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The Factors That Influence Twinning Rates

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In a study carried out in an African population in Western Nigeria and a Caucasian population in Aberdeen, Scotland, it was found that DZ twinning rates varied with maternal age and parity, the MZ twinning rate remaining fairly constant. However, women aged 30-34 were found to have the highest rate in Western Nigeria whereas the peak in Aberdeen population occurred in the older age group, 35-39 years. Other factors that influenced DZ twinning rates were maternal height, social class and ethnicity (in the Nigerian population), and illegitimacy (in the Aberdeen population). No significant association was found between twinning and maternal blood groups or season of the year in either of the two populations. An important factor that also influenced twinning in the two populations was the maternal serum FSH level. The levels were much higher in the Nigerian population than in the Aberdeen population. Furthermore, in the Aberdeen population, twin-prone and non-twin-prone women had similar serum FSH levels, whereas the levels were much higher in twin-prone women in the Nigerian population. This finding is consistent with the fact that the Nigerian population has a much higher twinning incidence (approximately 50 per 1,000 maternities) than Aberdeen population (approximately 12 per 1,000 maternities).

Key words: Twinning rate, Maternal age, Parity, Maternal height, Social class, Illegitimacy, Seasonality, Maternal blood groups, FSH level, Twin proneness, Fecundability

INTRODUCTION

It is well known that a number of factors influence the incidence of twinning. While it is generally accepted that twinning rates vary with maternal age and parity, the role played by other factors such as maternal height, social class, blood groups, and seasons of the year is uncertain. In this paper, the results of recent studies carried out in populations in Western Nigeria and Aberdeen (Scotland) will be presented to illustrate the influence of various factors on monozygotic (MZ) and dizygotic (DZ) twinning rates.

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Two populations were investigated in the Western Nigeria study—the populations of Ibadan, a large city in Western Nigeria and that of Igbo-Ora, a rural area in the same region. The investigation in the Ibadan studies included 1,052 newborn twin pairs delivered in three hospitals in the city in 1967 and 1968 and 15 healthy mothers in the city who participated in the hormone studies in 1972. Zygosity of the newborn twins was determined in individual twin pairs by sex, blood groups, red cell, and placental enzyme studies and examination of the placenta [15, 16]. In the Igbo-Ora study, twin births in the total rural population between 1964 and 1968 were studied. Zygosity was determined by the use of Weinberg's formula.

In the Aberdeen study, data on the total population of 608 pairs of twins born in the city between 1950 and 1965 were analyzed. Zygosity was determined in 440 pairs, consisting of all unlike-sexed twins but only those like-sexed twin pairs living in Aberdeen in 1965 and 1966, by sex, blood group studies, similarity in general appearance, and fingerprinting [17]. Forty-seven Aberdeen mothers participated in the hormone studies in 1974 [19, 20].

INCIDENCE OF TWINNING

Table 1 shows the incidence of twinning in the Western Nigeria and Aberdeen populations. The Ibadan twinning rate of 57.2 per 1,000 maternities is higher than that in the general population in Western Nigeria because of hospital selection factors. The incidence in Igbo-Ora (48.3) is more representative of the general population and is approximately four times that in the Aberdeen population. The MZ twinning rates in Igbo-Ora and Aberdeen are 4.1 and 4.2 per 1,000 maternities, respectively. The difference in the twinning rates in the two populations is thus due to the enormous difference in their DZ twinning rates (44.1 in Ibadan versus 8.2 in Aberdeen).

TABLE 1. Incidence of Twins in Ibadan, Igbo-Ora, and Aberdeen

	Western Nigeria		
Maternities	Ibadan	Igbo-Ora	Aberdeen
Twin maternities	1,052	290	608
Total number of maternities	18,400	6,010	49,000
Twinning rates per 1,000 maternities	57.2	48.3	12.4

TABLE 2. Incidence of Twinning in Igbo-Ora in Relation to Maternal Age (1966–1969)

		Twinning rates* per 1,000 maternities		
Maternal age	Total no. of maternities	Total	MZ	DZ
Under 25	1,128	26	4.2	32.3
25–29	1,385	46		
30–34	1,089	77	4.7	72.8
35–39	297	71		
40 and over	71			

*Rates based on less than ten twin maternities have been omitted.

