s), the time of first auscultation of fetal heart sounds, and early bimanual examination to yield a composite estimate of gestational age at the time of delivery. Infants for whom a best obstetrical estimate of gestational age could not be determined, or for whom birthweight data was missing, were excluded. Infants were grouped by the race of their mother, and only white or black infants were included, as these two racial groups make up almost our entire population. The final gestational age-specific birthweight standard included 19,072 singleton infants, of which 50.9% were male, 49.1% female, 66.3% black and 33.7% white. Using the overall gestational age-specific birthweight standard we then developed specific standards, stratified by infant sex and race, and by both sex and race in combination. The mean birthweights of singletons and twins were compared using the unpaired t test weeks 24-41 of gestation.

Table 1 - Characteristics of twin infant deaths

Category	Perinatal deaths[a] N	Perinatal deaths[a] %	Mean birthweight (grams ± SD)	Mean gestational age (weeks ± SD)
All twins	45	8.2	841 ± 376	27.6 ± 3.5
All males	24	8.9	833 ± 251	27.5 ± 3.2
All females	21	7.6	850 ± 474	27.8 ± 3.9
Black twins	24	7.1	756 ± 297	27.3 ± 4.1
Black males	12	7.4	832 ± 333	27.9 ± 4.4
Black females	12	6.9	679 ± 245	26.8 ± 3.8
White twins	21	10.0	939 ± 421	28.0 ± 2.7
White males	12	11.3	835 ± 144	27.0 ± 0.9
White females	9	8.6	1077 ± 613	29.2 ± 3.8

[a] Number of twin deaths divided by live, surviving twin infants, × 100.

RESULTS

Mean birthweights and gestational age of the study twins by sex, race, and sex and race in combination, are presented in Table 2. White males were heaviest at birth, followed, respectively, by black males, white females, and black females, although the differences between race or sex groups only ranged between 38-66.

In the evaluation of all twins vs all singletons (Fig. 1), only at weeks 26-27 and 28-29 did the mean birthweight of twins exceed that of singletons of the same gestational age, and this difference was less than 100 g (ns). However, by 30 and 31 weeks, respectively,

Table 2 - Mean birthweight gestational age of twins by race and sex

	All male twins	*All female twins*
N	269	278
Mean birthweight (g ± SD)	2208 ± 649	2167 ± 644
Mean gestational age (weeks)	34.6	34.7
	Black twins	*White twins*
N	336	211
Mean birthweight (g ± SD)	2167 ± 639	2219 ± 658
Mean gestational age (weeks)	34.8	34.4
	Black male twins	*White male twins*
N	163	106
Mean birthweight (g ± SD)	2182 ± 676	2248 ± 607
Mean gestational age (weeks)	34.8	34.3
	Black female twins	*White female twins*
N	173	105
Mean birthweight (g ± SD)	2153 ± 603	2191 ± 708
Mean gestational age (weeks)	34.8	34.4

twins averaged 219 g and 246 g less than singletons (both, $P<0.001$). At 32 weeks the difference was only 55 g, favoring singletons (ns). At weeks 33, 34, and 35 singletons were 168 g, 160 g, and 130 g heavier than twins, respectively; all these differences were statistically significant ($P<0.01$, <0.006, and <0.029, respectively). At 36 weeks the difference between twins and singletons tripled in magnitude to become 379 g ($P<0.0001$), and remained at this level and degree of significance for week 37 (373 g) and week 38 (382 g). At weeks 39 and 40 the magnitude of this difference nearly doubled to 734 g and 754 g, respectively (both $P<0.0001$). By 41 weeks, the difference favoring singletons was still 657 g ($P<0.0007$).

Among white twins (Fig. 2), the gestational age-specific differences in mean birthweights between singletons and twins were inconstistent and varied widely, ie, borderline statistical significance at 31 and 33 weeks ($P<0.06$ and $P<0.03$, respectively) or not significant through 35 weeks gestation. From 36 to 39 weeks, the difference favoring singletons over twins was large and consistent, ranging from 369 g. to 466 g. These differences were statistically significant at $P<0.01$ or better for each week. By week 40, this difference nearly tripled to 995 g. ($P<0.0001$).

Among black twins, a similar trend was observed, as shown in Fig. 3. At weeks 30 and 31, singletons were 215 g ($P<0.006$) and 235 g ($P<0.0035$) heavier than twins. The differences between singletons and twins fell below this level and were not significant for weeks 32 and 33. For weeks 34 and 35, mean birthweights favored singletons by 252 g ($P<0.018$) and 213 g. ($P<0.0047$), respectively. As was the case among white twins,

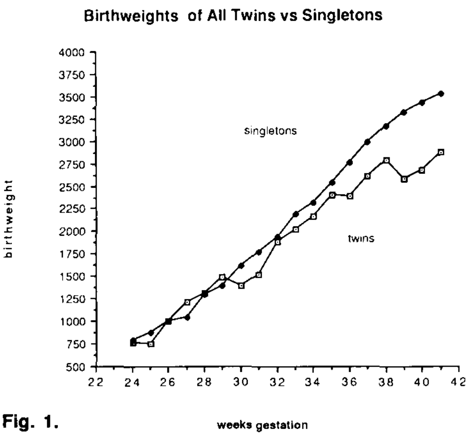


Fig. 1.

