MATERNAL AGE, STILLBIRTHS, ABORTIONS AND FACTORS RELATED TO MATERNAL BLOOD GROUPS : A HOSPITAL SURVEY FROM LAHORE (PUNJAB, PAKISTAN)

Pages with reference to book, From 27 To 34

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Abstract

Effects of maternal age and birth order were observed on abortions, stillbirths and sex ratio in a sample of 3160 children, of which 2382 were live births, 377 stillbirths and 410 abortions. Highest percentages of abortions is seen in mothers between < 15-18 years and 31-34 years of age. Maternal age has significant negative effects whereas birth order has significant positive effects on abortion. Stillbirths indicate higher percentages in mothers between < 15-18 years and 39+years of age. Maternal age shows negative effects on male stillbirths and positive effects on female stillbirths. Birth order has highly significant positive effects on male stillbirths. Maternal age shows negative effects on sex ratio of stillbirths, however, birth order has highly significant positive effects.
Mothers with B-positive blood groups show higher fertility and survival, and a higher proportion of males is seen in AB-positive and AB-negative mothers.
Optimum age for the marriage of females, between 19-26 years is suggested (JPMA 30:27, 1980).

Introduction

In man the incidence of abnormalities like mongolism (Penrose 1933, 1934, 1954), anencephaly, spina bifida, hydrocephaly (Penrose 1934, 1946, 1954; Collmann and Stoller, 1962) cleft palate and lip (Rank and Thomson, 1960), congenital malformations of central nervous system (Edwards, 1958; Record and Mckewon, 1949) have been shown to increase with maternal age.
The frequency of abortions in man have been shown to increase with maternal age(James, 1963; Warburton and Fraser, 1964). The possible causes of abortion have been looked at by Carr (1971), Debre (1971) and Bone et al (1973) indicating that in spontaneous abortions chromosomal aberrations like monosomy, trisomy, triploidy, chromosomal breakage and sex chromosome anomalies occur. Gedda and Del Porto (1969) found that abortions occur usually between 2nd and 3rd month of pregnancy. They suggest that abortions may not be due to an early death of fertilised egg, but may be due to interruption of normal internal secretion of progeste-ron.
Stillbirths increase in frequency especially in mothers aged over 40 years since fetal malformation is an important cause of stillbirth and neonatal mortality (Penrose 1946, 1954; Millis 1957). These workers showed that parity on the whole has much less effect than maternal age, though an increased risk for the first born.
Enders and Stern (1948) showed, in American White and Negro population, increase in twin confinements with one stillbirth in aging mothers. Bain et al (1976) showed incidence of Down's syndrome, stillbirths, macerated fetus and chromosomal abnormalities in the children of mothers 35 years of age. Penrose (1934) has shown that parity has no appreciable effects on the incidence of Down's syndrome. Banerjee and Roy (1962) indicated that birth weight increases with parity upto certain parity levels, and then decreases with higher parity levels.
Bennett (1955) carried out study of fertility in relation to maternal blood group, and gave no indication of significant association between the two factors. However, he showed that reproductive differences

between different ABO individuals are much greater. Plank and Buncher (1975) and Allan (1972) showed higher sex ratio in the offspring of AB-moth-ers as compared with the rest.
In this paper we present analysis of maternal age, parity, stillbirths, abortions, sex ratio, fertility and survival in relation to maternal ABO blood groups to indicate the favourable optimum reproductive age of mother and family size in the socio-economic conditions of the population.

Material and Methods

Data were collected from Ganga Ram Hospital and Lady Willingdon Hospital, Lahore. The data contain those cases which were visited at the time of birth. Previous records of maternal reproductive history include, maternal age at the time of first birth, and in the successive births (calculated from their dates of birth), total number of children produced, their sexes and birth ranks, previous stillbirths, abortions and nature of the latest delivery. In addition, records were also made regarding the deaths of children at a later stage (age not known).
The number of mothers scored for the study was 1036. The total sample of progeny from these mothers contained 3194 children, out of these live births were 2382 (1204 O+; 1178 O), abortion 410 (sexes not differentiated) and stillbirths 377 (160O+; 217 O).
Data comprising 724 mothers were available for their blood group types. They were typed for ABO and Rh (positive and negative) blood groups. Records of paternal age and their blood group types are not known in the present sample.
Methods of simple and partial correlations were applied for various analyses.