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THE INFLUENCE OF MATERNAL AGE AND PARITY ON TWINNING

Figure 1a, Table 2, and Figure 1b show the relationship between twinning rates (MZ, DZ, and total) and maternal age in Ibadan, Igbo-Ora, and Aberdeen. In the Ibadan population, the monochorial twinning rates have also been included, since the accuracy in zygosity determination in this group of twins is practically 100%. In the Aberdeen population, the twinning rate rises with maternal age up to a peak (at 35–39 years) and then falls, the increase being due mainly to variation in DZ twinning rates. In the Nigerian population, a similar rise is seen, but the peak is at the age group 30–34 years. A small rise of twinning rate with maternal age is also seen in the MZ and the monochorionic groups of twins but the increase is slight. The increasing incidence of DZ twinning with maternal age is probably due to increasing ovarian activity possibly under hormonal stimulus causing increased double ovulation, the fall in incidence occurring because of exhaustion of the Graafian follicles as menopause approaches. Since women usually begin childbearing much earlier in Nigeria than in Europe, it is possible that ovarian activity reaches a peak at an earlier age in Nigeria, thus accounting for the difference in pattern between the Ibadan and Aberdeen populations. It may be felt that the small rise in the MZ twinning rate with age in the Ibadan population is due to inclusion of some DZ twins in the MZ group, thereby reflecting the inability of the markers used in zygosity determination to diagnose monozygosity completely. This, however, cannot be entirely responsible for the rise since the monochorionic twinning rate (which refers only to MZ twins) also rises slightly with age. Some other investigators have found a small but definite rise of MZ twinning rate with maternal age [6, 12, 14].

Figures 2a and 2b and Table 3 show the variation of twinning rates with parity. In all the three populations, there is a rise of DZ twinning rates with parity, the MZ twinning rates remaining fairly constant. Since the incidence of twinning increases with maternal age and also with parity, and since the higher parity women

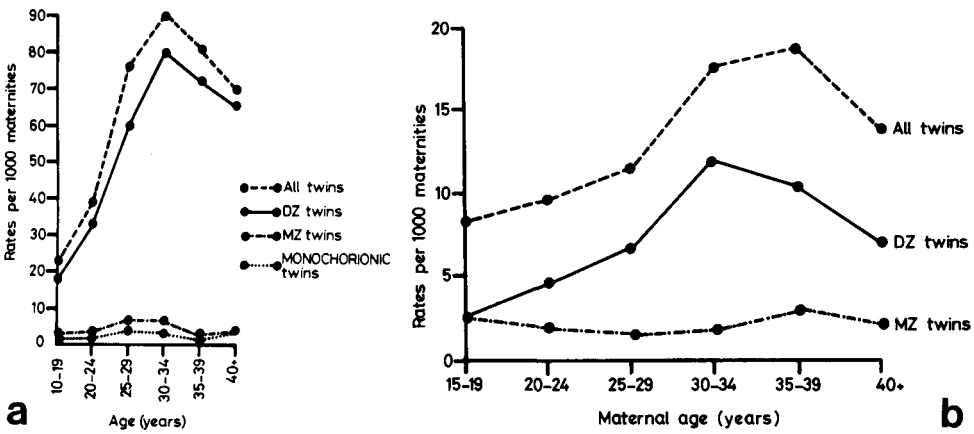

Fig. 1a. Incidence of twinning in Ibadan in relation to maternal age.

Fig. 1b. Incidence of twinning in Aberdeen in relation to maternal age.