Fig. 1. Comparison of mean birthweight for all twins vs all singletons by gestational age.

Fig. 2. Comparison of mean birthweight for all white twins vs all white singletons by gestational age.

Fig. 3. Comparison of mean birthweight for all black twins vs all black singletons by gestational age.

Fig. 4. Comparison of mean birthweight for all male twins vs all male singletons by gestational age.

Fig. 5. Comparison of mean birthweight for all female twins vs all female singletons by gestational age.

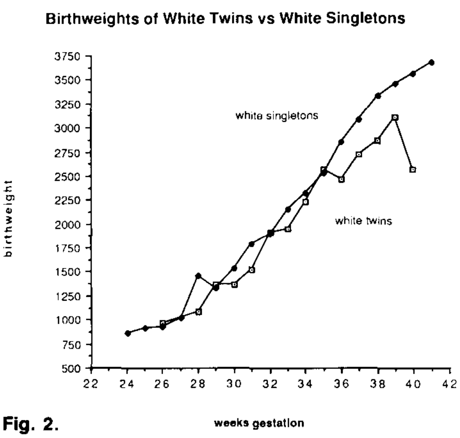
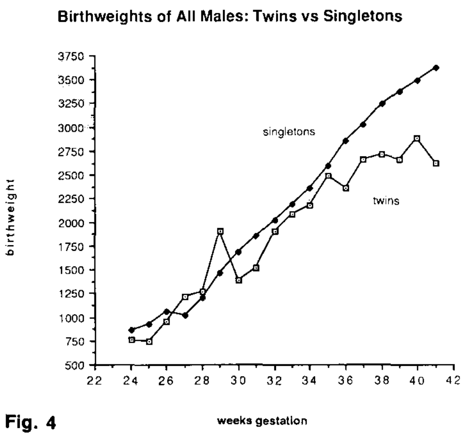


Fig. 2.



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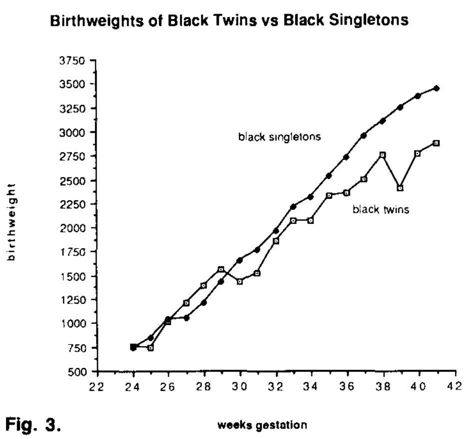

Fig. 3.

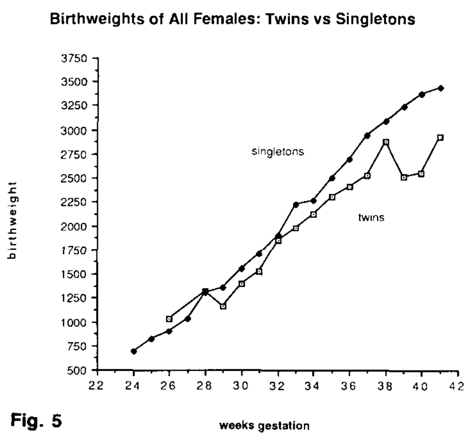

Fig. 5

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the mean birthweight differences became large at 36 weeks and remained consistent through 41 weeks. The differences ranged from 382 g at 36 weeks ($P<0.0001$) to 566 g at 41 weeks ($P<0.0017$), with the largest difference at 39 weeks (839 g, $P<0.0001$).

Among all male twins, the same pattern was observed, as shown in Fig. 4. Large differences were present at 30 and 31 weeks (292 g, $P<0.0002$, and 337 g, $P<0.0001$), followed by small differences (not of statistical significance) through week 35. At 36 weeks, the differences again became large (486 g, $P<0.0001$), and remained at about this level and significance through week 40 (619 g, $P<0.005$).

Among all female twins (Fig. 5), large and consistent differences did not appear until week 36 (298 g, $P<0.0003$), but they remained at this magnitude and degree of significance through week 41 (503 g, $P<0.0097$).

When the data was further stratified by both race and sex, the pattern of large, significant differences at 36 weeks remained, as shown in Figs. 6-9. The size of the difference varied for each race-sex group, ranging from 429 to 1262 for white males, 404 g to 907 g for black males, 346 g to 886 g for white females, and 292 g to 810 g for black females. However, because of small numbers in each group for each week, statistical significance was not always achieved.

