

Maternal Blood Groups and Differential Fertility: A Hospital Survey from Lahore

Pages with reference to book, From 2 To 7

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Abstract

The present study is based on a sample of 587 mothers and 1656 pregnancies. The results show that O-positive and B-positive mothers are more successful in reproduction and indicate low percentage of prenatal loss (stillbirths+abortions) than mothers from other ABO groups. Favourable age of marriage for O-positive and B-positive mothers is suggested between 15-22 years and 23-30 years respectively. Rh-negative mothers show significantly low livebirths, but higher prenatal loss than Rh-positive mothers.

Rh-negative mothers (AB- + B- than A- ± 0-) have significantly higher male births than in Rh-positive mothers. (AB + B+ than A++0+). (JPMA 32:2, 1982).

Introduction

ABO blood groups in man have been studied for their frequency distribution, association with diseases and maternal-foetal incompatibility. Brues (1954) was of the opinion that the ABO blood group polymorphism is maintained by natural selection, for which she constructed a system of selection coefficients favouring compatible A0, B0 and AB zygotes. Chung and Morton (1961) suggested that her method cannot distinguish between differential fertility and mortality. They found that maternal-foetal incompatibility significantly reduces fertility and causes elimination of incompatible zygotes. It is difficult to collect family data for the examination of reproductive differences in reciprocal matings. Efforts have been made to detect differences in fertility associated with the ABO blood groups from the records of the Blood Transfusions Service (Bennett and Walker, 1955). The present study on differential fertility and maternal blood group is based on a sample women admitted to local hospitals.

Material and Subjects

Data were collected from Sir Ganga Ram Hospital and Lady Willingdon Hospital, Lahore. Married women admitted in the hospitals at the time of survey were typed for A-B-0 and Rh-(positive and negative) blood groups. They were interviewed to obtain information regarding age at the time of the first birth and in the successive births; number of children born, their sexes and birth order; number of stillbirths, abortions and Postnatal deaths.

The number of mothers scored was 587. The number of pregnancies recorded was 1656, of which 1247 were livebirths (648 males; 599 females), 159 stillbirths and 250 abortions.

Results

Maternal ages were grouped into 5 classes (<15-18, 19-22, 23-26, 27-30 and 31-34+ years).

Table I

Distribution of ABO Mothers in Different Age Groups.

Maternal age (years)	O		A		B		AB		Total
	+	-	+	-	+	-	+	-	
<15-18	37	3	27	5	47	4	17	1	141
19-22	53	7	37	8	71	12	21	4	213
23-26	33	3	27	6	49	7	7	3	135
27-30	21	2	18	5	14	11	4	—	75
31-34+	3	1	5	1	11	—	—	2	23
Total	147	16	114	25	192	34	49	10	587
%	25.04	2.73	19.42	4.26	32.71	5.79	8.35	1.70	

Table I gives the distribution of maternal blood groups in different age groups. The highest percentage of mothers is associated to B+ (32.71) and O+ (25.04) blood groups. The lowest representation is that of AD- (1.70%) mothers. The sample shows the highest number of Rh+- mothers (85.52%). Livebirths, deaths, stillbirths, abortions and total number of pregnancies in each maternal age group for different ABO blood groups are shown in Table II.

Table II

Distribution of Livebirths (L), Deaths (D) Stillbirths (SB), Abortions (Ab), Prenatal Loss (PL) and Pregnancies (P) in Different Age Groups of ABO-Mothers.