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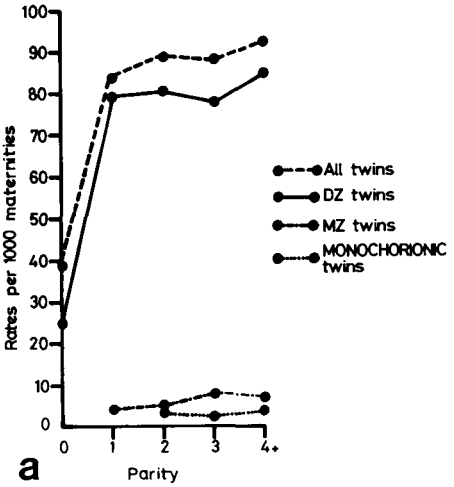


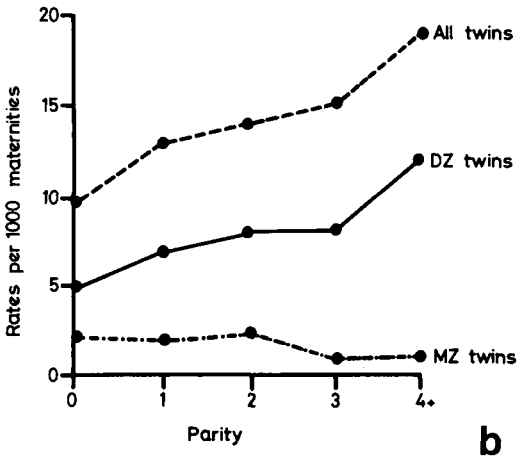
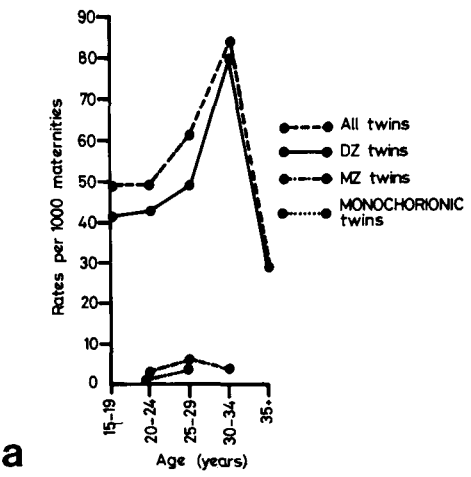


Fig. 2a. Incidence of twinning in Ibadan in relation to parity.

Fig. 2b. Incidence of twinning in Aberdeen in relation to parity.



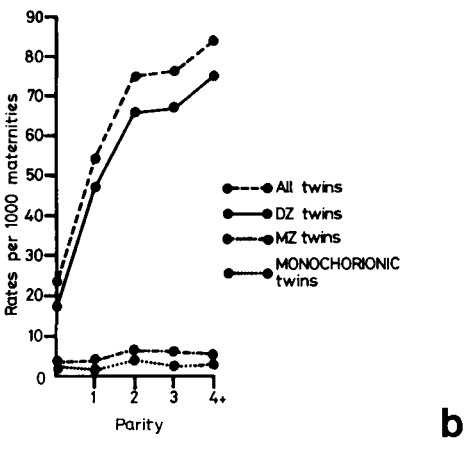


Fig. 3a. Incidence of twinning in Ibadan primiparae by maternal age.

Fig. 3b. Incidence of twinning in Ibadan 30–34-year-old women by parity.

TABLE 3. Incidence of Twinning in Igbo-Ora in Relation to Parity (1966–1969)

		Twinning rates per 1,000 maternities		
Parity	Total no. of maternities	Total	MZ	DZ
0	893	19	4.3	36.6
1	431	42		
2	964	60	4.7	69.2
3	683	73		
4 and over	589	75		

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are older, it may be thought that the rise in incidence with maternal age is merely a reflection of increasing parity and vice versa. A study of twinning rates in each birth order, however, shows that the rise with maternal age is independent of parity. Similarly, the rise in twinning rates with parity occurs independently of maternal age. Figures 3a and 3b illustrate this finding.