Result

Data were arranged in relation to maternal age and birth order for male and female offspring (Table I). Maternal ages were grouped into 7 classes (< 15-18, 19-22, 23-26, 27-30, 31-34, 35-38, 39+ years) with an interval of four years, and birth order first to tenth and over were analysed. The data for the respective age group and birth order in each cell contain total number of live births, abortions, female and male infant stillbirths, and the total number of pregnancies.
Percentage of live births, abortions and stillbirths are based on the total number of pregnancies present in each group.
Abortions: Higher percentage of abortions is seen in the first birth order (14.27%) and then show decrease until birth order 4 (8.47%). From birth order 5 onward frequency of abortions increases with a maximum of 25.64% in the birth order 10+ (Fig. 1).

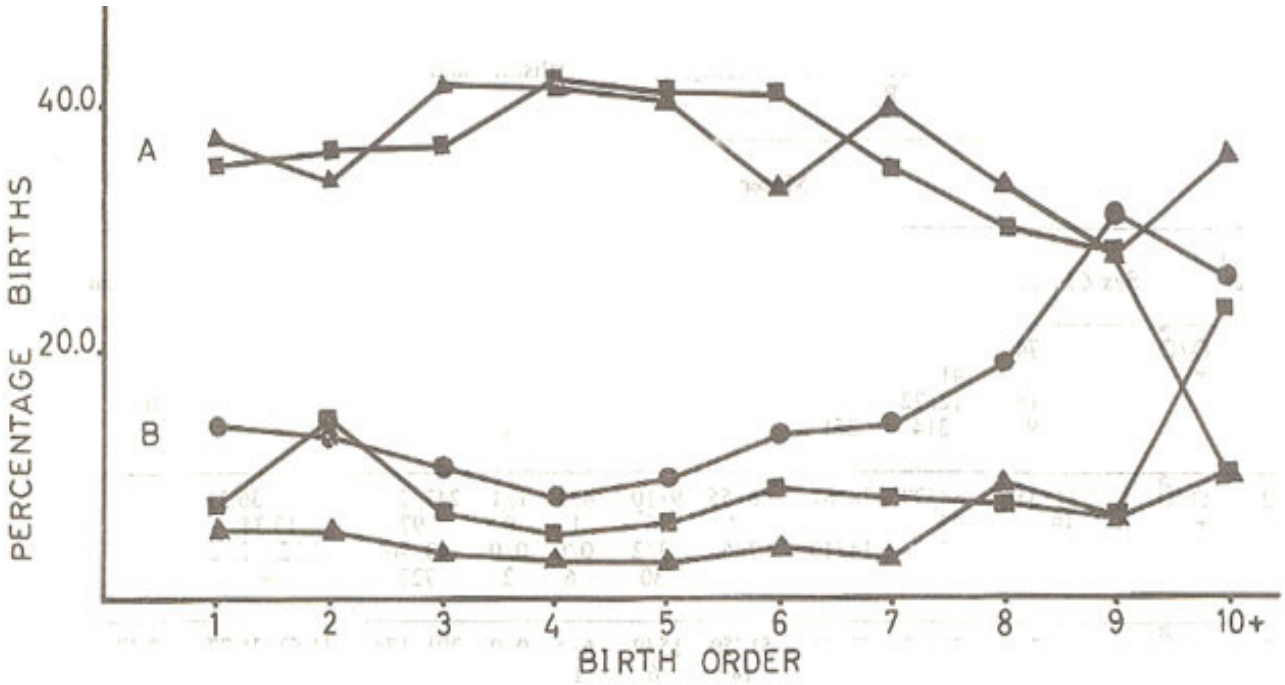

Fig. 1. Percentage births in relation to birth order (A)— female live births (▲) and male live births (■); (B)— abortions (●), female stillbirths (▲) and male stillbirths (■).

