Acta Genet Med Gemellol 28:353–360 (1979)
The Mendel Institute/Alan R. Liss, Inc.

The Effect of Zygosity on the Birth Weight of Twins in Aberdeen and Northeast Scotland

G. Corney,[1] B. Thompson,[2] D.M. Campbell,[3] I. MacGillivray,[3] D. Seedburgh,[1] D. Timlin[4]

[1] *MRC Human Biochemical Genetics Unit, The Galton Laboratory, University College, London;* [2] *MRC Medical Sociology Unit, Institute of Medical Sociology, Aberdeen;* [3] *Department of Obstetrics and Gynaecology, University of Aberdeen;* [4] *Medical Computer Centre, Westminster Hospital, London*

Birth weight data for 356 pairs of newborn twins of known zygosity and placentation are presented. The combined weights of dizygotic twins are heavier than those of monozygotic twins. The significance of this finding is discussed in relation to the association between increased maternal height and dizygotic twinning.

Key words: Twins, Zygosity, Placentation, Birth weight, Maternal height

INTRODUCTION

In 1972 one of us (G.C.) reported that, in a survey of newborn twins in Oxford and the surrounding area, dizygotic (DZ) twins were heavier at birth than monozygotic (MZ) twins, allowance having been made for such variables as sex, placentation, duration of gestation, maternal age, and parity [6]. As the Oxford study was being completed, a survey of newborn twins was starting in Aberdeen and Northeast Scotland, and we are now presenting birth weight data from this study for comparison with previous studies.

DESCRIPTION OF THE TWIN SAMPLE

The organisation of the Aberdeen twin survey was similar to that previously carried out in Oxford. The aim was to determine zygosity and the type of placentation for consecutive newborn twins, and the details for the period 1968–1973 have been reported previously [9]. For the present analysis, data were available for a longer period, August 1968 to February 1976, and during this time 436 pairs of twins were delivered. Data with regard to sex of the twin pairs, birth weight, maternal age, parity, and duration of gestation were obtained from the hospital notes. A total of 80 pairs have been excluded from this analysis, either because data with regard to sex, placentation, or birth weight were not available, or because they were non-Caucasian or did not meet the criteria for determination of zygosity (see below). The sample available for birth weight analysis is therefore one of 356 pairs.

There were 333 pairs of survivors in this sample (Table 1); the 23 pairs in which one or both twins did not survive will not be discussed further in this analysis because of the small number involved. In contrast to the Oxford study, this group does not include all the congenital abnormalities, only those malformed infants who did not survive. It was clear that the criteria for definition of abnormalities were

0001-5660/79/2804-0353$01.70

TABLE 1. Composition of the Aberdeen Twin Sample

		Survivors (pairs)	Total (pairs)
Sex	Unlike	112 (33.6%)	117 (32.9%)
	Like	221	239
	Total	333	356
Placentation	Dichorionic	275 (82.6%)	289 (81.2%)
	Monochorionic	58	67
	Total	333	356
Zygosity	DZ	223 (67.0%)	232 (65.2%)
	MZ	110	124
	Total	333	356
Zygosity and placentation	DZ dichorionic	223	232
	DZ monochorionic	...	...
	MZ dichorionic	52 (47.3%)	57 (46.0%)
	MZ monochorionic	58	67

quite different in the two surveys, as they were more precisely identified in Aberdeen, and consequently it was decided that survival would be the sole criterion for analysing birth weight data in the Aberdeen survey.

Amongst the 356 pairs (Table 1) there were 117 (32.9%) pairs of unlike sex; this is comparable to the proportion (31.5%) reported by the Registrar-General for Scotland for all twin births during the same period (1968–1976) [17].

The proportion of twin pairs (Table 1) with dichorionic placentation (81.2%) is slightly higher than that in similar surveys of newborn twins from England and the United States [7]. This observation will be discussed further in relation to zygosity. The further classification of dichorionic placentae as "fused" and "separate" has not been used for this analysis, since there is wide variation amongst observers in the criteria used for this particular subdivision [7, 11].

Zygosity

Difference in sex or in one or more of the genetic markers (red-cell antigens and genetically determined enzymes in red cells and placental tissue) was taken as evidence of dizygosity. In all studies of newborn twins of known zygosity so far reported, twins with monochorionic placentation have been found to be alike in sex and in all markers tested, and therefore such placentation was accepted as adequate evidence for monozygosity. Dichorionic pairs that were alike in sex and all markers tested were accepted as MZ when the statistical probability of dizygosity was less than 0.02. Dichorionic twins that did not meet this criterion were excluded. The methods used for calculation of zygosity have been described previously [8]. The proportion of DZ pairs (65.2%) is lower than that found in the English surveys, but approximates the proportion found in Caucasian newborn populations in the United States [7].