DISCUSSION

In this study, we demonstrated a pattern of growth retardation in twins that was large and consistent for all twins starting at 36 weeks of gestation. These differences were also present when race- and sex-specific comparisons were made. At 30-31 weeks gestation, a statistically significant difference between singletons and twins was also present, but due to the small sample size, was most likely a statistical artifact and not clinically significant. This difference may have also been due to selection factors, because the Johns Hopkins Hospital is a tertiary level obstetrical care facility which receives numerous high-risk transfers, including twin gestations. Although this study comprises a relatively large number of twins, when divided by race and sex the number in each cell becomes small, and our stratified results should be viewed as tentative because of the possibility of sampling error biasing the results.

Despite these limitations, our study suggests a statistically and clinically significant difference in the growth of twins compared to singletons beginning at 36 weeks and continuing on to term. This date is much later than has been reported by other investigators. For example, McKeown and Record [9] concluded that the rate of intrauterine growth was similar for all gestations until 27 weeks, and that the rate slowed for twins at about 30 weeks. Naeye et al [11] reported that the rate was the same until 29 weeks and that differences became evident by 33 weeks, with twins being about 10% lighter at term. Bleker et al [1] reported that twins had a lower mean birthweight from 33 weeks, resulting in a difference of about 600 g by 39-40 weeks gestation. Williams et al [17] found that the difference occurred at 26 weeks, with the peak velocity of growth occurring for singletons at 33 weeks vs 31 weeks for twins.

Several reasons may account for the uniqueness of our findings. First, we excluded all singleton and twin infants with anomalies, as well as those who died in utero or during the perinatal period, because we felt they might not have been representative of nor-

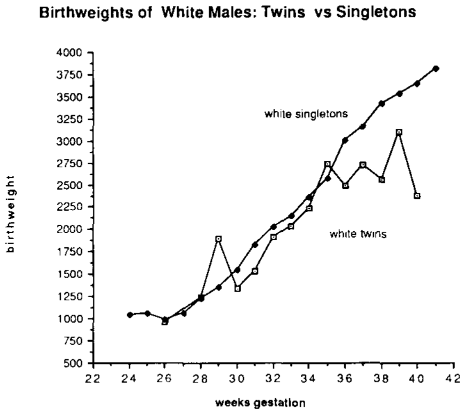

Fig. 6. Comparison of mean birthweight for all white male twins vs all white male singletons by gestational age.

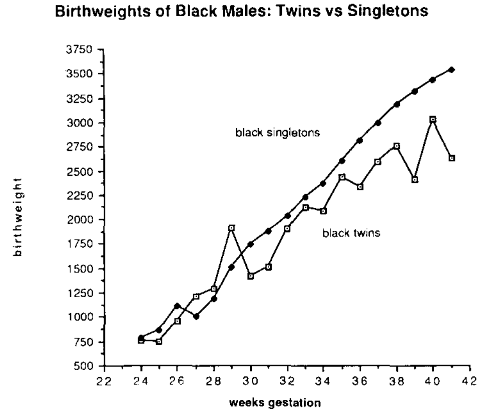

Fig. 7. Comparison of mean birthweight for all black male twins vs all black male singletons by gestational age.

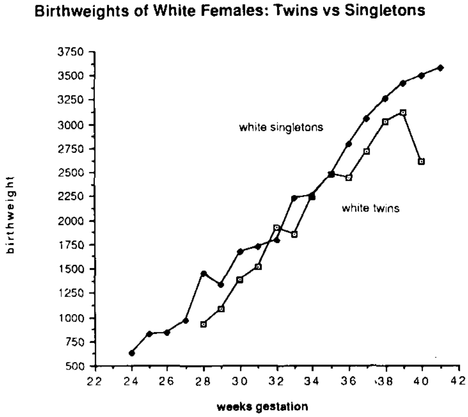

Fig. 8. Comparison of mean birthweight for all white female twins vs all white female singletons by gestational age.

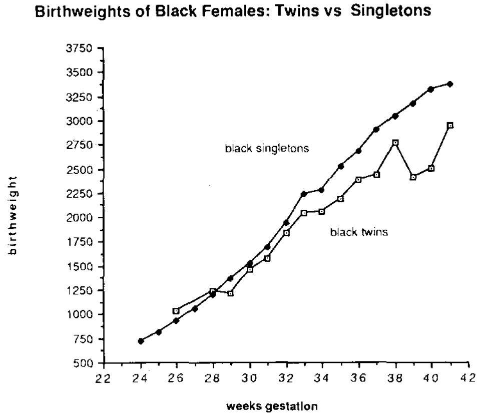

Fig. 9. Comparison of mean birthweight for all black female twins vs all black female singletons by gestational age.

mal intrauterine growth. Second, we compared singletons and twins from the same population base and for comparable time periods. And third, we made comparisons specific for race, sex, and gestational age.

Our study underscores the need for ultrasonic evaluation early in gestation (24-32 weeks) to document normal growth and to provide baseline data, and the importance of such monitoring later in gestation, specifically after 36 weeks. Other investigators studying twins previously have advocated a two-stage or serial ultrasonic evaluations of these infants at high risk for intrauterine growth retardation and low birthweight [5,13].

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