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Incidence of ABO and Rh Incompatibility in the Punjabi Couples

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Abstract: ***Background: ABO & Rh are the major blood group systems from transfusion point of view and reflect the genetic distribution and characteristics of molecular database of different ethnic groups, races, communities in the society and vary from one population to another in different regions of the country and in various parts of the world.***
Objective: To find out the incidence of ABO & Rh incompatibility in Punjabi couples and in different endogamous groups.
Material and Methods: This was a prospective, observational study performed on 550 Punjabi couples, female partners between 18 to 50 yrs. of age, ABO and Rh grouping was performed and compatibility was detected within each couple. The maternal record of couples was observed for fertility, live birth status, history of HDN.
Results: 53.1% were compatible and 46.9 % were incompatible. 50% of the Sikh couples, 16.7% of Muslims, 45.8% of Hindu, 42.1% of Christian and 33.3 % of Buddhist were found incompatible from their respective communities. Infertility was found maximum in SC (15.5%) minimum in BC (9.3%) but statistically not significant (p>0.050). Incidence of HDN was found significant (p<0.050) in incompatibles (8.21%) and in O-AB mating type (33.3%). Fertility outcome maximum in Muslims (3.0) and male/female ratio maximum in Sikhs, but found insignificant (p>0.050).
Conclusion: This study concluded that Incidence of incompatibility, infertility and live birth was not found statistically significant among different religion and endogamous groups in Punjabi population. Incidence of HDN was found significant in incompatibles as well in different mating types. The data generated from this study may help the researchers to understand the population related genetic studies.
Key words: ABO & Rh Incompatibility, Infertility, Endogamous Group, HDN, Live Birth, Punjabi Population

I. INTRODUCTION

Discovery of ABO system by Landsteiner marked the beginning of the era of research of different antigens on the red cells which proved to be first step for safe blood transfusion. Knowledge of these antigens at molecular level not only helped the scientists to understand the genetics of these antigens but also to frame them in certain blood group systems. Each blood group system has specific sequence of antigens either of carbohydrate or of protein depending upon its type. [(1)]These antigens are genetically controlled and are developed by the action of certain enzymes like ABH antigens, which resulted from the interaction of genes at three separate loci (ABO, Hh and Se). [(2)] These genes do not actually code for the productions of antigens but rather produce specific glucosyl transferases that add sugars to the basic precursor substance. A, B and H antigens are formed from the same basic precursor material to which sugars are attached in response to specific enzyme transferases elicited by an inherited gene. [(3)] The ABH antigens develop as early as the 37th day of fetal life but do not increase much in strength during the gestational period moreover the RBCs of the new born have been estimated to carry anywhere from 25-50% of the number of antigenic sites found on the adult RBC.[(4)]ABH antigens are integral parts of the membranes of RBCs, endothelial cells, platelets, lymphocytes, and epithelial cells and soluble antigens can also be found in all body secretions. The expression of A and B antigens on the RBCs is fully developed by 2-4 years of age and remains constant for life.[(5)]Their presence is dependent on the ABO genes inherited, as well as on the inheritance of another set of genes (secretor genes) that regulate their formation. ABO antibodies, in the absence of the corresponding antigens, appear during the 1st few months after birth, probably as a result of exposure to ABH antigen-like substances in the diet or the environment (naturally occurring). Anti-A and Anti-B are usually of IgM type, react best at low temperature and are nevertheless potentially lytic at 37^{0}C. [(4)] Hyper immune anti-A and anti-B, of IgG type, occur less frequently, usually in response to transfusion or pregnancy and mostly produced by group O and sometimes group A_2individuals. [(4)] Hyper immune Ig-G, anti-A or anti-B, from group O or group A_2mothers may cross placenta and cause hemolytic disease of newborn (HDN). So, the ABO phenotype of the fetus and immune status of the mother are the major determinant of manifestations of the ABO incompatibility which can be presented in the first pregnancy. These antibodies react over a wide thermal range and are more effective hemolysins than the

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naturally occurring antibodies. [6]The phenotypic expression of ABH antigens may vary with race, genetic interaction, and disease states which may be due to addition or suppression of an antigen in infection, malignancy or autoimmune diseases. [7,8,9,10,11]ABO antigens although most important in relation to transfusion are also expressed on most endothelial membranes and are important his to compatibility antigens. [12]