It is now established that a proportion of MZ pairs have dichorionic placentation; this is 46% in the present survey (Table 1), which is high in comparison with figures ranging from 19% to 38% derived from surveys in other parts of the world [7]. This finding may indicate a relative difference in the timing of the stages of MZ twinning in this part of Scotland. However, it may also be attributable to incorrect classification of some monochorionic placentae as dichorionic in the present study.

BIRTH WEIGHT ANALYSIS

In this analysis, data for both surviving and total pairs are given in some tables, but only for survivors in others. In general, discussion is confined to surviving pairs, as these are likely to represent a more homogenous population. Birth weights were compared using the t-test; the two-tailed probabilities quoted have been confined to those of 0.05 or less.

Sex

The combined birth weights of twin pairs of unlike sex (Table 2) are higher than those of pairs of like sex; the difference in mean weight between the two groups is 282 g (P = 0.01). Male twins are heavier than females in unlike-sexed pairs (P = 0.03); amongst pairs of like sex, the difference in weight between the two sexes is in the same direction, but is not significant. Males from pairs of unlike sex are heavier than males from like-sexed pairs (P = 0.001). The apparent difference in weight for females is in the same direction.

Placentation

Birth weight data classified by placentation and sex are given in Table 3. Dichorionic pairs are heavier than monochorionic pairs, the difference in mean combined birth weight being 386 g (P = 0.005).

Zygosity

Data with regard to zygosity, sex, placentation, and mean birth weight are given in Tables 4 and 5. DZ pairs are heavier than MZ pairs, the difference in mean weight being 373 g (P = 0.001). It seems likely (Table 5) that dichorionic DZ pairs are heavier than MZ pairs with the same type of placentation (P = 0.05). Amongst the MZ pairs, however, those with dichorionic placentation are not significantly heavier than pairs with a monochorionic placenta.

Mean birth weights for males and females from pairs of like sex are summarised in Table 6.

Duration of Gestation, Maternal Age, and Parity

The duration of gestation for DZ pairs was 37.95 weeks (SD: 2.43) and for MZ pairs 37.81 weeks (SD: 2.38); thus, as was found in the Oxford study, there is no appreciable difference in duration of gestation attributable to zygosity. Recently, Falkner [10] has reported a similar observation based on the Louisville Twin Study. The mean maternal ages for mothers of DZ and MZ twins were, respectively, 26.90 years (SD: 4.82) and 25.71 years (SD: 5.12), and when parity was considered, the results were 2.21 (SD: 1.19) and 1.86 (SD: 0.98). These effects of maternal age (P = 0.04) and parity (P = 0.01) reflect the well-known associations between these two variables and dizygosity. The birth weight data in relation to these and other factors will be discussed in more detail in a future publication.

*TABLE 2. Mean Birth Weight for Twins Classified by Sex and Survival**

Sex		Survivors			Total		
		N	Mean weight (g)	SD	N	Mean weight (g)	SD
Unlike	Pair	112	5227	914	117	5136	1002
	Male	112	2688	535	117	2638	578
	Female	112	2539	486	117	2498	521
Like	Pair	221	4945	964	239	4846	1053
	Male	228	2476	556	250	2442	587
	Female	214	2469	500	228	2402	563

*Combined weight is given for pairs and individual weight where sex is specified.

https://doi.org/10.1017/S0001566000008916 Published online by Cambridge University Press

TABLE 3. Mean Birth Weight of Twin Pairs Classified by Sex, Placentation, and Survival

	Dichorionic						Monochorionic					
	Survivors			Total			Survivors			Total		
	N (pairs)	Mean weight (g)	SD	N (pairs)	Mean weight (g)	SD	N (pairs)	Mean weight (g)	SD	N (pairs)	Mean weight (g)	SD
Unlike sex	112	5227	914	117	5136	1002						
Like sex	163	5025	980	172	4954	1039	58	4721	891	67	4569	1046
Total	275	5107	957	289	5028	1026	58	4721	891	67	4569	1046

TABLE 4. Mean Birth Weight of Twin Pairs Classified by Sex, Zygosity, and Survival

	DZ						MZ					
	Survivors			Total			Survivors			Total		
	N (pairs)	Mean weight (g)	SD	N (pairs)	Mean weight (g)	SD	N (pairs)	Mean weight (g)	SD	N (pairs)	Mean weight (g)	SD
Unlike sex	112	5227	914	117	5136	1002						
Like sex	111	5099	1018	115	5052	1053	110	4790	885	124	4655	1021
Total	223	5163	967	232	5094	1026	110	4790	885	124	4655	1021