VARIATION WITH MATERNAL HEIGHT

The relationship between maternal height and twinning is shown in Tables 4, 5, and 6. In the Ibadan population, there is a marked gradient of twinning with maternal height, which persists after standardization for maternal age and parity. This gradient is due to variation in the DZ twinning rate, the MZ rate being fairly constant. The height gradient, which can be seen in the group of women with twins whose zygosity has not been determined (Table 4), is probably due to the overwhelming proportion of DZ twins in this group. There is evidence that twinning may be influenced by the standard of nutrition; for example, in sheep the better fed ewes have a higher twinning rate than those that are poorly fed [11, 25]. Also, the findings of Bulmer [3] of a fall in the DZ twinning rates in some coun-

TABLE 4. Incidence of Twinning in Relation to Maternal Height in Ibadan (1967–1968)

	No. of twin maternities	Twinning rates per 1,000 maternities in maternal height groups		
		Short	Medium	Tall
MZ twins	84	5.1	4.3	4.3
DZ twins	874	44.7	50.7	57.6
Twins with undetermined zygosity	56	1.6	2.7	5.4
All twins	1,014	51.4	57.7	67.4

TABLE 5. Incidence of Twinning in Relation to Maternal Height in Aberdeen (1950–1965) by Zygosity

	No. of twin maternities	Twinning rates per 1,000 maternities in maternal height groups		
		Short	Medium	Tall
MZ twins	95	1.9	1.8	2.2
DZ twins	345	6.5	6.9	7.3
Twins with undetermined zygosity	168	3.5	3.3	3.4
All twins	608	12.0	12.0	12.9

TABLE 6. Incidence of Twinning in Relation to Maternal Height in Aberdeen by Time

Population	Total no. of maternities	Twinning rates per 1,000 maternities in maternal height groups		
		Short	Medium	Tall
1950–1955	15,049	11.9	13.8	14.9
1956–1965	32,979	12.0	11.2	12.0

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tries in Europe during the years of deprivation during the war followed by a rise when conditions returned to normal, is indirect evidence that twinning may also be influenced by nutrition in man. It is, therefore, reasonable to expect the tall, better-nourished women in a population to have a higher twinning rate than the short, poorly-nourished women. The lower DZ twinning rate in the short women in Ibadan may be due to the possibility that women living in these conditions are not only stunted in growth but they are also under-nourished, a factor normally associated with a lowered twinning rate.

The association of the twinning incidence with maternal height in the Aberdeen population is not very definite. Although Table 5 shows that there was a small gradient of twinning rates with height (due to variation in the DZ twinning rate) when the whole period of study (1950–1965) is considered [see also 1 and 8], the finding that there was no association between twinning rates and height in this population between 1956 and 1965 (Table 6) suggests that some other factor may be operating in the population. It is likely that the influence of such a factor was temporary since Campbell et al [8] showed that the gradient of twinning rates with height (in favor of the taller women) reappeared in the same population between 1966 and 1969.

VARIATION WITH SOCIAL CLASS

Tables 7, 8, and 9 show the relationship between twinning and social class in Ibadan and Aberdeen. In Ibadan, the population has been divided primarily into two broad groups—those who are literate and those who are not. The illiterate group consists mainly of farmers and traders belonging to the lowest social class (Group C). The literate group is further subdivided into two groups—A, including wives of professionals, teachers, typists and other "white collar" workers, and B, consisting mainly of manual workers. Table 7 shows that the twinning rate in the lowest social class (C) is over twice that in classes A and B.