The picture is different with maternal age. The highest frequency of abortions (18.54%) is seen in younger mothers (< 15-18 years) and decreases thereafter, except in maternal age group between 31-34 years where an increase in abortions is observed (14-53%) (Table I, Fig. 2).

Table I: Distribution of Live Births(L), Abortions(A), Stillbirths(S) and Total Births(T) in Different Maternal Age Groups and Birth Ranks.

Birth order	Sex		Maternal age (years) < 15-18	19-22	23-26	27-30	31-34	35-38	39+	Total	% Sex	Sex ratio
1	♂/♀	L	67/74	126/113	100/89	39/37	5/8	3/1	1/0	341/322	37.15/35.07	0.49
		A	36	41	32	14	7	1	0	131	14.27	—
		S	14/18	12/22	15/15	9/13	4/0	1/1	0/0	55/69	5.99/7.52	0.56
		T	209	314	251	112	24	7	1	918	—	0.52
2	♂/♀	L	31/31	68/99	78/67	56/55	9/10	4/1	1/1	247/264	33.98/36.31	0.52
		A	19	27	27	17	6	1	0	97	13.34	—
		S	5/6	14/9	14/10	7/6	3/2	0/0	0/0	43/76	5.92/10.45	0.43
		T	92	217	196	141	30	6	2	727	—	0.47
3	♂/♀	L	6/7	56/40	67/68	51/50	15/9	6/4	0/0	201/178	41.53/36.77	0.47
		A	3	12	15	14	6	1	0	51	10.54	—
		S	2/5	4/6	5/10	6/10	2/3	0/1	0/0	19/35	3.93/7.23	0.65
		T	23	118	165	131	35	12	0	484	—	0.56
4	♂/♀	L	1/0	19/25	67/47	47/47	18/26	4/10	0/2	156/157	41.27/41.53	0.50
		A	2	6	13	7	3	1	0	32	8.472	—
		S	0/1	3/3	5/4	3/8	1/4	1/0	0/0	13/20	3.44/5.29	0.61
		T	4	56	136	112	52	16	2	378	—	0.55
5	♂/♀	L	0/0	4/8	29/38	42/27	15/19	14/16	3/0	107/108	40.27/40.60	0.50
		A	1	4	6	8	6	1	0	26	9.77	—
		S	0/0	0/3	1/3	1/7	4/3	1/1	1/0	8/17	3.01/6.39	0.68
		T	1	19	77	85	47	33	4	266	—	0.59
6	♂/♀	L	0/0	1/2	7/15	18/28	18/16	14/13	3/2	61/76	32.62/40.64	0.55
		A	0	4	6	8	6	0	1	25	13.37	—
		S	0/0	3/3	0/3	1/7	0/4	2/2	2/0	8/17	4.28/9.09	0.68
		T	0	13	31	62	44	31	8	187	—	0.61
7	♂/♀	L	0/0	1/0	3/3	18/18	12/10	9/7	5/4	48/42	39.67/34.71	0.47
		A	0	2	2	6	4	3	0	17	14.05	—
		S	0/0	1/1	0/0	1/4	0/3	1/2	1/0	4/10	3.31/8.26	0.71
		T	0	5	8	47	29	22	10	121	—	0.59
8	♂/♀	L	0/0	2/0	0/0	4/4	7/10	6/3	2/2	21/19	33.33/30.16	0.47
		A	0	1	2	4	2	3	0	12	19.04	—
		S	0/0	0/0	1/0	0/2	4/0	0/3	1/0	6/5	9.52/7.94	0.45
		T	0	3	3	14	23	15	5	63	—	0.46
9	♂/♀	L	0/0	0/0	0/0	1/1	3/1	3/4	1/2	8/8	27.59/27.59	0.50
		A	0	0	3	3	2	1	0	9	31.03	—
		S	0/0	0/0	0/1	0/0	0/0	2/1	0/0	2/2	6.90/6.90	0.50
		T	0	0	4	5	6	11	3	29	—	0.50
10	♂/♀	L	0/0	0/0	2/0	3/0	4/1	4/2	1/1	14/4	35.90/10.25	0.22
		A	0	0	1	4	1	4	0	10	25.64	—
		S	0/0	0/0	0/0	1/4	0/0	1/2	0/3	2/9	5.13/23.08	0.82
		T	0	0	3	12	6	13	5	39	—	0.52
Total	♂/♀	L	105/112	277/287	353/327	279/267	106/110	67/61	17/14	1204/1178	37.99/37.18	0.49
		A	61	97	107	85	43	16	1	410	12.94	—
		S	21/30	37/47	41/46	29/61	18/19	9/11	5/3	160/217	5.05/6.85	0.5
		T	329	745	874	721	296	164	40	3169	—	0.53
Sex ratio		L	0.52	0.51	0.48	0.49	0.51	0.47	0.45	0.49	—	—
		S	0.59	0.56	0.53	0.68	0.51	0.55	0.37	0.57	—	—
		T	0.55	0.53	0.50	0.58	0.51	0.51	0.41	0.53	—	—

