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# ABO Blood Group Incompatibility and Perinatal Deaths in Pahariya Tribe of Rajmahal Hills, Bihar

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**KEY WORDS** Foetal Loss. Blood Group. Incompatibility. Couple Combinations.

**ABSTRACT** In all the three sects of the Pahariyas, the highest phenotypic frequency of blood group B was recorded (31.9%), while AB was recorded the least (12.7%). Allele frequency of *O* blood group was predominant : 0.5510 in the Mals, 0.5453 in the Saurias and 0.5205 in the Kumarbhags. The couple combinations having A type wives and B type husbands or *vice versa* as well as of O type wives and A or B type husbands showed maximum foetal loss. As far as infant death was concerned, no clear cut trend was observed with regard to ABO incompatibility.

## INTRODUCTION

A disquieting finding in recent years is that anti-A and -B appear to attack the foetus early in pregnancy resulting in abortion or miscarriage. Levine (1943 and 1958) also showed that incompatible ABO mating, apart from Rh (D) discordance, led to abortion, miscarriage and haemolytic diseases. It has been observed that spontaneous abortion before sixth month of pregnancy occur more often among type O women married to men type A or B than among A or B women married to men of O type. In terms of pregnancies terminating prematurely, ABO incompatibility looms more frightening than Rh-incompatibility (Volpe, 1971). In ABO incompatible marriages foetal erythrocytes, which bear an antigen for which the mother's blood contains the corresponding antibody and which cross the placenta, will be quickly destroyed before anti-Rh antibody formation can occur (Satyanarayana et al. 1978; Burns, 1983; Srivastava and Sinha, 1989 and Bandyopadhyaya, 1992).

Many scholars studied the significance of blood groups in natural selection (Waterhouse and Hogben, 1947; Kirk et al, 1955; Matsunaga and Itoh, 1953 and 1955; Banerjee and Das, 1986; Reddy and Shebhu, 1986; Rajeshwari et al., 1992 and Pandey et al., 1997). A connection between incompatibility and primary infertility was although not established, but ample evidence to correlate the existence of antispermatozoa antibody in the female with incompatible matings to account for unexplained infertility was reported (Nag and Banerjee, 1970). It is not yet fully understood whether the differcence in blood groups, as couple combination, can also disturb fertility (Matsunaga, 1958; Reddy and Reddy, 1980 and Srivastava and Sinha, 1989).

Thus, the main aim of the present study is to establish a relationship between ABO incompatibility and perinatal mortality (*i.e.,* foetal and infant deaths) in three sub-tribes of the Pahariyas of the Rajmahal hills, Bihar.

## MATERIAL AND METHOD

The present survey was carried out in three sects of the Pahariya tribe, *viz.,* the Saurias, the Mals and the Kumarbhags, who were supposed to be the original inhabitants of the Rajmahal hills, Bihar, an oldest mountain series of the world. Malwa of the Vindhya range between Bundelkhand and Gujarat was believed to be the prototype of this tribe.

At the out set, a total number of 1036 couples (435 of the Saurias, 385 of the Mals and 216 of the Kumarbhags) selected randomly were approached to get information about their reproductive life, *i.e.,* gap in time between her marriage and first conception, age of the first motherhood, present age and age at birth of different children were recorded. Data on the number of their surviving as well as dead children were also obtained. From this detailed information, data regarding perinatal deaths were put into four categories: (i) abortion within 6 months of gestation, (ii) those who were dead before birth

(iii) those who died within a month and lastly (iv) those who died before attaining the age of one year.

The blood group of parents were determined by serum agglutination method using anti-A and anti-B sera. The expectant mother was followed up till termination. The compatibility or incompatibility of the couples on the basis of their blood group was based as per table 1. Out of 16 incidences of couple combinations with regard to ABO blood groups, 9 couple combinations are of compatible and 7 are of incompatible types.

**Table 1: Compatible and incompatible type of couple combination with regard to ABO blood groups (Burns, 1986)**

| *Type of mating* | *Male* | *Female* |
|---|---|---|
| Compatible | A | A, O |
| | AB | A, B, AB, O |
| | B | B, O |
| | O | O |
| Incompatible | | |
| | A | B, AB |
| | B | A, AB |
| | O | A, B, AB |

## RESULTS AND DISCUSSION

The phenotypic frequencies for blood group system investigated among the adults (both sexes) in the pahariya tribe and gene frequencies are presented in table 2. The results showed that in entire Pahariya population B blood group was dominated (31.9%), followed by O (29.1%), A (26.4%) and AB (12.7%). The preponderance of blood group A was recorded in the Saurias (33.1%) in comparison to the Mals (23.5%) and Kumarbhagas (22.6%), while B blood group was found to be dominated in both the Kumarbhags (37.1%) and the Mals (34.4%). AB blood group was the least frequent group in each of the three sub-tribes of the Pahariyas —13.1% in the Saurias, 11.7% in the Mals and 13.2% in the Kumarbhagas. The blood group O was recorded to be highest in the Mals (30.4%), followed by the Saurias (29.7%) and the Kumarbhags (27.1%).