TABLE 5. Mean Birth Weight of Twin Pairs Classified by Placentation, Zygosity, and Survival

	Survivors						Total					
	DZ			MZ			DZ			MZ		
	N (pairs)	Mean weight (g)	SD	N (pairs)	Mean weight (g)	SD	N (pairs)	Mean weight (g)	SD	N (pairs)	Mean weight (g)	SD
Dichorionic	223	5163	967	52	4868	881	232	5094	1026	57	4757	989
Monochorionic				58	4721	891				67	4569	1046

TABLE 6. Mean Birth Weight of Individuals From Twin Pairs of Like Sex (Survivors Only) Classified by Sex, Placentation, and Zygosity (Numbers in Parentheses)

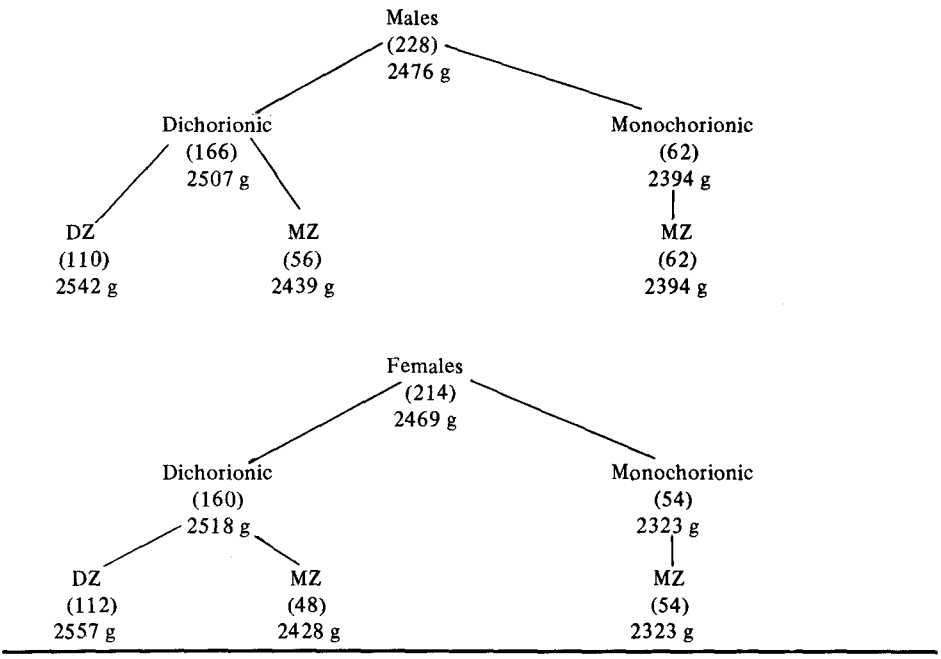

TABLE 7. Mean Birth Weight of Individuals From Surviving Twin Pairs of Like Sex Classified by Zygosity

		DZ		MZ	
		N	Mean weight (g)	N	Mean weight (g)
Oxford	Males	160	2728	144	2583
	Females	144	2601	124	2483
Aberdeen	Males	110	2542	118	2415
	Females	112	2557	102	2372

DISCUSSION

The results of this survey are very similar to those from other studies. The effect of sex, pairs of unlike sex being heavier than those of like sex and males heavier than females, has been reported from various centres throughout the world [4], and more recent reports have confirmed these findings [3, 12, 19, 20]. Dichorionic pairs in the present survey are heavier than those with a monochorionic placenta, which has been the case in previous reports from England, the United States, and Holland [3, 6].

DZ pairs are heavier than MZ pairs, and data for surviving twins from pairs of like sex from the Oxford [6] and Aberdeen surveys are given for comparison in Table 7. Two other reports [2, 21] show similar findings with regard to the effect of zygosity on birth weight; however, both were retrospective without details of placentation, and neither is

clear about the method of determination of zygosity. All these studies, therefore, indicate the superiority of dizygosity in terms of birth weight. With regard to placentation, it does not seem, from these results, that the combined birth weight of twins is affected by the type of placenta, as a consistent effect is not demonstrable between the two placental groups amongst MZ twin pairs. This is similar to the findings in the Oxford study [6]. However, it is known that, presumably because of the shared circulation, monochorionic placentation does affect intrapair differences in birth weight [10, 18].