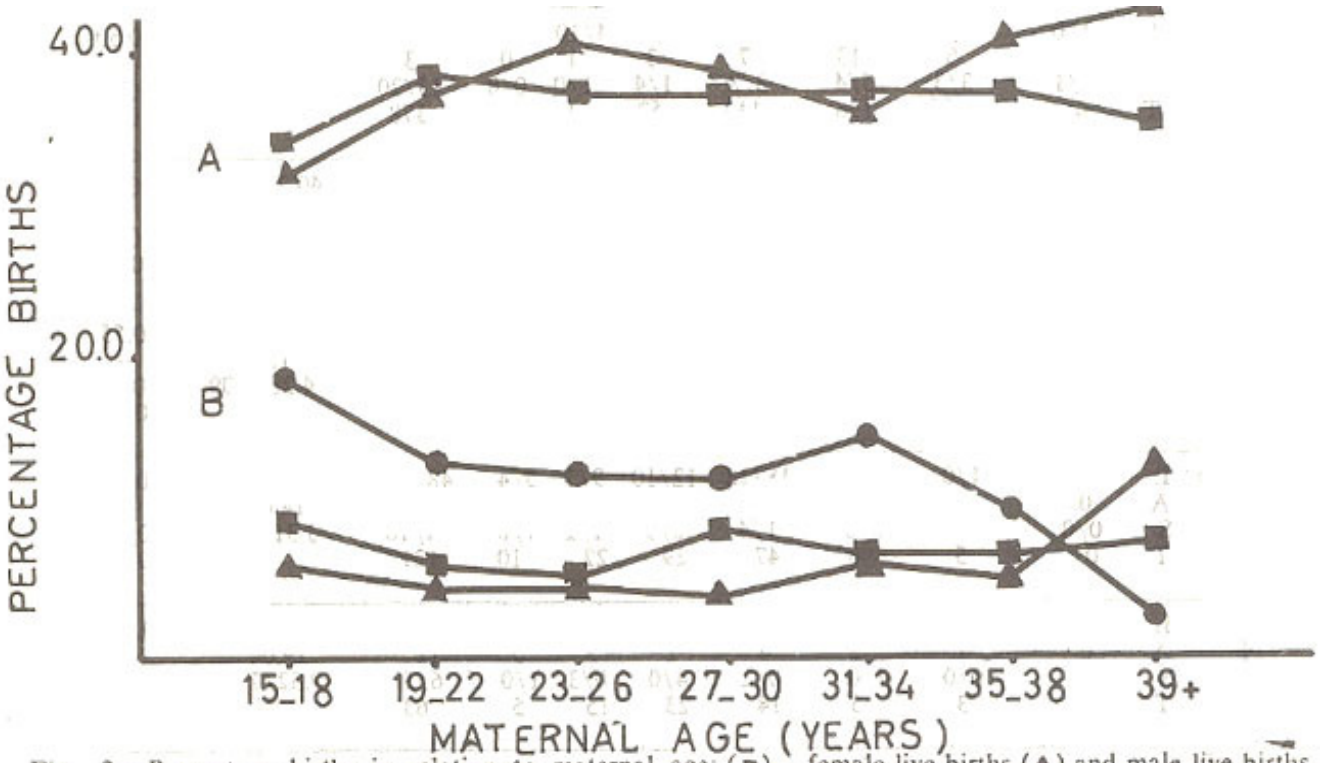

Fig. 2. Percentage births in relation to maternal age: (■)— female live births (▲) and male live births (■); (B)— abortions (●), female stillbirths (▲) and male stillbirths (■).

If we follow births from the first child to the tenth plus, in different maternal age groups, maximum abortions in mothers bet-ween < 15-18 years of age are seen in preg-nancy No. I, II, III, IV and V. Mothers bet-ween 19-22 years of age indicate higher abor-tions in pregnancies VI and VII. Maximum abortions are seen in pregnancies VII and IX in mothers between 23-26 years of age. Pregnancies VIII and IX show; higher abortions in mothers of 27-30 years of age. Maternal age 31-34 years show maximum abortions in pregnancies I, II, III, and IX. A trend to-wards decrease in abortions is seen in mothers between 35-38 years (except pregnancy No. IX) and 39+ years of age.

Simple and partial correlations for different correlated factors were estimated (Table II).

Table II: Simple and Partial Correlations Between Correlated Factors: Maternal Age, Birth Order and Abortions. (N= (no. of cells in Table I) 53).

Correlated factors	*Simple correlation*	*Corrected for*	*Partial correlation*
Maternal age & birth order	+0.0792	—	−0.0113
Maternal age & abortions	−0.2413	birth order	−0.2797
Birth order & abortions.	+0.3703	maternal age	+0.4025

Maternal age and birth order show very low simple (+0.0792; P<0.1) and partial correlations (-0.0113; P<0.1). Maternal age effects on abortion shows nearly significant negative simple correlation (-0.2413; P< 0.05) and significant negative partial correlations (-0.2797; P<0.05). Birth order and abortions indicate significant positive simple (+0.3703; P<0.01) and partial correlations (+0.4025; P < 0.01).