The finding of a higher twinning rate in women in the lowest social class (illiterate women) in Ibadan appears to contradict the previous finding that the shorter, poorly nourished women have a lower twinning rate than the taller better nourished ones. However, Table 8 shows that there is no gradient of twinning with height in women in the upper social classes (the literate women) probably because the shorter women in this group are small as a result of hereditary factors and not because of under-nutrition. It appears that it is in the illiterate women (most of whom are stunted in growth, probably because of malnutrition) that the gradient of twinning and height occurs (the medium and tall women having a higher twinning rate than the shorter women). Again, it is the variation in the DZ twinning rate that is responsible for the gradient in twinning rates and social class in Ibadan, there being no such gradient in the MZ twinning rate.

In the study of the twinning rate in relation to social class in Aberdeen (Table 9), no gradient has been observed. This finding is in agreement with those of previous investigators [1, 8]. Smith [23] has reported a gradient of twinning with social class for the population of Scotland as a whole in favor of the lower social class. Smith has attributed this finding to a higher proportion of highly-parous mothers (who have a high twinning rate) in the lower social classes, since he was unable to show any such gradient when data for each birth order was examined separately.

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TABLE 7. Incidence of Twinning by Social Class: Ibadan

Twinning rate per 1,000 maternities	Social class A	B	C
Total twinning rate	28.1	30.4	61.6
MZ twinning rate	5.6	1.7	4.4
DZ twinning rate	19.6	25.2	54.2
No. of maternities	1,991	1,150	4.320

TABLE 8. Incidence of Twinning by Social Class and Height in Yoruba Women Delivered in U.C.H. and Oke-Offa Hospital, Ibadan

	Literate group			Illiterate group		
	Short	Medium	Tall	Short	Medium	Tall
Incidence per 1,000 maternities	31.4	25.8	30.1	57.8	74.4	65.2
No. of maternities	541	1,200	631	1,125	1,639	675

TABLE 9. Incidence of Twinning by Husband's Occupational Group: Aberdeen

Twinning rate per 1,000 maternities	Occupational group Nonmanual	Skilled manual	Semi- and unskilled
Total twinning rate	11.8	13.5	10.9
MZ twinning rate	1.9	2.8	1.6
DZ twinning rate	6.4	7.6	6.0
Others	3.5	3.1	3.4
No. of maternities	12,249	20,214	12,723

SEASONAL VARIATION

Tables 10, 11, and 12 show the incidence of twinning by month in Ibadan, Igbo-Ora, and Aberdeen. There are no significant differences from the rainy season (May–October) to the dry one (November–April), both in Ibadan and in Igbo-Ora, but it appears that the twinning incidence during the rainy season is high in Ibadan and low in Igbo-Ora. However, differences in utilization of hospital services in Ibadan by mothers of twins and singletons during the rainy and dry seasons may be responsible for the *apparent* seasonal variation in the incidence of twinning. This factor may account for the findings in this study and in that of Knox and Morley [13].

No significant seasonal variation in twinning rates has been found in the Aberdeen study. This finding agrees with those of Bender [2] and of Smith [23] in his analysis of twin maternities for Scotland.

If the hypothesis of Timonen and Carpen [24] that the frequency of double ovulation increases during the summer months (as a result of higher output of gonadotrophin by the pituitary in its response to light) is correct, one would expect a higher frequency of conceptions of twin pregnancy in summer. Although

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TABLE 10. Incidence of Twinning by Month of Birth in Ibadan Hospitals (1967–1969)

Month	No. of twin maternities	Total no. of maternities	Rate of twinning per 1,000 maternities
January	67	1,247	53.7
February	57	1,114	51.2
March	87	1,497	65.5
April	140	2,220	63.1
May	125	2,204	56.7
June	124	1,950	63.6
July	99	1,819	54.4
August	126	1,448	87.0
September	101	1,791	56.4
October	122	1,987	61.4
November	100	1,961	51.0
December	103	2,050	50.2
May–October	697	11,199	62.2
November–April	565	10,089	56.0

TABLE 11. Incidence of Twinning by Month of Birth in Igbo-Ora (1967–1969)