Maternal age (years)	Maternal Blood Groups								Total
	O		A		B		AB		
	+	-	+	-	+	-	+	-	
<15-18									
L	109	6	77	19	134	15	38	4	402
D	13	3	13	4	27	0	6	2	68
SB	11	1	10	3	9	4	3	0	41
Ab	14	2	11	7	24	3	9	0	70
PL%	18.65	33.33	21.43	34.48	19.76	31.82	24.00	0.00	21.59
P	134	9	98	29	167	22	50	4	514
19-22									
L	128	19	77	8	148	21	55	8	464
D	28	0	12	0	16	2	9	3	70
SB	11	1	15	0	25	8	11	2	73
Ab	18	6	16	2	30	5	8	1	68
PL%	18.47	26.92	28.70	20.00	27.09	38.23	25.67	27.27	22.52
P	157	26	108	10	203	34	74	11	623
23-26									
L	52	4	32	16	86	17	11	3	221
D	6	1	10	6	16	2	0	0	41
SB	7	0	7	1	11	2	0	3	31
Ab	11	2	19	8	11	2	4	2	59
PL%	25.71	33.33	44.83	36.00	20.37	19.05	26.67	62.50	22.71
P	70	6	58	25	108	21	15	8	317
27-30									
L	22	0	29	6	38	8	9	0	112
D	6	0	4	0	5	0	2	0	17
SB	3	0	4	0	1	5	0	0	13
Ab	5	4	3	1	4	5	4	0	26
PL%	26.62	100.00	19.44	14.29	12.19	55.58	30.77	0.00	26.17
P	30	4	36	7	41	18	13	0	149
31-34+									
L	5	3	8	3	25	0	0	4	48
D	2	1	2	0	6	0	0	2	13
SB	0	0	0	0	1	0	0	0	1
Ab	0	1	1	2	4	0	0	1	9
PL%	0.00	25.00	11.11	40.00	16.67	0.00	0.00	20.00	17.24
P	5	4	9	5	30	0	0	5	58
Total									
L	316	32	223	52	431	61	113	19	1247
%	79.80	65.31	72.17	68.42	78.22	64.21	74.34	67.86	75.30
D	55	5	41	10	70	4	17	7	209
%	17.40	15.62	18.38	19.23	16.24	6.56	15.04	36.84	16.76
SB	32	2	36	4	47	19	14	5	159
%	8.08	4.08	11.85	5.26	8.53	20.00	9.21	17.86	9.61
Ab	48	15	50	20	73	15	25	4	250
%	12.12	30.61	16.18	26.31	13.25	15.79	16.45	14.28	15.09
PL	20.20	34.69	27.83	31.58	21.81	35.79	25.66	32.14	24.70
P	396	49	309	76	551	95	152	28	1656
%	23.91	2.96	18.66	4.59	33.27	5.74	9.18	1.69	

TPercentages of livebirths, stillbirths and abortions were calculated by dividing with the total number of pregnancies in each class, and percentage deaths from the total number of livebirths. The highest livebirths are seen in O+ (79.80%) and B (78.50%) mothers respectively. The lowest percentage of births (64.21) is in B- mothers. Mothers with O-, A-, B- and AB- blood groups indicate comparatively

less number of livebirths than their positive counterparts. The highest percentage of postnatal deaths of offspring are seen in AB- mothers (36.86%) and the lowest in B- mothers (6.56%). The stillbirth rates are higher in B- mothers (20.00%) and the lowest in O- mothers (4.08%). Abortions are the highest in O- mothers and the minimum in O+ mothers (12.12%). Total prenatal loss (stillbirths+abortions) observed is the highest in B- mothers (35.79%) and O mothers (34.69%) while the lowest prenatal loss is seen in O+ mothers (20.20%) and B+ mothers (21.86%). The highest percentage pregnancies are observed in B+ mothers (33.19) and the lowest in O mothers (2.96).

Table III

Distribution of Livebirths, Deaths, Stillbirths, Abortions, Prenatal Loss and Pregnancies in Different Age Groups of Rh-positive and Rh-negative Mothers.

Maternal blood group	Maternal Age (Years)					Total
	<15-18	19-22	23-26	27-30	31-34+	
Rh-positive						
L	358	408	181	98	38	1083
D	59	65	32	17	10	183
SB	33	62	25	8	1	129
Ab	58	72	45	16	5	196
PL%	20.27	24.73	27.89	19.67	13.64	23.08
P	449	542	251	122	44	1408
Rh-negative						
L	44	56	40	14	10	164
D	9	5	9	0	3	26
SB	8	11	6	5	0	30
Ab	12	14	14	10	4	54
PL%	31.25	30.86	33.33	51.73	28.57	33.87
P	64	81	60	29	14	248

Table III shows the distribution of livebirths, deaths, stillbirths, abortions and pregnancies in different age groups of Rh-positive and Rh-negative mothers. Rh-positive mothers show highest livebirths (76.70%) than Rh-negative mothers (66.13%). A higher percentage of stillbirths (12.09) and abortions (21.77) are observed in Rh-negative mothers. The differences in the number of stillbirths and abortions in Rh-positive and Rh-negative mothers are statistically highly significant ($\chi^2=13.75$; $P<0.001$). Total prenatal loss in Rh-positive mothers (23.08%) is less than in Rh-negative mothers (33.87%). The highest prenatal loss in Rh-positive mothers is seen between ages 23-26 years (27.89%) and 19-22 years (24.72%) while in Rh-negative mothers in the age groups 27-30 years (51.72%) and 23-26 years (33.33%). Mothers between 31-34+ years of age have the lowest prenatal loss in Rh-positive (13.64%) and Rh-negative mothers (28.57%). However, postnatal deaths are the highest in this age group in Rh-positive (25.31%) and Rh-negative mothers (30.00%). The livebirth data were arranged in relation to family size and ABO maternal blood groups (Table IV).

Table IV

Mean Family Size and Variance of Offspring in ABO-Mothers.