Stillbirth : Stillbirths, sexes combined, show higher percentage in the first (13,51%), second (16.37%), eighth (17.46 per cent) and birth order 10+ (28.21 %). Higher frequencyof male stillbirths is seen in the first (7.52%),and second (10.45%) birth orders, and fluctuates thereafter with the highest percentage of stillbirths in the birth order 10+ (23.08%) (Fig. 1). The stillbirth rate of females was lower than males in all except eighth birth order (9.52%) as compared to 7.52% in males. In younger mothers (< 15-18 years) a higher percentage of stillbirths (15-50%), sexes combined is seen, and the lowest percentage in mothers between 23-26 years of age. The highest frequency of stillbirths is examined in mothers aged 39+ years. Both the male and female infant stillbirths show higher percentage in the younger mothers (< 15-18 years) but a definite pattern is not observed in the higher maternal age groups.
If we look at first birth to the tenth plus birth in different maternal age groups, male stillbirth, in comparison with female stillbirths, are maximum in pregnancy No. I-V in mothers between < 15-18 years of age. Mothers between 19-22 years of age show higher male stillbirths in pregnancies I, II, and VI. Higher male stillbirths are seen in pregnancies III, V, VI and IX in mothers of 23-26 years of age. Pregnancies I, III, IV, VI and VII show maximum male stillbirths in maternal age between 27-30 years of age. Male stillbirths are higher in pregnancies III, IV, VII in mothers between 31-34 years of age. In mothers between 35-38 years of age male and female stillbirths show the same frequency (14.29%) in the first pregnancy, and in the rest of the pregnancies higher frequency of female stillbirths is seen, except in pregnancy No. VII where male stillbirths are higher than females. Data for male stillbirths is lacking in the present sample, in mothers aged 39+ years.
Simple and partial correlation estimates were made for different correlated factors. Simple correlations between maternal age and birth order are significant for male (+0.3225; P<0.05) and female (+0.3394; P< 0.05) stillbirths (Table III).

