



Acta Genet Med Gemellol 40: 21-27 (1991)  
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Received 8 February 1990  
Final 18 April 1990

## Four-Year Follow-up of Locomotor and Language Development in 34 Twin Pairs

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**Abstract.** A group of 34 twin pairs was studied at four years of age. Characteristics of the group were a homogeneous social background, good parental interrelationship and conscientious care during pregnancy, delivery and the neonatal period. All the children were tested with the Griffiths' Mental Development Scales. The girls generally showed a higher development quotient than the boys. Birth weight seemed to be the most important factor; at 4 years of age, the twins with a birth weight of less than 2500 grams had a significantly lower locomotor quotient. The language quotient showed a similar trend. This difference was, however, not significant. No significant differences in either locomotor or language development could be observed between MZ and DZ twins.

**Key words:** Locomotor development, Language development, Mental development, Twins, Prematurity

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### INTRODUCTION

Several studies during the last 30 years have shown a lag in the development of twins compared with singletons. There has been a difference of opinion as to whether this is an inherent feature of twinning, whether it is a result of prematurity or birth trauma, or whether it could be due to postnatal factors [5-7,19].

With modern antenatal diagnosis and care, the prospects for premature infants have improved vastly [14]. Also, knowledge of the factors which determine early postnatal development both in singletons and twins have accumulated during the last decades [3,4]. We therefore considered of interest to study development in a group of 4-year twins who had been followed closely from birth. Since earlier studies have described developmental lags especially in the locomotor and language fields, our study focused on these.

## MATERIAL AND METHODS

The sample consists of 34 pairs. Their parents were asked to participate in the study during the gestation period. All gave their oral consent. The pregnant women were followed at the Department of Obstetrics and Gynecology at the Karolinska Hospital, most of them by one of the authors (PT). The main features of the check-ups were ultrasonography and examination of the cervix at regular intervals. When premature delivery seemed imminent, the women were hospitalized. The rate of cesarean section was 50%.

The parents represented a high and uniform social and educational level. As part of the antenatal psychoprophylaxis, it was pointed out to them that the twins should be treated as two individuals after birth.

Postnatally, zygosity was determined by examination of the placentas and membranes in all like-sexed twins. In those 9 pairs who were neither monochorionic, as a sign of monozygosity, or of different sex, as a sign of dizygosity, blood group tests were used to establish zygosity.

The tests administered by the first author, were modified from those developed in 1970 by Ruth Griffiths [9]. Details of the methodology as employed in this study have been published previously [1]. In short, the tests include six subscales for different development parameters. Only the subscales for language and locomotor development, as well as the scale for total development were used.

The use of Griffiths' system makes it possible to calculate quotients (quotient = mental age  $\times$  100/chronologic age) for a group of children of the same age. As such quotients have been determined for representative samples of 4-year old children in Sweden and in other countries, comparison can be made with norms calculated for these.

The tests were performed in the homes of the twin families within 7 days prior to, or 7 days after, the fourth anniversary. Both parents were usually present. One of the parents took part in the procedure, while the other looked after the other twin. It was felt that in this way, the inhibiting effect of solving tasks in front of an unknown adult could be diminished. Each total mental test lasted for about one hour. In addition, a semi-structured interview with the parents took one hour, thus every session lasted for about three hours.

## RESULTS

The distribution of the twins by sex and zygosity is shown in Table 1.

The average birth weight for the 31 male twins was 2306 g and for the 37 girls 2484 g. MZ twins were slightly heavier than DZ twins, and this may explain the difference in birth weight between males and females (Table 2). Only 3 of the 12 MZ pairs are males.

The distribution of birth weights is shown in Table 2. None of the infants weighed more than 3400 g, and only two of the twins weighed less than 1500 g (the smallest, a girl, weighed 1240 g). From Table 2, it is seen that more boys (N = 13) than girls (N = 5) weighed less than 2000 g.

**Table 1 - Distribution of twin pairs by sex and zygosity**

	MZ pairs	DZ pairs	Total
Female	8	6	15
Male	4	7	10
Different sex		9	9
Total	12	22	34

**Table 2 - Distribution of birth weights**

	Birth weight (g)			Total
	< 2000	2001-2499	> 2500	
Female twins	5	11	21	37
Male twins	13	8	10	31
Total	18	19	31	68

Fourteen of the infants (11 boys and 3 girls) were born before 37 complete gestational weeks. It is interesting to note that 23 infants (9 boys and 14 girls) weighed less than 2500 g despite the fact that they were born after 37 complete weeks.

Table 3 shows the quotients for subscales of locomotor and language performance and total development for MZ and DZ boys and girls.

The girls had significantly higher locomotor scale quotients and total mental development (general quotient). Their language performance was also better than that of the boys (Table 4). This difference, however, was not statistically significant, possibly due to the large standard deviation (particularly for the boys). There were no significant differences between MZ and DZ twins.

**Table 3 - Average quotients for locomotor, language and total development at 4 years of age related to sex and zygosity**

	N	Locomotor development		Language development		Total	
		Quotient	SD	Quotient	SD	Quotient	SD
MZ girls	16	106*	13	106	14	107	11
DZ girls	21	104**	12	112	20	106	13
MZ boys	8	93*	10	114	9	101*	7
DZ boys	23	92**	15	96**	25	94*	14
Total	68	99	13	107	17	102	11

\* p<0.05; \*\* p<0.01 (t-test).

**Table 4 - Average quotients for locomotor, language and total development at 4 years of age related to sex**

	N	Locomotor development		Language development		Total	
		Quotient	SD	Quotient	SD	Quotient	SD
Girls	37	105*	12	109	17	107*	12
Boys	31	92*	14	100	24	96*	13

\*  $p < 0.05$ ; t-test.