In 1972 we proposed [6] that the positive correlation between maternal size and the rate of twinning which had previously been reported from Aberdeen and Ibadan, Nigeria [1, 13, 14], warranted further investigation in the light of the known relationship between maternal height and birth weight and the demonstrated effect of zygosity on the combined weight of twins at birth. The effect of maternal height on the twinning rate in Aberdeen has since been confirmed [5], and Nylander [15, 16] has subsequently shown that the height association is with DZ twinning. Analysis of maternal height data from the present Aberdeen survey and also from the Oxford survey has in addition shown that mothers of DZ twins are taller than mothers of singletons. Mothers of MZ twins do not differ in height from mothers of singletons [9]. Therefore, an increase in maternal height might, as postulated [6], contribute to the difference in weight between DZ and MZ pairs. It would also seem that, in terms of height, mothers of DZ twins represent a separate group and, thus, body size might now possibly be included with other factors known to be associated with DZ twinning, such as increased maternal age, the number of previous births independent of age, and ethnic group. These may all represent manifestations of the relationship between pituitary function and multiple ovulation.

Acknowledgments. We are grateful to Professor E.B. Robson for advice in the preparation of this paper and to Mike Samphier and the computing staff of the MRC Medical Sociology Unit for assistance with the data. We would also like to thank the staff of the Aberdeen Maternity Hospital for their cooperation.

REFERENCES

1. Anderson WJR (1956): Stillbirth and neonatal mortality in twin pregnancy. J Obstet Gynaecol Br Emp 63:205–215.
2. Bakwin H (1973): Body-weight regulation in twins. Dev Med Child Neurol 15:178–183.
3. Bleker OP, Breur W, Huidekoper BL (1979): A study of birth weight, placental weight and mortality of twins as compared to singletons. Br J Obstet Gynaecol 86:111–118.
4. Bulmer MG (1970): "The Biology of Twinning in Man." Oxford: The Clarendon Press.
5. Campbell DM, Campbell AJ, MacGillivray I (1974): Maternal characteristics of women having twin pregnancies. J Biosoc Sci 6:463–470.
6. Corney G, Robson EB, Strong SJ (1972): The effect of zygosity on the birth weight of twins. Ann Hum Genet 36:45–59.
7. Corney G (1975): Placentation. In MacGillivray I, Nylander PPS, Corney G (eds): "Human Multiple Reproduction." London: W.B. Saunders.
8. Corney G, Robson EB (1975): Types of twinning and determination of zygosity. In MacGillivray I, Nylander PPS, Corney G (eds): "Human Multiple Reproduction." London: W.B. Saunders.
9. Corney G, Seedburgh D, Thompson B, Campbell DM, Mac Gillivray I, Timlin D (1979): Maternal height and twinning. Ann Hum Genet 43:55–59.
10. Falkner F (1978): Implications for growth in human twins. In Falkner F, Tanner JM (eds): "Human Growth," Vol. I. "Principles and Prenatal Growth." New York: Plenum Press.
11. Fox H (1978): "Pathology of the Placenta." London: W.B. Saunders.
12. Grande R, Escalante JM, Hernández JM, Ezcurdia MA (1976): Variabilidad ponderal de los recién nacidos gemelares. An Esp Ped 9:353–363.

13. MacGillivray I (1970): The changing incidence of twinning in Scotland 1939–1968. Acta Genet Med Gemellol 19:26–29.
14. Nylander PPS (1971): Biosocial aspects of multiple births. J Biosoc Sci Suppl 3:29–38.
15. Nylander PPS (1975): Factors which influence twinning rates. In MacGillivray I, Nylander PPS, Corney G (eds): "Human Multiple Reproduction." London: W.B. Saunders.
16. Nylander PPS (1975): Biosocial and clinical studies in twinning in an African and a Caucasian population. MD Thesis. University of Aberdeen.
17. Registrar-General (1969–1977): Annual Reports for Scotland for the Years 1968–1976. Edinburgh: HM Stationery Office.
18. Robson EB (1978): The genetics of birth weight. In Falkner F, Tanner JM (eds): "Human Growth." Vol. I. "Principles and Prenatal Growth." New York: Plenum Press.
19. Wilson RS (1974): Twins: Measures of birth size at different gestational ages. Ann Hum Biol 1:57–64.
20. Wilson RS (1974): Growth standards for twins from birth to four years. Ann Hum Biol 1:175–188.
21. Zazzo R (1960): "Les Jumeaux, le Couple et la Personne." Vol. 1. "L'Individuation Somatique." Paris: Presses Universitaires de France.