Table III : Simple and Partial Correlations Between Correlated Factors : Maternal Age, Birth Order and Stillbirths (N= (no. of cells in Table I) 40 ♀; 42 ♂)

Correlated factors	*Simple correlation*		*Corrected for*	*Partial correlation*	
	Females	*Males*		*Females*	*Males*
Maternal age & birth order	+0.3394	+0.3225	—	+0.3037	+0.2473
Maternal age & stillbirths	+0.1795	+0.2204	birth order	+0.0817	—0.0607
Birth order & stillbirths	+0.3056	+0.7845	maternal age	+0.2644	+0.7727

Their respective partial correlations are also high- Maternal age shows positive simple correlations for male (+0.2204; P<0.1) and females (+ 0.1795; P< 0.1) stillbirths (Table III). When corrected for birth order, partial correlations for male stillbirths show negative maternal effects (-0.0607; P< 0.1) and positive for females (+ 0.0819; P< 0.1). Birth order effects on male stillbirths are highly significant in simple (+0.7845; P< 0.001) and partial correlation (+0.7727; P< 0.001).

Sex Ratio: The analyses are based on the data arranged in relation to maternal age and birth order (Table I). The average sex ratio calculated from the total births, live birthsand stillbirths, disregarding maternal age and birth order effects, is 0.53 in our sample. Sex ratio based on total live births is 0.49 and that based on total stillbirths is 057 (Table I).

Sex ratio in relation to maternal age birth order were based on live births, stillbirths and total births (live+stillbirths) (Table I). Live births show higher sex ratio (0.52) in maternal age between < 15-18 years. This shows decrease upto 27-30 years of maternal age. It increases in mothers between 31-34 years of age (0.51) and decreases thereafter. Sex ratio, based on stillbirths (S.B) and total births (T.B) is higher in maternal ages between <. 15-18 years and decreases upto 23-26 years of maternal age. This shows very high rise in maternal age from 27-30 years (0.68 S.B; 0.58 T.B) and decreases in later maternal age groups. Overall advancing maternal age effects show negative trends in the sex ratio.

The first birth order shows nearly 1:1 sex ratio for live births, but this rises in the 2nd birth order and decreases upto 5th birth order, shows increase in the 6th birth order (0.55) and declines in later birth orders with a sharp decrease in 10+ birth order. Sex ratio for stillbirths (0.56) and total births (0.52) in the first birth order is quite high, then shows a decrease in the 2nd birth order. From 3rd birth order upto 7th birth order an increase in sex ratio is seen. In later birth orders sex ratio decreases for stillbirths and total births but shows a sharp rise in sex ratio (0.82) for stillbirths in 10+ birth order. Unlike maternal age, increasing birth order shows positive trends in sex ratio for stillbirths.

Relationship between maternal age, birth order and sex ratio were estimated with simple and partial correlation methods. Due to small sample size, birth orders 9 and 10+ were combined together for the purpose of calculations. Sex ratio in each cell was adjusted by the weighing factor, MF/M+F (Barrani et al., 1961).