The Rh-D antigen is the most immunogenic red cell antigen after A and B, can stimulate anti-D production after transfusion or pregnancy in the majority of Rh-D negative individuals. In feto-maternal Rh incompatibility, the RBCs of the Rh-D negative mother get sensitized after the exposure of Rh-D positive cells of the fetus (inherited from Rh-D positive father) due to significant hemorrhage occur at delivery or in association with other intra-partum episodes such as amniocentesis, external version or abortion and thus having children affected with hemolytic disease in the succeeding pregnancies. Any pregnancy has 50% probability of producing Rh negative child if the male partner is heterozygous for Rh-D.So, Phenotype (blood group) and zygosity of the male partner (husband) and antibody titer of female partner (wife) are important determinant of the maternal sensitization. Incompatibility of ABO & Rh blood groups in feto-maternal relations may lead to certain manifestations in the maternal outcome like HDN, which further results into Jaundice, anemia, hydrops fetalis and sometimes intrauterine death (still birth) of fetus. Researchers also observed the association between ABO blood group and cardiovascular diseases and found that persons of group A group individuals have more frequently affected with coronary heart disease, ischemic heart disease, venous thrombosis and atherosclerosis, while its low in people with blood group O[13] and further these people are known to have 14 % reduced risk of squamous cell carcinoma and 4 % reduced risk of basal cell carcinoma when compared to non-O group.[14] It is also associated with a reduced risk of pancreatic cancer.[15] The B antigen is associated with increased risk of ovarian cancer.[16] Gastric cancer is more common in blood group A and least in group O.[17]So, considering these observations, ABO and Rh systems are of major clinical importance among the 36 blood group systems described till date in the numeric catalogue of red cell antigens maintained by International society of Blood Transfusion working party. [18] The incidence of ABO and Rh group varies markedly in different races, ethnic groups, and socio-economic groups in different parts of the world. [19]

II. ABO & RH INCOMPATIBILITY IN COUPLES

Compatible couple may be defined as a couple in whom male partner is able to donate his blood to his wife and in incompatible couple, unable to donate. Not much information is available on the incidence of incompatible couples in Punjabi population and specially in different endogamous groups. To further explore the subject of ABO incompatibility in the couples and to find out its incidence in the Punjabi population, this is one of the original research planned in the dept. of Obstetrics and Gynaecology (OBG) and dept. of Blood Transfusion & Immunohematology of Punjab Institute of Medical Sciences (PIMS), Jalandhar, the only teaching, tertiary care hospital in the central region (Doaba) of Punjab. Population in this area may be considered as the representative population of the whole Punjab as many people migrated here from other regions also i.e. Majha and Malwa and moreover many patients are routinely referred to this teaching hospital from the surrounding areas also. No such study has been done so far in this institute.

III. MATERIAL & METHODS

This was a prospective, observational study, performed on 550 couples, having female partners ranging 18 to 50 yrs. of age, selected at random, whom male partners were also available for blood sampling, attended the outdoor and indoor departments of Obs. and Gynae (OBG) of Punjab Institute of Medical Sciences (PIMS), Jalandhar from Nov 2016 to June 2017. ABO & Rh Blood grouping was performed by Micro plate Hem-agglutination method on fully automatic Immunohematology analyzer Galileo-Echo (Immucor, USA) in the dept. of Blood Transfusion and Immunohematology. All discrepant and further advance immune-hematological investigations were performed using conventional tube technique (CTT) and ID-Gel technology. All the Rh-D Negative groups were retested for weak-D antigen. Samples for subgroup typing were sent to Immucor's reference lab for confirmation. The demographic detail, socioeconomic status, endogamous group detail (Classification as per notification of Punjab Govt.) and maternal record of all the couples was recorded through a questionnaire with the consent of the participant subjects.

A. Statistical Analysis

The tabulated data was analyzed for frequencies of incidence of incompatibility in the study population among Punjabi couples belonging to different endogamous group by using software IBM SPSS Statistics 23. All the observed frequencies were tested for significance of association between observed attributes in different endogamous groups with statistical technique using Chi-square.

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B. Observations & Results

1) Participation: Among the selected suitable 550 couples, 537(97.64%) couples were participated from the OPD and 13 (2.36%) were from IPD. All the residing communities participated in this study i.e. Hindu (56.4%), Sikh (38.6%), Christian (3.5%), Muslim (1.1%) and Buddhist (0.6%). 37 % of the couples belonged to General Category, 32 % to Scheduled castes and 31% to backward class.Doaba region (97.27%) dominated over Majha (1.27%) and Malwa (1.45%) as the location benefit of hospital for the residents of Doaba (Fig. 1,2,3,4)