The Chi-Square test for goodness of fit between observed and the expected phenotype number is statistically non-significant in all the three sub-tribes of the Pahariya ($\chi^2 = 9.58$ in the Saurias, 3,55 in the Mals and 1.84 in the Kumarbhagas, at d.f. = 3). Non-significant $\chi^2$ values are also obtained sex-wise in the distribution of blood groups. The non-significant $\chi^2$ values suggest that the population does exist in the state of genetic equilibrium.

Compatible and incompatible marriages in three sub-tribes of the Pahariya are presented in table 3. Percentage of compatible marriages were recorded higher than the incompatible marriages: 61.4% in the Saurias, 59.4% in the Mals and 65.7% in the Kumarbhags.

**Table 3: Percentage of compatible and incompatible marriages and their pregnancies among the three sub-tribes of the Pahariyas**

| *Populations (No. of Couples)* | *Marriage group* | *Percentage of marriages* | *Total No. pregnancies* |
|---|---|---|---|
| Saurias (435) | Compatible | 61.4 | 1161 |
| | Incompatible | 38.6 | 794 |
| Mals (385) | Compatible | 59.4 | 1017 |
| | Incompatible | 40.5 | 697 |
| Kumarbhags | Compatible | 65.7 | 631 |
| (216) | Incompatible | 34.3 | 334 |

**Table 2: Distribution of ABO blood group and their allele frequencies in three sub-tribes of the Pahariyas**

| *Populations* | *Sex* | *Percentage of blood groups* | | | | *Allele frequencies* | | |
|---|---|---|---|---|---|---|---|---|
| | | *A* | *B* | *O* | *AB* | *A* | *B* | *O* |
| Saurias | M | 30.0 | 26.1 | 30.8 | 12.1 | 0.4644 | 0.4149 | 0.1206 |
| | F | 35.5 | 21.8 | 28.5 | 14.2 | 0.4226 | 0.2890 | 0.2854 |
| | M + F | 31.1 | 24.1 | 29.7 | 13.1 | 0.3976 | 0.3059 | 0.2974 |
| Mals | M | 26.9 | 31.5 | 28.5 | 13.1 | 0.3347 | 0.3800 | 0.2834 |
| | F | 19.7 | 37.7 | 32.3 | 10.3 | 0.2485 | 0.4279 | 0.3255 |
| | M+F | 23.5 | 34.4 | 30.4 | 11.7 | 0.2238 | 0.4028 | 0.3055 |
| Kumarbhags | M | 23.2 | 37.8 | 25.0 | 14.0 | 0.3018 | 0.4482 | 0.2500 |
| | F | 21.9 | 36.3 | 29.5 | 12.3 | 0.2770 | 0.4324 | 0.2905 |
| | M+F | 22.6 | 37.1 | 27.1 | 13.2 | 0.2919 | 0.4371 | 0.2709 |

**Table 4: Foetal losses in different couple combinations among three sub-tribes of the Pahariyas**

| *Populations* | *Blood groups* | *Husbands* | | | | | | | | $\chi^2$ - *values* | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | *A* | | *B* | | *O* | | *AB* | | | |
| *Wives* | | *6 months* | *Till birth* | *6 months* | *Till birth* | *6 months* | *Till birth* | *6 months* | *Till birth* | *6 months* | *Till birth* |
| Saurias | A | 9 | 9 | 15 | 17 | 7 | 8 | 9 | 9 | 3.6 | 4.7 |
| Mals | | 9 | 10 | 24 | 24 | 14 | 15 | 9 | 9 | 15.20 | 9.73 |
| Kumarbhags | | 17 | 18 | 19 | 20 | 7 | 7 | 14 | 14 | 5.80 | 6.70 |
| Saurias | B | 12 | 13 | 9 | 10 | 9 | 9 | 8 | 8 | - | - |
| Mals | | 24 | 25 | 8 | 10 | 9 | 9 | 19 | 19 | 12.1 | 11.1 |
| Kumarbhags | | 21 | 21 | 7 | 8 | 9 | 11 | 13 | 15 | 9.2 | 10.48 |
| Saurias | O | 9 | 10 | 10 | 12 | 7 | 7 | 11 | 14 | - | - |
| Mals | | 14 | 16 | 17 | 17 | 7 | 7 | 7 | 8 | - | - |
| Kumarbhags | | 17 | 18 | 22 | 24 | 7 | 8 | 18 | 18 | 6.62 | 7.9 |
| Saurias | AB | 11 | 13 | 10 | 11 | 17 | 18 | 8 | 8 | - | - |
| Mals | | 7 | 9 | 11 | 12 | 13 | 13 | 10 | 12 | - | - |
| Kumarbhags | | 11 | 12 | 8 | 10 | 8 | 8 | 9 | 10 | - | - |