Month	No. of twin maternities	Total no. of maternities	Rate of twinning per 1,000 maternities
January	17	282	60.2
February	9	251	35.9
March	18	274	65.7
April	13	283	45.9
May	17	290	58.6
June	7	271	25.8
July	18	299	60.2
August	18	257	70.0
September	9	246	36.6
October	12	244	49.2
November	19	234	81.2
December	14	261	53.6
May–October	81	1,607	50.4
November–April	90	1,585	56.8

there is variation in the gestation periods in singleton and twin pregnancies, the *average* duration of gestation in twin pregnancy is approximately 36 weeks [22]. A higher frequency of conceptions of twin pregnancy in summer will therefore be likely to give rise to a higher twinning rate about springtime (ie, 36 weeks later). The findings in the Aberdeen study show that the frequency of twinning is highest during Spring (13.8 per 1,000 maternities), but the differences in twinning rates between the different seasons are not significant. It is possible that a significant variation may be found if large numbers—for example, national statistics, were used, as in the investigation of Timonen and Carpen [24].

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TABLE 12. Incidence of Twinning by Month of Birth in Aberdeen (1961–1965)

Month	No. of twin maternities	Total no. of maternities	Twinning rate per 1,000 maternities	
January	18	1,305	13.6	1.0
February	11	1,199	9.1	10.4
March	10	1,263	7.9	
April	20	1,275	15.4	
May	16	1,310	12.1	13.8
June	17	1,263	13.3	
July	14	1,240	11.2	
August	16	1,259	12.5	13.3
September	20	1,266	15.6	
October	15	1,364	10.9	
November	15	1,169	12.7	12.2
December	16	1,230	12.8	

TABLE 13. Incidence of Twinning in Relation to Maternal Blood Groups in U.C.H., Ibadan (1967–1968)

Blood group	No. of twin maternities	Total no. of maternities	Twinning rate per 1,000 maternities
A	52	667	78.0
B	57	703	81.0
AB	9	87	103.4
O	113	1,576	71.7
Rh positive	217	2,831	76.7
Rh negative	14	202	69.3

TABLE 14. Incidence of Twinning in Relation to Maternal Hemoglobin Types in U.C.H., Ibadan (1967–1968)

Hemoglobin type	No. of twin maternities	Total no. of maternities	Twinning rate per 1,000 maternities
AA	141	1,945	72.5
AS	46	671	68.6
SS + SC	6	120	50.0
Others (EE, etc)	9	120	75.0

VARIATION WITH BLOOD GROUPS AND HEMOGLOBIN TYPE

Tables 13, 14, and 15 show the twinning rates of mothers of different blood groups and hemoglobin types in Ibadan and Aberdeen.

In both the Ibadan and Aberdeen studies, no significant association of twinning rates with blood groups has been found. The studies have, therefore, not confirmed previous suggestions of an association of twinning with blood group B [eg, 5] or blood group O [eg, 10, 21]. Also, no association has been found between twinning and hemoglobin types in the Ibadan population.

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TABLE 15. Incidence of Twinning in Relation to Maternal Blood Groups in Aberdeen

Maternal blood group	No. of twin maternities	Total no. of maternities	Twinning rate per 1,000 maternities
A	131	10,249	12.8
B	32	3,047	10.5
AB	13	953	13.6
O	173	14,728	11.7
Rh positive	286	25,175	11.4
Rh negative	63	5,447	11.6

TABLE 16. Twinning Incidence in Illegitimate and Legitimate Maternities in Relation to Maternal Age (Aberdeen)

	Twinning rate	
Maternal age (yrs)	Illegitimate maternities	Legitimate maternities
15–24	10.1	9.3
25–34	18.8	13.7
35 and over	28.6	16.8
All ages	14.9	12.3
Total no. of maternities	2,424	46,116

TABLE 17. Twinning Incidence in Illegitimate and Legitimate Maternities in Relation to Parity (Aberdeen)