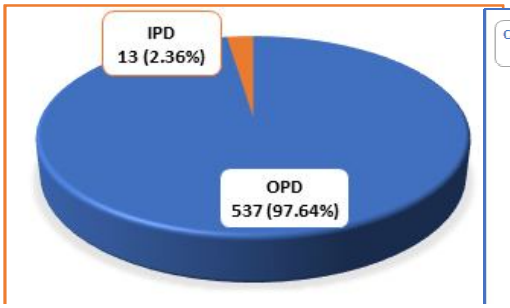


Fig.1 Participation - OPD & IPD

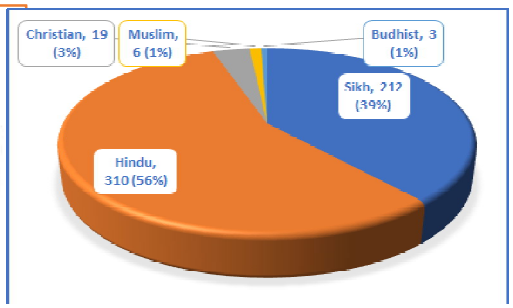


Fig.2 Participation - Religion wise

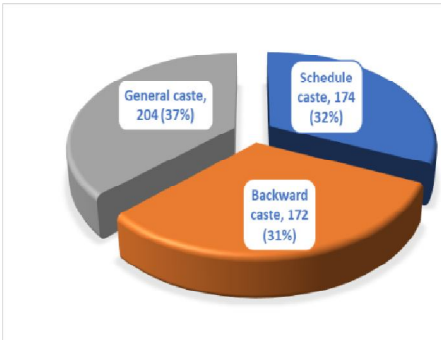


Fig.3 Participation–Endogamous group wise

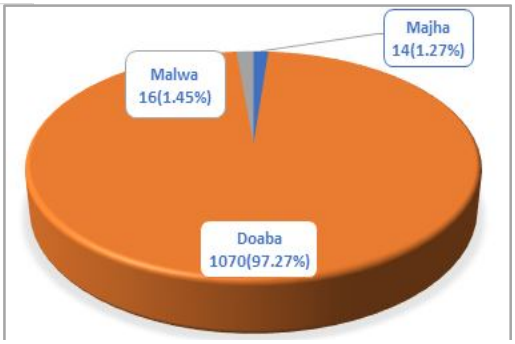


Fig.4 Participation - Region wise

2) Incompatibility: Among the total selected 550 couples, 292 (53.1%) were found compatible and 258 (46.9 %) were incompatible. Among the incompatible couples, 14 (2.55%) couples were ABO & Rh-incompatible (ABO & Rh-IC), 221 (40.18%) were ABO-incompatible (ABO-IC) and 23 (4.18%) couples were Rh-incompatible (Rh-IC). (Fig. 5)

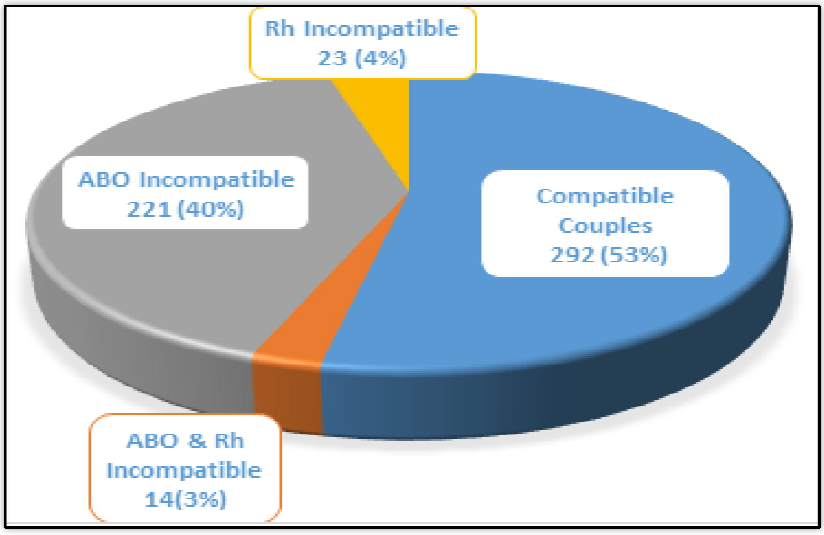


Fig 5. Incidence of Incompatibility in Couples

Among the total incompatible couples, incidence of ABO & Rh blood group incompatibility was observed with average of 46.9%. 50% of the couples belonging to Sikh community had incompatibility and this was observed only in 16.7% of Muslim couples.

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Table 1. Incidence of ABO & Rh Incompatibility among and within different religions (n=550)

		Compatible	Incompatible			
Religion	No. of Couples	No. of Couples	Total	ABO & Rh	ABO	Rh
Hindu	310 (56.4)	168 (54.2)	142 (45.8)	6 (4.2)	125 (88.0)	11 (7.8)
Sikh	212 (38.6)	106 (50.0)	106 (50.0)	8 (7.6)	87 (82.1)	11 (10.4)
Christian	19 (3.4)	11 (57.9)	8 (42.1)	0	7 (87.5)	1 (12.5)
Muslim	6 (1.1)	5 (83.3)	1 (16.7)	0	1 (100)	0
Buddhist	3 (0.6)	2 (66.7)	1 (33.3)	0	1 (100)	0
Total	550	292 (53.1)	258 (46.9)	14 (5.4)	221 (85.7)	23 (8.9)

Hindu, Christian and Buddhist had 45.8%, 42.1% and 33.3% of incompatibility respectively. It was observed maximum in backward classes (52.91%) particularly in Suniara and TonkKashatriya castes, minimum in general caste couples (41.67%) especially in Baniyas (33.3%) and 47.1% in Scheduled castes couples (Table 1,2,3). On analyzing the data for type of incompatibility i.e. ABO-IC, Rh-IC and ABO & Rh-IC, ABO type incompatibility (ABO-IC) dominated over the other types. In ABO-IC, maximum incidence was observed in Muslims and in Buddhist (not significant as participation was too less) and in class wise it was maximum in Backward classes (87.91%). In ABO & Rh-IC, Sikhs had maximum of 7.6% and in class wise, General categories had 8.24% of incidence. In Rh-IC, Christian had maximum of 12.5% of incidence and in class wise it was maximum in schedule castes (9.76%) (Table 1,2). No such significant association was found between incompatibility and different endogamous groups i.e. both attributes were found independent (p=0.094).

