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Decline of the Twinning Rate in Brazil

M.H. Baena de Moraes¹, B. Beiguelman¹, H. Krieger²

¹Department of Medical Genetics, School of Medicine, UNICAMP, Campinas; ²Department of Genetics, FIOCRUZ, Rio de Janeiro, Brazil

Abstract. The twinning rate during a twenty-year period (1965-1985) was investigated at five-year intervals in four Brazilian hospitals. During this period the twinning rate has decreased significantly (from 10.68‰ to 8.11‰), being highly negatively correlated with the five-year intervals ($r = -0.97$). This change was due mainly to the decline in dizygotic twinning, since the incidence of DZ twins has fallen from around 7‰ in 1965 to around 3.6‰ in 1985. The detected decline in DZ twinning seems to be due to the remotion of the fertility advantage of the more fecundable DZ twin-prone women by the introduction of effective birth control at the present, while some other mechanisms are causing the decline irrespective of the type of twinning.

Key words: Twinning rate, Fecundity, Maternal age, Parity, Contraception

It is well established that the twinning rate has declined in the United States, Canada, several countries of Europe, Japan, Australia, Chile, Venezuela, Panama and Mexico [6-8,10,12,14-22,25-27]. This change became particularly evident by the early sixties, and has been restricted to the decrease of the dizygotic (DZ) twinning rate. In contrast, the incidence of monozygotic (MZ) twins is fairly constant in most countries, at about 3 to 4 per thousand [26] or is slightly increasing in a few others [7,17].

Since data concerning the twinning rate in Brazilian population are not available, a pilot study was developed in four hospitals (two in the city of Campinas and two in the city of São Paulo, State of São Paulo, Brazil).

MATERIAL AND METHODS

The twinning rate during a period of twenty years (1965-1985) was investigated retrospectively at five-year intervals in four Brazilian hospitals (*Maternidade de Campinas* (MC), *Casa de Saúde de Campinas* (CSC), *Maternidade de São Paulo* (MSP) and *Hospital do Servidor Público do Estado de São Paulo* (HSPESP)) but only in two of them (CSC and HSPESP) were the twin pairs classified according to sex. Almost all mothers (98%) were living in urban areas (95% at Campinas or São Paulo). It should be added that the frequency of house deliveries in southern urban Brazil is rather negligible.

The twinning rate was defined as the ratio of twin pair deliveries to the total childbirths, excluding fetuses of less than 22 weeks. The numbers of DZ pairs were estimated by both Weinberg's [28] and James' [19] methods.

Racial groups, maternal age and parity (number of previous births, abortions excluded) were collected from two samples of 200 women who bore twins in two hospitals (CSC and HSPESP) during periods of high (1965-1968) and low twinning rates (1980-1983). The same data were drawn from two samples of 200 mothers of singletons who were born consecutively to the twin pairs in the same hospitals.

RESULTS AND DISCUSSION

The figures in Table 1 show clearly that between 1965 and 1985 a steady fall in twin incidence (24%) occurred in the whole sample (10.68‰ to 8.11‰), the twinning rate being almost completely and negatively correlated to the five-year intervals ($r = -0.97$). This change was due to the decline in the DZ twinning rate (Table 2), which has fallen 50% in this twenty-year period, the correlation coefficient between the DZ rate and the five-year intervals being also very high ($r = -0.90$). Thus, between 1965 and 1985 this rate decreased from 7.17 to 3.60, or from 7.68 to 3.85, according to Weinberg's or James' method, respectively.

Table 1 - Multiple birth rate (per 1,000) observed in four Brazilian hospitals during a twenty-year period (1965-1985) at five-year intervals

Year	Total births	Twins	Triplets
1965	20,044	10.68	*
1970	27,151	10.35	0.11
1975	39,196	9.95	0.10
1980	39,464	8.67	0.08
1985	26,520	8.11	0.15

* One set of quadruplets (rate = 0.05)

Table 2 - Proportion of DZ twins and DZ twinning rate during a twenty-year period (1965-1985) at five-year intervals. DZ proportions estimated according to Weinberg's [28] and James'[19] methods.