Table IV : Simple and Partial Correlations Between Correlated Factors : Maternal Age, Birth Order and Sex Ratio of Stillbirths. (N= (no. of cells in Table I) 49).

Correlated factors	*Simple correlation*	*Corrected for*	*Partial correlation*
Maternal age & birth order	+0.3623	—	+0.2594
Maternal age & sex ratio	−0.3806	birth order	−0.2249
Birth order and sex ratio	+2.1556	maternal age	+2.3412

Table IV shows simple and partial correlations in relation to different correlated factors. Maternal age shows negative trends in the simple (-0.3806; $P< 0.01$) and partial correlation analysis (-0.2249; $P>0.1$). Sex ratio in relation to birth order shows highly significant positive simple correlation (+ 2.1556; $P< 0.001$) and partial correlations (+ 2.3412; $P< 0.001$).

Maternal Blood Groups: Data available for mothers typed for ABO and Rh blood groups were analysed to see fertility, survival and sex ratio in different blood group phenotypes.

Fertility in relation to blood group phenotypes indicates that the highest number of offspring is associated with B-positive phenotypes, and next higher fertility is seen in O-positive (Table V).

Table V: Percentage Survival, Fertility and Sex Ratio in Relation to Maternal Blood Group Type

Item	Sex	Blood Group A +	A −	B +	B −	AB +	AB −	O +	O −	Total
Total		69	30	102	35	26	4	77	16	359
Alive	♀	44	21	80	21	17	2	50	11	246
Survival (%)		63.77	70.00	78.43	60.00	65.38	50.00	64.93	68.75	
Total		55	19	115	29	32	12	91	12	365
Alive	♂	31	14	89	20	22	6	58	9	249
Survival (%)		56.36	73.68	77.39	68.75	68.75	50.00	63.73	75.00	
Grand Total		124	49	217	64	58	16	168	28	724
Fertlity (%)		17.13	6.77	29.97	8.84	8.01	2.21	23.20	3.87	
Sex ratio		0.43	0.40	0.52	0.48	0.56	0.75	0.53	0.45	

Highest percentage of survival for males (77.39%) and females (78.43%) is seen in B-positive phenotypes. The next higher survival for males (73.68%) and females is observed in A-negative phenotypes (Table V).
The highest sex ratio is indicated in AB-positive phenotypes (0.56) and AB-negative phenotypes (0.75) (Table V).

Discussion

The present investigation shows a higher frequency of abortions in the first birth order, then declines upto 4th birth order and shows an increase from 5th birth order onward. Advancing maternal age shows trends towards decrease in frequency of abortions. Highest rates of abortion are seen in mothers between < 15-18 years of age, and between 31-34 years of age. Number of abortions in different pregnancies show bimodality. The highest number is seen in mothers between < 15-18 years and 31-34 years age (Table VI).

Table VI: Maximum Number of Pregnancies lost through Abortions and Still Births in Different Maternal Age Groups (Brackets Show the Number of Pregnancy)

Maternal age(years)	Abortions	Stillbirths		Total	Percentage
		Male	Female		
15-18	5	5	1	11	22.45
19-22	(I-V)	(I-V)	(III)		
19-22	2	3	1	6	12.25
	(VI, VIII)	(I,III,VI)	(VI)		
23-26	2	4	1	7	14.28
	(VII,IX)	(III,V,VI,IX)	(VIII)		
27-30	2	5	1	8	16.32
	(VIII,IX)	(I,III,IV,VI, VII)	(?)		
31-34	4	4	2	10	20.41
	(I,II,III,IX)	(III,IV,VI,VII)	(I,VIII)		
35-38	1	1	3	5	10.20
	(IX)	(VII)	(I,V,IX)		
39+	-	-	2	2	4.08
			(VI,VII)		
Total	16	22	11	49	
Percentage	32.65	44.95	22.41		14.28