Table 2. Incidence of ABO & Rh Incompatibility among and within different Endogamous Groups (n=550)

Endogamous group	Total	Compatible	Incompatible	ABO & Rh-IC	ABO-IC	Rh-IC
Schedule caste	174 (31.64)	92 (52.87)	82 (47.13)	4 (4.88)	70 (85.37)	8 (9.76)
Backward caste	172 (31.27)	81 (47.09)	91 (52.91)	3 (3.30)	80 (87.91)	8 (8.79)
General caste	204 (37.09)	119 (58.33)	85 (41.67)	7 (8.24)	71 (83.53)	7 (8.24)
Total	550	292 (53.09)	258 (46.91)	14 (5.43)	221 (85.66)	23 8.91)

C. Incompatibility and Infertility

The data when tabulated for infertility to observe the incidence in the different religions, endogamous groups (castes), the average frequency of infertility was 11.6% in which it was observed high in the Buddhist (66.7%) but the participation was not significant as only three couples had participated in this. Hindu couples and couples belonging to schedule caste were found with high incidence of infertility i.e. 12.9% and 15.5 % respectively and the later had highest incidence in compatibles (17.44%) as well as in incompatibles (13.4%) (Table 3).

Table 3. Incidence of incompatibility and infertility in different Endogamous groups (n=550)

Ethnic Group	Total	Infertile	Compatible	Infertile	Incompatible	Infertile
Schedule Castes						
Addharmi	97 (17.64)	14 (14.43)	47(48.45)	7 (14.89)	50(51.55)	7 (14.0)
Balmiki	32 (5.82)	4 (12.50)	17(53.13)	2 (11.76)	15(46.88)	2 (13.33)
Bazigar	4 (0.73)	0.00	3(75.00)	0	1(25.00)	0
Buddhist	3(0.55)	2 (66.67)	2(66.67)	1 (50.0)	1(33.33)	1 (100.0)
Khatik	2(0.36)	1 (50.0)	2(100.00)	1 (50.0)	0(0.00)	0
Mazhbi	17(3.09)	3 (17.65)	10(58.82)	2 (20.0)	7(41.18)	1 (14.29)
Ramdasia	9(1.64)	1 (11.11)	5(55.56)	1 (20.0)	4(44.44)	0
Ravidasia	8(1.45)	2 (25.0)	5(62.50)	2 (40.0)	3(37.50)	0
Sansi	2(0.36)	0.00	1(50.00)	0	1(50.00)	0
Total	174(31.64)	27 (15.52)	92(52.87)	16 (17.39)	82(47.13)	11(13.41)

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Backward Castes						
Bhatt Sikh	3(0.55)	0.00	1(33.33)	0	2(66.67)	0
Chhimba	4(0.73)	0.00	1(25.00)	0	3(75.00)	0
Christian	19(3.45)	1 (5.26)	11(57.89)	1 (9.09)	8(42.11)	0
Jheer	4(0.73)	0.00	1(25.00)	0	3(75.0)	0
Julaha	2(0.36)	2 (100)	1(50.00)	1 (100)	1(50.0)	1 (100)
Kamboj	10(1.82)	0.00	3(30.00)	0	7 (70.0)	0
Kuchband	19(3.45)	5 (26.32)	11(57.89)	3 (27.27)	8 (42.11)	2 (25.0)
Kumhar	7(1.27)	0.00	3(42.86)	0	4(57.14)	0
Labana	2(0.36)	0.00	2(100.00)	0	0 (0.00)	0
Lohar	6(1.09)	1 (16.67)	3(50.00)	1 (33.33)	3 (50.0)	0
Nai	7(1.27)	0.00	4(57.14)	0	3 (42.86)	0
Rajput	27(4.91)	3 (11.11)	16(59.26)	1 (6.25)	11 (40.74)	2 (18.18)
Ramgarhia	41(7.45)	3 (7.32)	20(48.78)	2 (10.0)	21 (51.22)	1 (4.76)
Saini	10(1.82)	0.00	4(40.00)	0	6 (60.0)	0
Suniara	9(1.64)	1 (11.11)	0(0.00)	0	9 (100)	1 (11.11)
TonkKashatrya	2(0.36)	0.00	0(0.00)	0	2 (100)	0
Total	172(31.27)	16 (9.30)	81(47.09)	9 (11.11)	91 (52.91)	7 (7.69)
General Castes						
Ahir	6 (1.09)	0	3 (50)	0	3 (50.0)	0
Arora	32 (5.82)	3 (9.38)	17 (53.13)	1 (5.88)	15 (46.88)	2 (13.33)
Baniya	12 (2.18)	2 (16.67)	8 (66.67)	2 (25.0)	4 (33.33)	0
Bhagat	1 (0.18)	0	1 (100)	0	0	0
Brahmin	41 (7.45)	4 (9.76)	26 (63.41)	2 (7.69)	15 (36.59)	2 (13.33)
Jatt Sikh	47 (8.55)	6 (12.77)	25 (53.19)	3 (12.0)	22 (46.81)	3 (13.64)
Khatri	57 (10.36)	6 (10.53)	33 (57.89)	3 (9.09)	24 (42.11)	3 (12.50)
Mahajan	1 (0.18)	0	1 (100)	0	0	0
Muslim	6 (1.09)	0	2 (83.33)	0	1 (16.67)	0
Walia	1 (0.18)	0	0	0	1 (100)	0
Total	204 (37.1)	21 (10.3)	119 (58.3)	11 (9.2)	85 (41.7)	10(11.8)
Endogamous Class wise						
Schedule caste	174	27 (15.5)	92	16 (17.4)	82	11(13.4)
Backward caste	172	16 (9.3)	81	9 (11.1)	91	7 (7.7)
General caste	204	21 (10.3)	119	11 (9.2)	85	10(11.8)
Total	550	64 (11.64)	292	36 (12.3)	258	28(10.9)
p value	0.148		0.188		0.456	
Religion wise						
Hindu	310	40 (12.9)	168	21 (12.5)	142	19 (13.4)
Sikh & Others	240	24 (10.0)	124	15 (12.1)	116	9 (7.8)
Total	550	64 (11.6)	292	36 (12.3)	258	28 (10.9)
p value	0.292		0.917		0.149	