	Twinning rate	
Parity	Illegitimate maternities	All maternities
0	11.0	9.7
1 and 2	17.7	12.9
3 and over	32.6	16.2
All parities	14.9	12.3
Total no. of maternities	2,424	46,116

TWINNING INCIDENCE IN ILLEGITIMATE AND LEGITIMATE MATERNITIES

An interesting finding in the present study is the higher twinning rate among illegitimate mothers who delivered in Aberdeen, which persists when the data are analyzed for each age and parity group separately (Tables 16 and 17). This finding is in agreement with that of Erikson and Fellman [9] who found a higher twinning rate among illegitimate mothers in Finland. It is probable that the higher rate is due to high fecundity in such mothers, which also makes them more likely to have twins. The higher twinning rate found by Bulmer [4] in women during their first three months of marriage is also indirect evidence that high fecundity and twin proneness may be associated.

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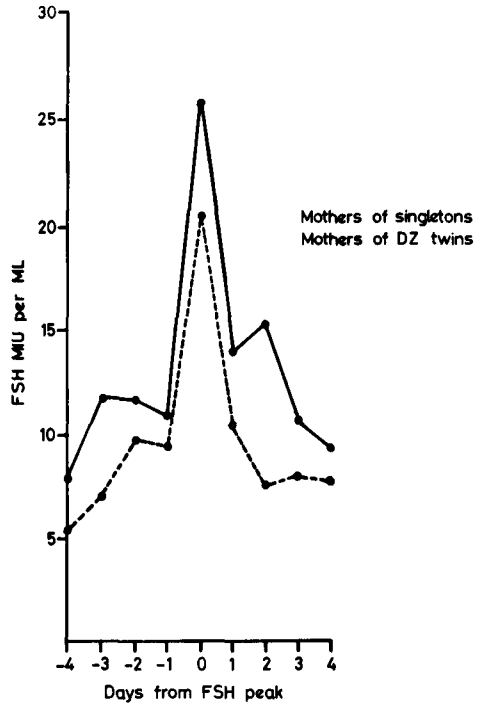

Fig. 4. Mean FSH values in mothers of singletons and of twins.

ENDOCRINOLOGICAL FACTORS IN RELATION TO TWINNING

The association between serum pituitary gonadotrophin levels and twinning was investigated in the Ibadan and Aberdeen populations. Figure 4 shows the mean serum FSH levels in two groups of Ibadan women, viz: those who are twin-prone (ie, those who have had twins previously) and those who are not (ie, those who have had only singletons previously) [18]. The levels are higher in the twin-prone than in the non-twin-prone women on each day of the menstrual cycle. In Figure 5, the mean FSH levels are shown for three groups of women, viz: (a) those who are highly twin-prone, having had two sets of twins previously; (b) twin-prone women who have had only one set of twins; and (c) non-twin-prone women who have had singletons only.

The levels are highest in women of group a and lowest in those of group c. The mean serum LH levels are shown for the same group of Ibadan women in Figure 6. There does not appear to be the same consistent trend between LH levels and twinning tendency as is seen for FSH, there being considerable overlap in mean LH levels between the twin-prone and non-twin-prone women.

The results of a similar investigation of serum FSH levels and twinning in the Aberdeen women are shown in Figure 7. There does not appear to be any convincing association between mean FSH hormone levels and twinning in these mothers. Furthermore, the mean FSH levels in the Aberdeen mothers are considerably lower than corresponding levels in their Nigerian counterparts.