Foetal losses (abortions) and infant deaths in different couple combinations are presented in table 4 and 5. Early foetal losses, *i.e.,* losses within six months of pregnancies as well as for the entire period of pregnancies (till birth) among the couples of A-type wives and B type husbands were recorded highest in the Mals, followed by the Kumarbhags and the Saurias, and the differences being significant ($P < 0.05$) in the Mals ($\chi^2 = 15.20$ in early stage and 9.73 for the entire period, d.f. = 3) in comparison to other couple combinations where wives were of A type. No such differences were recorded in remaining two sub-tribes, *i.e.,* in the Saurias and the Kumarbhags. Further, when couple combination having B type wives and A type husbands, the foetal losses were significantly higher ($P < 0.05$) in the Mals and the Kumarbhags at early stage ($\chi^2 = 12.1$ in the Mals and 9.2 in the Kumarbhags, d.f. = 3) and for the whole period too ($\chi^2 = 11.1$ in the Mals and 10.48 in the Kumarbhags, d.f. = 3) in comparison to other couple combinations with same type wives. In these two cases of couple combinations, *i.e.,* A type wives and B type husbands or vice versa, are of incompatible type and hence, the diffusing foetal blood cells can be destroyed by maternal ABO anti-bodies leading to miscarriage (Levine, 1958). In the Kumarbhags, O type women and B type men showed higher foetal losses and difference being non-significant at early stage, but for entire period of pregnancy it was significant ($P < 0.05$). In remaining two sub-tribes also the foetal deaths were high, but differences being non-significant.

**Table 5: Infants deaths in different ABO couple combinations among three sub-tribes of the Pahariyas**

| *Populations* | *Blood groups* | *Husbands* | | | | | | | | $\chi^2$ - *values* | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | *A* | | *B* | | *O* | | *AB* | | | |
| *Wives* | | *One month* | *One year* | *One month* | *One year* | *One month* | *One year* | *One month* | *One year* | *One month* | *One year* |
| Saurias | A | 12 | 16 | 24 | 52 | 15 | 23 | 14 | 27 | 7.38 | 24.38 |
| Mals | | 12 | 25 | 40 | 66 | 16 | 33 | 22 | 29 | 13.10 | 11.02 |
| Kumarbhags | | 9 | 18 | 31 | 39 | 18 | 19 | 22 | 26 | 19.5 | 11.01 |
| Saurias | B | 29 | 55 | 12 | 19 | 7 | 11 | 11 | 32 | 19.88 | 36.91 |
| Mals | | 18 | 27 | 19 | 25 | 12 | 15 | 12 | 23 | - | - |
| Kumarbhags | | 16 | 16 | 11 | 15 | 9 | 12 | 11 | 18 | - | - |
| Saurias | O | 20 | 23 | 23 | 30 | 7 | 13 | 11 | 16 | 10.97 | - |
| Mals | | 20 | 27 | 13 | 19 | 3 | 11 | 17 | 20 | - | - |
| Kumarbhags | | 8 | 15 | 9 | 12 | 9 | 9 | 4 | 8 | - | - |
| Saurias | AB | 16 | 20 | 19 | 21 | 7 | 3 | 2 | 4 | - | - |
| Mals | | 6 | 16 | 4 | 13 | 7 | 7 | 9 | 10 | - | - |
| Kumarbhags | | 18 | 21 | 6 | 7 | 22 | 34 | 18 | 28 | - | - |

Similar findings were reported by different workers in different populations where high foetal wastage occured in marriages between O type wives and A or B type husbands. In these cases the foetus contain an A or B antigen (inherited from father) that is not present in the mother herself. In other words, the mothers carry the naturally occuring antibodies in her serum, anti-A or anti-B. Any embryonic A or B red blood cells which leak through the placental membrane of an O type mother may quickly be destroyed by already existent anti-A or anti-B antibodies. Erythroblastosis due to anti-A or anti-B may occur (Volpe, 1971; Reddy and Sheshu, 1986; Strickberger, 1986 and pandey et al. 1997). Maximum foetal losses recorded in all the three sub-tribes of the Pahariya is in confirmity with earlier report (Volpe, 1971).

Although infant mortality recorded very high among the three sub-tribes of the Pahariyas, any clear cut trend was not come into view with regard to ABO incompatibility. Significantly higher infant deaths were observed in case of A type wives and B type husbands in all three sub-tribes at early (1 months) and for one year ($\chi^2$ = 7.38 and 24.38 in the Saurias, 13.10 and 11.02 in the Mals and 19.5 and 11.01 in the Kumarbhags, d.f. = 3) indicated the tendency towards the ABO-incompatibility. Higher infant deaths in the present case might be due to various reasons such a delivery related factors (tetanus neonatorum), extreme age of mothers, multiparity, short-birth interval and malnutrition etc. (Puffer and Serrano, 1975; De Vanzo and Habicht, 1983 and Mahadevan et al., 1986). Further, it is also reported that the chances of consanguinity/inbreeding are high in the population studied (Ansari and Sinha, 1978), leading to increased in the prenatal, postnatal deaths thereby decreased fertility, live births and survival of offsrings (Mian and Mustaq, 1994).

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