Average infertility rate was high in compatibles (12.3%) as compared to incompatibles (10.9). On statistical analysis, no association was found between compatible and incompatibles of different religions and endogamous groups with infertility ($p > 0.050$).

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D. Incompatibility and Haemolytic disease of New born (HDN):

Among the 258 incompatible couples, 123 (48%) of the female partners had O Phenotype, 73 (28%) had B, 60 (23%) had A and 2 (0.8%) had AB phenotype. Among the 123, O group females, 112 (91.1%) were ABO-IC, 7 (5.7%) were ABO & Rh-IC and 4 (3.3%) were Rh incompatibles (Rh-IC). After analysing the 112, O Group ABO incompatibles, it was found that 67 % of the male partners were B group, 27.7% were A group and 5.4% were AB group.

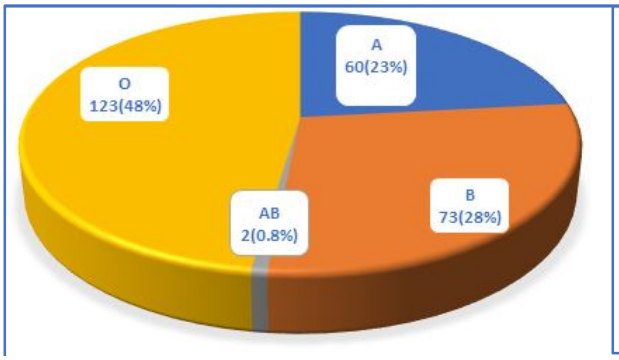


Fig. 6 Phenotype of Female Partner among Incompatibles (n=258)

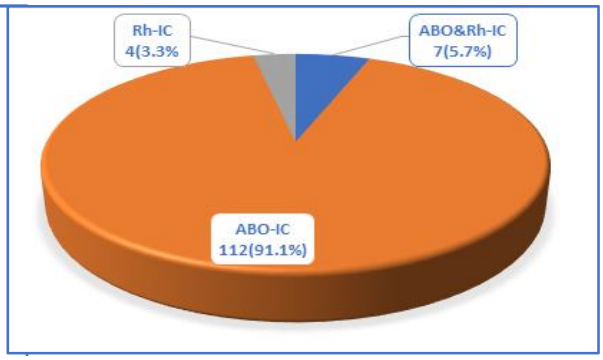


Fig. 7 Incompatibility in O Group Female Partners (n=123)

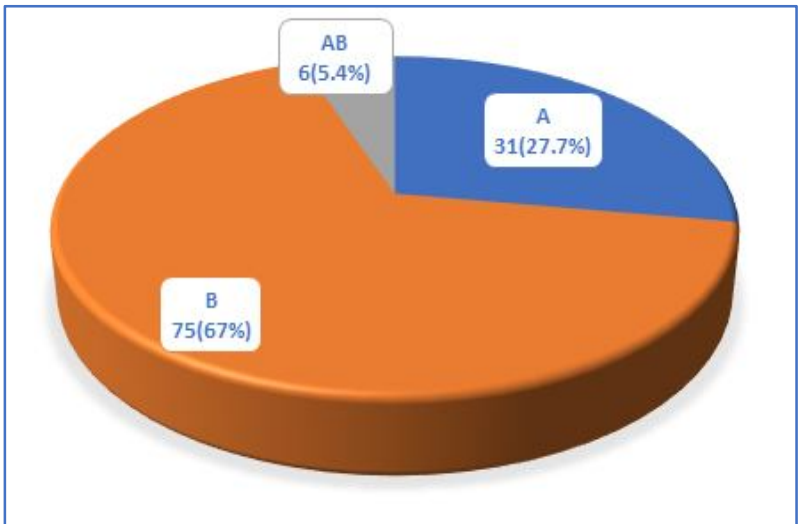


Fig. 8ABO Incompatibility in O Group Female Partners (n=112)

Incidence of HDN was also found significant in incompatibles (p=0.005) as compared to compatibles with mild association (phi=0.120) and moreover it had maximum incidence in ABO & Rh-IC (20%) (Table 4).