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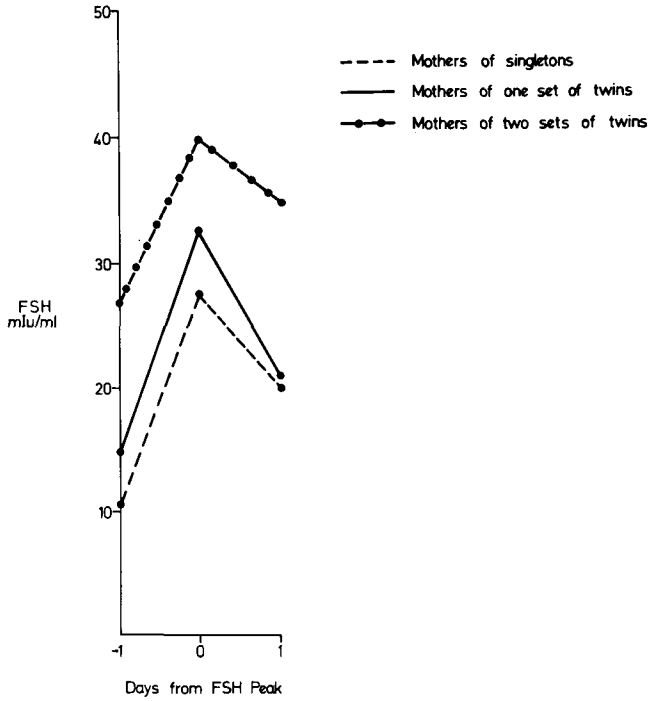

Fig. 5. Mean FSH values in mothers of singletons, and in mothers of one set and of two sets of twins.

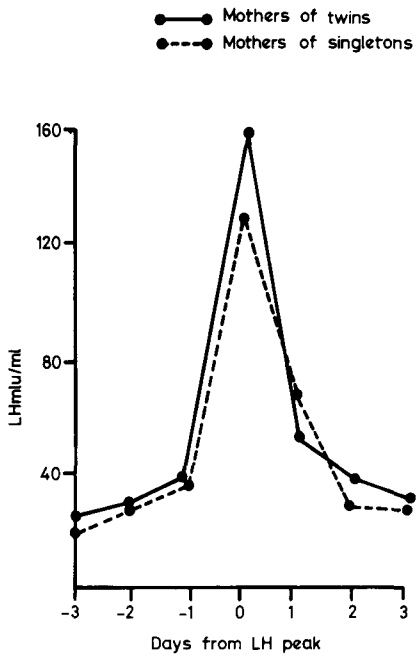

Fig. 6. Mean LH values in mothers of singletons and of twins.

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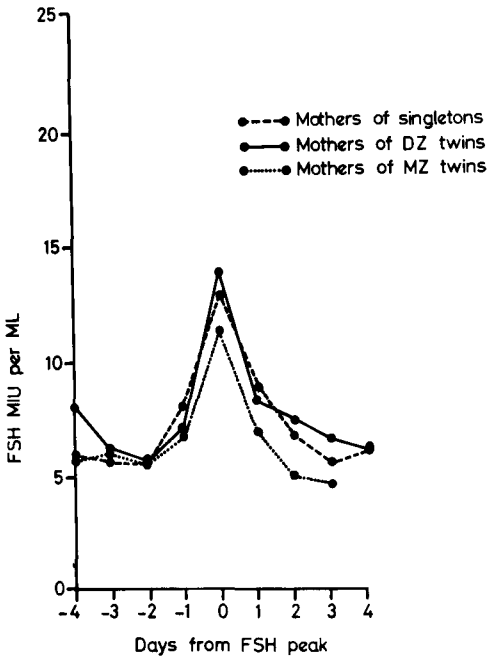

Fig. 7. Mean FSH values in mothers of singletons, of MZ twins, and of DZ twins in Aberdeen, Scotland.

It is therefore apparent that high serum FSH levels are associated with increased tendency to twinning. This finding is consistent with experience in clinical practice that administration of exogenous FSH or similar drugs (eg, fertility pills) may cause multiple ovulation and increase the probability of multiple births.

These and other findings not described here [see 18] suggest that some environmental factor (eg, a substance in the diet) may be acting like a fertility pill in the Nigerian population causing high serum FSH levels and increased tendency to multiple births [20].

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