A comparison between infants (irrespective of sex) who weighed more or less than 2500 g at birth was made. The infants who weighed less than 2500 g at birth even at 4 years of age had significantly lower quotients in locomotor and total functions. The language development, however, was quite similar (Table 5).

**Table 5 - Average quotients for locomotor, language and total development at 4 years of age related to birth weight**

	N	Locomotor development		Language development		Total	
		Quotient	SD	Quotient	SD	Quotient	SD
< 2,500 g	37	94*	13	105	17	98*	12
≥ 2,500 g	31	105*	14	104	26	105*	14

\*  $p < 0.05$ ; t-test.

## DISCUSSION

Until recently, most studies concerning twin development have focused on the interaction between environment and inheritance. A few researchers, however, discovered interesting features of the language development in twins. Zazzo, in 1960, found that twins were older than singletons when they uttered their first words [19]. In recent years, the La Trobe study revealed that twin boys at 30 months of age were 8 months late in language development as compared with singleton boys [7]. As a consequence of this, the ability of twin boys to perform in symbolic playing was lower than that of singletons.

The observation that twins often show a delayed language development has been ascribed to the fact that they often have a special kind of communication [19]. This "twin language" has recently been studied by Hay et al [7] who found that particularly the male twins had articulation problems at 3-4 years of age. The picture is, however,

complex. In older studies concerning language development, girls generally performed better than boys [13], and Bakker [2] found that the development of an autonomous language is not unique for twins — all children may, during periods, use such a means of communication. Recent research concerning the language of twins by Savic [16] suggests that much of the failure in language development found in earlier studies is caused by factors such as prematurity, birth injury and low socioeconomic level. In fact, she suggests that the twin situation is a positive factor, and that so-called egocentric language expressions are less often seen among twins than singletons. She also thinks that the typical “twin language” is a passing phenomenon, and something which is found not only among twins.

Much less research has been done concerning the locomotor development in twins. Dales [5] used Gesell's Developmental Scales on 206 pairs of twins and compared the results with those from matched singleton controls. She found a significantly slower locomotor and language development in the twins. It is a well known fact that locomotor development in general is strongly dependent on gestational length and birth weight. Some recent studies in Sweden found developmental and locomotor deficiencies in prematurely born children even after the children had passed two years of age [8,11,12]. Most investigators agree that prematurity (defined as birth before 37 complete gestational weeks) is more important in this respect than low birth weight (defined as less than 2500 g at birth).

Generally, boys are heavier at birth than girls. In a sample of children who were investigated for the transformation of Griffiths' Developmental Scales to Swedish standards, 362 boys had an average birth weight of 3489 g vs an average of 3389 g for 363 girls [15]. Twins generally have a much lower birth weight than singletons. Ninety-eight twins at the Karolinska Hospital 1980-81 had a median birth weight of 2400 g vs an average of 3500 for all singletons. This is partly due to the fact that so many twins are born prematurely, and partly a result of a lower intrauterine growth rate in twins during the last trimester. In this context, it is important to remember that low socioeconomic status is strongly related to the development of prematurely born infants [7,17,18].

In the present study it has been possible to compare boys vs girls and prematurely born twins vs twins born near term. A few, careful comparisons may also be made between the early development of twins and singletons. We do not have matched singleton controls (the extensive protocol made such an approach impractical), but in the period during which the study took place, a Swedish study using Griffiths' Development Scales on a sample of 408 children was made [15]. The results of this study have not been published, but the quotients at 4 years of age have been established. With the permission of the authors, these figures will be used as reference (Table 6).

A comparison between the figures in Tables 5 and 6 shows that there is no difference in language, locomotor or total development at 4 years of age between twins weighing more than 2500 g and the reference group. It is also apparent, from Table 5, that twins who weighed less than 2500 g at birth (irrespective of whether it was because of prematurity or growth retardation) had significantly lower locomotor and total score. The language quotient was also low, especially when compared with the reference group (105 vs 111), but this difference was not significant.

If we look at gender differences, it is apparent from the reference material (Table 6) that girls generally perform better than boys at 4 years of age. This is even more

**Table 6 - Average Griffiths' development quotients at 4 years of age in a representative sample of 408 Swedish children**

	N	Locomotor development quotient	Language development quotient	Total quotient
Girls	205	104	112	110
Boys	203	101	110	104
Total	408	102	111	107

pronounced in our sample (Table 4). One possible explanation for this may be the fact that twice more male than female twins weighed less than 2500 g (Table 2).

Our twins did not have any significant delay in language development, as compared to singletons, when the birth weight was taken into account. This is contrary to previous results [7,19]. It is an interesting fact that at 9 months of age there was a significant lag in language development in our twin group, a lag which had disappeared at 4 years of age. None in the study group had apparent cerebral injuries and the parents of the group had a high and uniform social level. Our results, therefore, support the theory that language development is to a high degree dependent on optimal surroundings, as compared to locomotor development which is much more dependent on organic factors. Only in one of the pairs (MZ girls) an autonomous language was present.

A comparison between the performance of MZ and DZ twins showed only one significant difference. The DZ twin boys generally performed less well (Table 3). An analysis of this group shows that 7 of 23 boys were born prematurely, a fact which may explain the observed difference. We also noted that in 6 of the pairs of different sex, the boys performed less well than the girls irrespective of birth weight. It may very well be that the constellation girl-boy in a twin pair constitutes a special situation, which is important for the individual development.

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