Table 4 Incidence of HDN among the live Births in the Study Population (n=555)

Type	Couples	Total Live Birth	HDN	p Value
Compatible Couples	292	287	8 (2.79)	0.005*
Total Incompatible Couples	258	268	22 (8.21)	
Total	550	555	30 (5.41)	
Incompatibles				* Significant
ABO & Rh Incompatible couples	14	10	2 (20.0)	0.383
ABO Incompatible couples	221	231	18 (7.8)	
Rh Incompatible couples	23	27	2 (7.4)	
Total	258	268	22 (8.21)	

Maximum incidence was observed in O group wives, in which O-AB had high frequency of incidence (33.3%) and O-A and O-B had equal number (8.6%). B-AB and B-A types had 8.3% and 4.8% of incidence respectively.

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Table 5 Incidence and frequency of HDN among the live births of different mating types

Mating Types	No. of couple	Live Birth	HDN
O-O	45	45 (1.0)	0
O-A	34	35 (1.03)	3 (8.6)
O-B	79	81 (1.03)	7 (8.6)
O-AB	6	6 (1.0)	2 (33.3)
A-O	39	35 (0.9)	0
A-A	28	27 (0.96)	1 (3.7)
A-B	46	48 (1.04)	5 (10.4)
A-AB	10	7 (0.70)	1 (14.3)
B-O	60	53 (0.88)	0
B-A	41	42 (1.02)	2 (4.8)
B-B	89	108 (1.21)	9 (8.3)
B-AB	19	22 (1.16)	0
AB-O	11	11 (1.0)	0
AB-A	10	9 (0.90)	0
AB-B	27	23 (0.85)	0
AB-AB	6	3 (0.5)	0
Total	550	555 (1.01)	30 (5.4)
p value	0.019*		

*****Significant

Among the A group wives, A-AB types had maximum incidence of 14.3 % and A-B had 10.4% of incidence against live births. Statistically the incidence of HDN and different mating types were found associated (p=0.019) although having mild association (phi=0.226) (Table 5). It was found that there was no incidence of HDN observed in the couples where husbands had O group (Universal donor) and wives had AB group ((Universal recipient).

Table 6 Incidence of HDN in ABO-IC couples having O Group Females (n=112)

Male Partner's Phenotype	No. of Couples	Live Births	HDN	P value
A	31	32	2 (6.3)	0.109
B	75	79	7 (8.9)	
AB	6	6	2 (33.3)	
Total	112	117	11	

There were 112 ABO-IC couples in whom female partners were having O group, when analysed for incidence of HDN against live birth, the results were apparently similar to the mating types. O-AB mating experienced maximum incidence of HDN than O-A (6.3%) and O-B (8.9%). Statistically significant difference was not established in all the three mating types.

E. Live Births status in Endogamous groups (castes)

This study also observed that average fertility outcome per couple in the form of live birth was 1.7 with maximum in Muslims (3.0) and lowest in Christians (1.5) with equal rate of 1.7 in Hindu and Sikhs. Male/Female ratio was observed maximum in Sikhs (1.08) i.e. they had more male children (51.9%) than female (48.1%) and minimum in Christians (M=33.3%, F=66.7%) with 0.5 ratio only.

Table 7. Endogamous group wise live birth status (n=555)

Endogamous Groups	No. of Couples	Live Birth	Male	Female
Schedule Castes				
Addharmi	54 (16.27)	84(1.56)	43(51.19)	41(48.81)
Balmiki	14(4.22)	24(1.71)	12(50.00)	12(50.00)
Bazigar	3(0.90)	10(3.33)	3(30.00)	7(70.00)