Year	Total births (N)	Twinning rate	Weinberg		James	
			DZ (%)	DZ rate (‰)	DZ (%)	DZ rate (‰)
1965	6,697	10.15	70.6	7.17	75.6	7.68
1970	5,797	10.87	60.3	6.56	64.6	7.02
1975	6,762	9.46	43.8	4.14	46.9	4.44
1980	7,993	9.26	54.0	5.00	57.9	5.36
1985	6,671	8.54	42.1	3.60	45.1	3.85

Ethnic variation of population may affect the incidence of multiple births, since twinning rate is highest among Negroids, followed by Caucasoids, and lowest among Mongoloids [1,3,14,20,23]. The same is true concerning maternal age, twinning rate among women aged 35 to 40 years being three to five times as high as among women under 20 [9].

Nevertheless, the decline in DZ twinning in the analysed samples cannot be attributed to racial composition or to reduction of maternal age. As shown in Table 3, no significant differences were observed among ethnic groups ($\chi^2 = 3.900$, $df = 2$, $0.10 < P < 0.20$) and no significant heterogeneity among periods ($\chi^2 = 2.945$, $df = 2$, $0.20 < P < 0.30$) or age ($F_{(1;796)} = 1.89$; $P > 0.05$ for types of mothers; $F_{(1;796)} = 3.41$; $P > 0.05$ for periods; $F_{(1;796)} = 0.05$; $P > 0.05$ for interaction) in the four collections of mothers sampled in periods of high and low twinning rates.

Table 3 - Mothers of twins and of singletons sampled in periods of high (1965-1968) and low twinning rates (1980-1983) according to racial group

Racial group	Mothers of twins		Mothers of singletons	
	1965-1968	1980-1983	1965-1968	1980-1983
Caucasoid	162	162	177	164
Negroid	36	38	21	34
Mongoloid	2		2	2
Total	200	200	200	200
Mean age \pm SD	29.04 \pm 6.19	28.35 \pm 5.78	28.55 \pm 5.85	27.67 \pm 6.22

The absence of significant differences concerning maternal age may be due to the small samples. In fact, the face values of Table 3 indicate that mothers of twins tend to be older than mothers of singletons, independent of the examined period.

Moreover, women who bore twins or singletons in 1965-1968 tend to show a higher mean age than the corresponding women in 1980-1983. At any rate, in spite of these tendencies, the reduction of maternal age is too small to play an important role in the decline of twin births in Brazil.

Table 4 - Distribution according to parity of the mothers of twins and of singletons sampled in periods of high (1965-1968) and low twinning rate (1980-1983)

Parity	Mothers of twins		Mothers of singletons	
	1965-1968	1980-1983	195-1968	1980-1983
0	46	70	62	80
1	48	59	53	57
2	41	35	43	34
3	16	16	20	14
4	15	7	7	8
5	8	4	8	3
6	6	3	2	2
7	10	2	1	
8	4	1	2	2
9	1		1	
10	2	1		
11	1	1	1	
12	2	1		
Total	480	298	322	242
Mean	2.40	1.49	1.61	1.21

As shown in Table 4, a role is beyond any doubt played by parity. Parity has decreased significantly since 1965 among both mothers of twins ($t = 6.526$; $P < 0.001$) and of singletons ($t = 3.368$; $P < 0.001$). Besides, the difference between the number of previous children born to mothers of twins and to mothers of singletons in 1965-1968 was 2.8 times as large as that observed in 1980-1983 ($((480 - 322)/(298 - 242) = 2.8)$).

A factorial analysis of variance of parity applied on these data has shown results indicating that both twinning ($F_{(1,796)} = 15.00$; $P < 0.0005$) and periods ($F_{(1,796)} = 22.40$; $P < 0.0005$) effect parity without interaction ($F_{(1,796)} = 3.21$; $P > 0.05$), thus indicating that the parity change in this period was large enough to account for the observed decline in the twinning rate.

It is known that twins tend to occur in larger families because twin-prone women have high fecundity, and not by numerical odds [2,5,9,21]. On the other hand, the contraceptive methods used during the sixties by Brazilian fertile couples were very inefficient, consisting [4] of coitus interruptus (42.7%), condom (28.1%), acid pellets (15.5%), vaginal washing (10.7%), and abstinence at fertile days (3.0%).

In contrast, between 1980-1983 a high proportion of efficient contraceptive methods were used (about 50% of women who bore twins or singletons). They were as follows: oral contraceptives (75.2%), abstinence at fertile days (16.8%), condom (3.2%), coitus interruptus (3.2%), intrauterine device (0.8%), and vaginal washing (0.8%).