Simple and partial correlations show negative effects on the frequency of abortions as the maternal age increases but highly significant positive correlations are seen in the increasing birth ranks. Massobrio et al (1971) indicated that the chromosomal abnormals and normal abortions occur in the mean maternal ages of 29.2 and 27.2 years. Genetic aspects of abortions discussed by Carr (1971), Debre (1971) and Bone et al (1973) show that these are due to chromosomal abnormalities like trisomy, polyploidy, X-monosomy, translocations. Debre (1971) examined that between conception and 6 week gestation period 70% of abortions are due to chromosomal abnormalities and this falls to 50% after a 10 week gestation period. Hahnemann (1973) carried out studies on induced abortions in a material with an average maternal age of 25.5 years. He showed the occurrence of chromosomal aberrations in an average maternal age of 33.6 years, and gestation period of 10.5 weeks.

This study shows higher rates of stillbirth in mothers between < 15-18 years 39+ years of age, and in the first and second birth order. Pregnancies showing male stillbirths, compared with female stillbirths, are the highest in maternal age between 27-30 years of age-The two extremes of maternal ages, < 15-18 years and 35-38 years of age show less number of pregnancies (Table VI).

Estimates of simple and partial correlations show negative maternal age effects on male stillbirths and positive effects on female stillbirths. Parity shows highly significant positive effects on male stillbirths.

The results are not in agreement with those of early workers (Penrose, 1946; Millis, 1957; James, 1963; Warburton and Fraser, 1964) who showed that the frequency of abortions and stillbirths increases with maternal age.

The average percentage loss through abortions and stillbirths, of pregnancies in different maternal age groups is 14.28%. Maximum loss of pregnancies due to abortions and stillbirths indicate higher percentage in mothers between < 15-18 years (22.45%) and 31-34 years of age (20.41%). Comparatively less loss through these abnormalities is seen in mothers of 19-22 years (12.25%), 35-38 years (10.20%) and in later maternal age groups, 39+ years (4.08%) (Table VI). The favourable ages for reproduction are indicated between 19-22 years and 35-38 years. These age groups show higher live births and less loss through stillbirths and abortions than others. These results derive support from the studies of chromosomal aberrations (Massobrio et al., 1971; Hahnemann, 1973) which appear mostly in mean maternal ages of 29.2 years, 27.2 years and 36.6 years-

The highest sex ratio is seen in the offspring of mothers between 27-30 years of age for stillbirths (0.68) and total births (0.58). The live births show higher sex ratio in mothers between < 15-18 years (0.52) and 31-34 years of age (0.51). Live births in relation to birth order show decrease from 3rd to 5th birth order and an increase in sex ratio from 3rd to 7th birth order and decreases thereafter with a sharp rise in 10+ birth order (0.82).

Analyses carried out for sex ratio show that the maternal age has negative effects but birth order has highly significant positive effects on the proportion of male stillbirths. Similar maternal age effects have been shown by Novitski and Sandler (1956), Shami and Tahir (1978) with live births. However, increase in sex ratio with the advance in birth ranks is contrary to the studies with live births (Novitski and Sandler, 1956; Shami and Tahir, 1978). Ciocco (1940) examined that the sex ratio decreases with the increase in gestation time.

The relationship between maternal ABO blood groups, fertility and survival shows that both the components of fitness are highly associated with B-positive maternal phenotypes. Maternal AB-positive and AB-negative phenotypes indicate the highest number of males born to them. Allan (1972) and Plank and Buncher (1975) showed higher proportions of males among children of AB-mothers. The data indicate that selection favours B-positive maternal phenotypes more than the others. It is difficult to generalise conclusions from the present data. This aspect needs further investigation with larger body of data-

Since most of the pregnancies are lost through abortions and stillbirths in mothers between < 15-18 years and 31-34 years of age, these results suggest that the optimum age of females for marriage is between 19-26 years. Marriages of very young females (< 15-18 years) should be discouraged and maternal ages between 27-34 years are not desirable for reproducing.

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