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Buddh	1(0.30)	2(2.00)	2(100.00)	0(0.00)
Khatik	1(0.30)	2(2.00)	0(0.00)	2(100.00)
Mazhbi	6(1.81)	9(1.50)	6(66.67)	3(33.33)
Ramdasia	5(1.51)	7(1.40)	6(85.71)	1(14.29)
Ravidasia	6(1.81)	12(2.00)	6(50.00)	6(50.00)
Total	90(27.11)	150(1.67)	78(52.00)	72(48.00)
Backward Castes				
Bhatt Sikh	2(0.60)	2(1.00)	0(0.0)	2(100.0)
Chhimba	4(1.20)	6(1.50)	2(33.3)	4(66.7)
Christian	10(3.01)	15(1.50)	5(33.3)	10(66.7)
Kamboj	8(2.41)	12(1.50)	7(58.3)	5(41.7)
KuchBand	11(3.31)	28(2.55)	14(50.0)	14(50.0)
Kumhar	5(1.51)	9(1.80)	5(55.6)	4(44.4)
Lobana	1(0.30)	1(1.00)	0(0.0)	1(100.0)
Lohar	3(0.90)	4(1.33)	0(0.0)	4(100.0)
Nai	4(1.20)	6(1.50)	4(66.7)	2(33.3)
Rajput	19(5.72)	30(1.58)	19(63.3)	11(36.7)
Ramgarhia	23(6.93)	44(1.91)	23(52.3)	21(47.7)
Saini	6(1.81)	12(2.00)	5(41.7)	7(58.3)
Suniara	7(2.11)	13(1.86)	8(61.5)	5(38.5)
TonkKashatriya	2(0.60)	3(1.50)	2(66.7)	1(33.3)
Total	105(31.63)	185(1.76)	94(50.8)	91(49.2)
General Castes				
Ahir	5(1.51)	10(2.00)	5(50.0)	5(50.0)
Arora	27(8.13)	48(1.78)	23(47.9)	25(52.1)
Baniya	8(2.41)	16(2.00)	5(31.3)	11(68.8)
Bhagat	1(0.30)	1(1.00)	0(0.0)	1(100.0)
Brahmin	26(7.83)	37(1.42)	18(48.6)	19(51.4)
Jatt Sikh	24(7.23)	32(1.33)	13(40.6)	19(59.4)
Jheer	1(0.30)	2(2.00)	2(100.0)	0(0.0)
Khatri	39(11.75)	59(1.51)	31(52.5)	28(47.5)
Mahajan	1(0.30)	2(2.00)	0(0.0)	2(100.0)
Muslim	4(1.20)	12(3.00)	6(50.0)	6(50.0)
Walia	1(0.30)	1(1.00)	1(100.0)	0(0.0)
Total	137(41.27)	220(1.61)	104(47.3)	116(52.7)
Class wise				
Schedule caste	90 (27.1)	150 (1.67)	78 (52.0)	72 (48.0)
Backward caste	105 (31.6)	185 (1.76)	94 (50.81)	91 (49.19)
General caste	137 (41.3)	220 (1.61)	104 (47.27)	116 (52.73)
Total	332	555 (1.67)	276 (49.73)	279 (50.27)
p value			0.629	
Religion wise				
Hindu	190 (57.2)	314 (1.7)	153 (48.7)	161 (51.3)
Sikh	127 (38.3)	212 (1.7)	110 (51.9)	102 (48.1)
Christian	10 (3.0)	15 (1.5)	5 (33.3)	10 (66.7)
Muslim	4 (1.2)	12 (3.0)	6 (50.0)	6 (50)
Buddhist	1 (0.3)	2 (2.0)	2 (100)	0
Total	332	555 (1.7)	276 (49.7)	279 (50.3)
p value			0.650	

Muslim had equal number of male female children (50%) with 1.0 M/F ratio and Hindu had slightly higher number of female children (51.3%) with 0.95 M/F ratio. In different Endogamous groups, average fertility outcome per couple in the form of live birth was almost equal with slight difference i.e. Backward classes had 1.8 with maximum in Kuchband caste (2.6), Schedule class had

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1.7 with maximum in Bazigar (3.33) and General class had 1.6 with almost equal rate. Statistically Hindu and other communities including Sikh, Christian, Muslim and Buddhist have no significant association with child birth i.e. live birth and gender of child was not found associated with religion and endogamous groups (class).

IV. DISCUSSION

The Punjabi population mainly comprised of people who speaks Punjabi language (mother tongue) and inherited same ethnicity. Traditionally Punjabi people are bound to same linguistic, geographical and cultural identity although having different faiths (religion), endogamous groups and having different socioeconomic status. Historically, Punjabi people are heterogenous and subdivided into different 'biradari' (tribes). Punjabi Sikh, Punjabi Hindu and Punjabi Muslims were the main sub groups of the earlier Punjab but with the passage of time, Christian and Buddhist were also evolved by conversions from different endogamous groups. Migration of Punjabi people from Punjab of Pakistan at the time of partition have greatly affected the socio-economic and cultural framework of Punjab. There might have some participation of those couples in this study whom forefathers or grandparents might have migrated from Pakistan. Due to participation of lesser number of participants/subjects in some of the endogamous group and religions, we have analyzed the results as per classification by Govt. of Punjab regarding the classification of different castes and tribes in some particular sections like Scheduled Castes, Backward Classes and General categories. [(20)]and in case of religion, Hindu and others were classified and observed.

Focus of this study was to find the incidence of incompatibility in the Punjabi population in general and in endogamous groups/classes in specific. As we have observed frequency of incidence of incompatibility along with infertility and HDN in the couples in the study population and tested for it association. It was found that Incidence of incompatibility was not found statistically significant among different endogamous groups of Punjabi population ($p>0.050$). As far as the issue of infertility and incompatibility is concerned it was observed insignificant ($p>0.050$). This finding is in accordance with the studies done by G. Ganitha et al [(21)] and Sigler et al[(22)] in which the researchers found that ABO blood group or ABO incompatibility is not directly associated with infertility.It was also observed that ABO-Incompatibility type was found dominating over the other types of incompatibilities i.e. ABO & Rh and Rh incompatibility. Incidence of HDN was found significant in incompatibles as well in different mating types ($p<0.050$). So, incidence of HDN was found associated with incompatibility. Faris B. Swaf et al[(23)] also concluded that the ABO incompatibility is the most common cause of hemolytic disease of newborn. Live birth and gender of child type attributes were also found not associated with religion and endogamous groups (class) in Punjabi population ($p>0.050$).On comparing this study with one of the study done in earlier times (1979-81) on Bengalee Hindu population including upper caste Brahmin and Scheduled castes,[(24)] in which the researchers found theoverall increasing trend of the incidence of caste exogamy among the couples which contributes the heterogeneity in distribution of the ABO blood groups among the couples of some of the caste groups, specially the upper castes, which in turn led to increase in the incidence of ABO incompatibility in couple combinations.