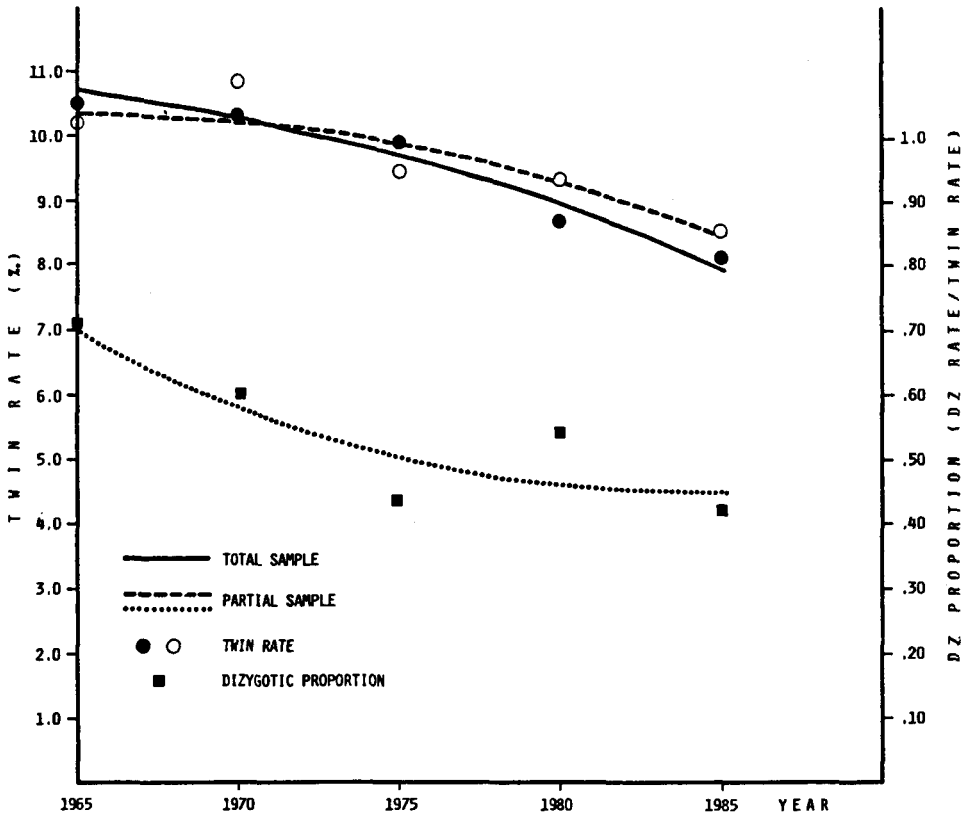


Figure. Distribution of twinning rates for the total sample and partial sample and of the DZ proportion (DZ rate/twin rate) and their respective regression plots.

Therefore, it seems that the most obvious interpretation for the decline of DZ twinning in the Brazilian data is that the fertility advantage of the more fecundable Brazilian DZ twin-prone women is being removed by birth control. This advantage would be stressed in the sixties by inefficient contraception, which would increase the relative birth-rate for twin-prone couples [11]. With efficient contraceptive methods, the actual fecundity of twin-prone couples tends to be reduced to the same fecundity as that of other couples with the same socioeconomic and cultural level by the limitation of family size at a desired number.

Other possible explanations for the decrease of parity and decline of DZ twin-

ning in Brazil may be cooperative rather than alternative to the above hypothesis. Such may be the influence of pesticides and stilboestrol [15,18], the increasing rate of spontaneous abortions [24], psychological stresses of modern industrial life [26,27], long-term effects of oral contraceptives [13], or the decline of sperm quality [20].

The quadratic weighted regressions of twinning rates, based both on the total sample (Table 1) and on the sub-sample with sex-information (Table 2), and of the DZ proportion of twins fit rather well to the observed data (see Figure):

$F_{(2;149,372)} = 1.8 \times 10^6$, $r^2 = 0.96$ for the whole sample;

$F_{(2;33,917)} = 70,771$, $r^2 = 0.81$ for the partial sample;

$F_{(2;33,917)} = 54,531$, $r^2 = 0.76$ for the DZ proportion.

Although the alternative and/or concomitant explanations for the twinning rate decline cannot be tested in the present data, it should be kept in mind that the results shown in the Figure strongly suggest that the mechanisms which caused the decline of the DZ proportion are becoming unimportant, since this proportion shows a stabilising trend which, if true, signify that the twinning rate is declining as a whole, irrespective of the type of twinning.

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Correspondence: Professor Bernardo Beiguelman, Dept. of Medical Genetics, Faculty of Medical Sciences UNICAMP, CP 1170, 13081 Campinas, SP, Brazil.