Family size	Maternal Blood Groups								Total
	O		A		B		AB		
	+	—	+	—	+	—	+	—	
0	5	—	5	1	11	—	4	—	26
1	82	9	63	12	101	22	26	6	321
2	21	3	20	6	30	6	5	1	92
3	13	2	12	1	13	1	4	2	48
4	7	1	5	3	7	2	4	—	29
5	5	—	2	—	11	2	2	1	23
6	7	—	3	1	6	1	1	—	19
7	3	1	1	1	5	—	2	—	13
8	2	—	—	—	2	—	—	—	4
9	—	—	2	—	5	—	1	—	8
10	1	—	—	—	—	—	—	—	1
11	1	—	1	—	—	—	—	—	2
—	—	—	—	—	—	—	—	—	—
16	—	—	—	—	1	—	—	—	1
Total	147	16	114	25	192	34	49	10	587
$\bar{X}$	2.15	2.00	1.95	2.08	2.24	1.79	2.30	1.90	2.12
O ²	2.66	2.67	2.43	2.91	5.27	1.93	3.13	1.88	3.98
S.E.	0.13	0.41	0.14	0.34	0.16	0.24	0.25	0.43	0.08

There is no appreciable difference in the family size of mothers belonging to different blood groups. The mean family size and variance of the total sample is 2.12 and 3.98 respectively. The data contain a small number (26) of childless mothers of which the highest number is that of B+ mothers (42.30%). Table V shows the distribution of sons and daughters born to mothers of different ABO groups. The highest male births is observed in AB-negative mothers (0.7895) and the lowest is seen in O-negative mothers (0.4375). Rh- positive mothers show higher male births (0.5254) than Rh-negative mothers (0.4817).

Discussion

The present study indicates the presence of a higher percentage of B+ (32.71) and O+ (25.04) mothers. These two types of mothers show the highest percentage of livebirths (O+ = 79.80; B+ = 78.50). Stillbirths, abortions and livebirths in O+ and 11+ mothers are significantly different from those in A+ and AB+ mothers ($\chi^2=6.28$; $P<0.05$). In O++B+ mothers the observed number of stillbirths and abortions is less than the expected number and a higher number of observed livebirths than the expected one. Mothers with A+ and AB+ blood groups possess higher number of observed stillbirths and abortions and lesser number of livebirths than the expected value. In a similar comparison, when

O- and B- mothers are compared with A+B mothers for stillbirths, abortions and livebirths the results are statistically non-significant ($\chi^2=2.02$; $P>0.30$). The differences in the number of stillbirths, abortions and livebirths in Rh-positive and Rh-negative mothers are statistically highly significant $\chi^2=13.75$; $P<0.001$).

O-positive mothers at younger age <15-18 years (81.34) and 19-22. years (81.53) show the highest percentage of livebirths and the lowest prenatal loss 18.65% and 18.47% respectively. The condition is somewhat different with B-positive mothers which show comparatively less livebirths (80.24% and 72.91%) in the two younger age groups, but higher percentage of prenatal loss (19.76% and 27.09%). In the next two higher age groups, 23-26 year and 27-30 years, B-positive mothers show higher percentage of livebirths (79.63 and 92.68) and low prenatal loss (20.37% and 12.19%) compared with O+ mothers (livebirths, 74.28% and 73.33%; prenatal loss 25.71% and 26.62% respectively). These results indicate that O+ mothers marrying at younger age bear more live-births and low prenatal loss, but for B+ mothers the years between 23 and '30 seem favourable age for marriage.

B-positive and O-positive mothers show comparatively higher percentage of pregnancies (33.27% and 23.91% respectively) than other ABO-mothers.

The results suggest that selective forces operate against the offspring of Rh-negative mothers and significantly favour those from the Rh-positive group, particularly O-positive and B-positive. There is some indication, too, for age specific action of selection but this cannot be generalized due to lack of large body of data. Bennett and Walker (1955) gave no indication of differences in fertility associated with ABO blood groups but they did observe reproductive differences between individuals. Matsunaga and Itoh (1958), Chung and Morton (1961), who typed both the parents for ABO blood groups, showed that maternal-foetal incompatibility reduces fertility. The present data lack such information.

AB-negative mothers show the highest number of male births. Plank and Buncher (1975) showed highest male births in AB mothers (both Rh+ and Rh-). Allan (1972) observed significantly higher male births in Rh-negative sibs (AB- + B- and A- + O-) than Rh-positive (AB+ + B+ than A+ + O+). The present findings also indicate that Rh-negative (AB- 4- B- than A- 4- O-) mothers have significantly higher male births $\chi^2=4.08$; $P<0.05$) but non-significant ($\chi^2=0.07$; $P>0.70$) male births in Rh-positive mothers (AB+±B+ than A+±O+).

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