V. CONCLUSION

This study concluded that Incidence of incompatibility, infertility and live birth was not found statistically significant among different religion and endogamous groups in Punjabi population. Incidence of HDN was found significant in incompatibles as well in different mating types. The data generated from this study may help the researchers to understand the population related genetic, endogamous groups related heterogenicity of population and to understand the different aspects of blood group incompatibility related attributes and manifestations. These results may help the researchers in the genetic and anthropology related studies and to understand the inheritance related issues also.

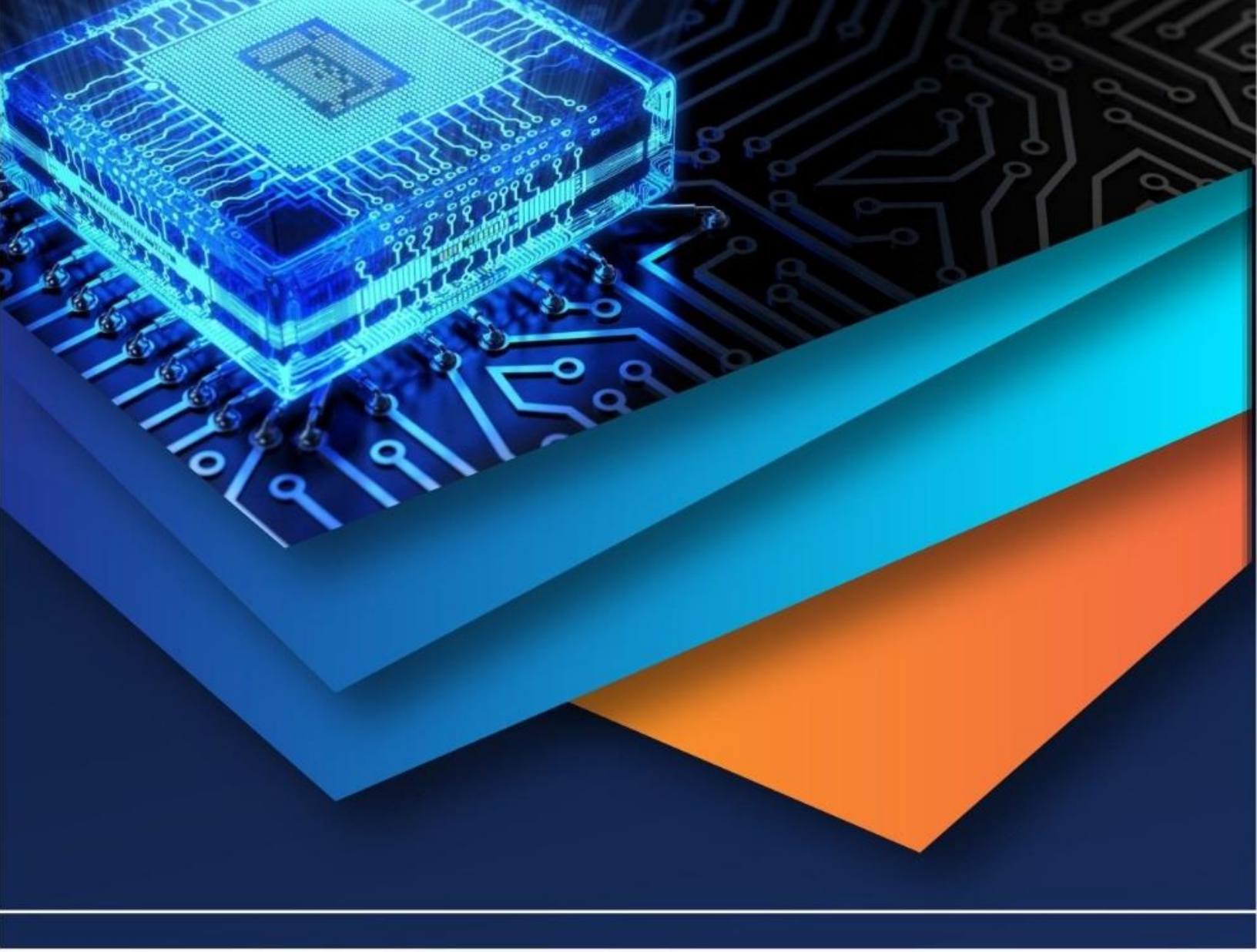
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