



Short Communication

Evaluating the link between ABO blood groups and hearing impairment among South Indian individuals

Jaya Sankar Rao¹, Vidya Gowda², Abhilash Hebbal Rajendra¹, Rabiya Fathima¹, Charles Sylvester^{1*}

¹ Unit for Human Genetics, All India Institute of Speech and Hearing, Mysore, India.

² Department of Audiology, All India Institute of Speech and Hearing, Mysore, India.

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*Corresponding Author:

Dr. Charles Sylvester

Email: charlessylvester29@gmail.com

Phone: +91 9008146584

ABSTRACT

Background: Blood group antigens are genetically inherited and play a vital role in transfusion safety, genetic studies, and disease susceptibility. Hearing is a vital special sense essential for communication, and several studies suggest a potential association between blood group types and susceptibility to hearing loss. **Objective:** This study aimed to explore the correlation between ABO blood group distribution and the occurrence of non-syndromic hearing loss (NSHL) among hearing-impaired individuals in South India. **Methods:** Ninety-four patients diagnosed with NSHL were included after obtaining informed consent. ABO blood grouping was performed by agglutination, and pure-tone audiometry (PTA) was conducted. **Results:** The predominant blood group was O+ve, followed by A+ve, B+ve, and AB+ve. PTA findings showed that O+ve was more frequent in mild to moderately severe hearing loss categories, while A+ve was more common among moderate cases. **Conclusion:** The findings collectively indicate that individuals with blood group O may have a greater predisposition to auditory dysfunctions, including sensorineural hearing loss. This association, supported by multiple studies, suggests potential underlying biological mechanisms linking blood group O to increased vulnerability of cochlear or neural auditory pathways.

1. INTRODUCTION

Blood group antigens are genetically inherited and play a crucial role in transfusion safety, as well as in understanding genetics, inheritance patterns, and disease susceptibility (Patel et al., 2012; Li and Guo, 2022). The ABO blood group system, discovered by Karl Landsteiner in 1901 using the agglutination method, is the most important and widely known human blood typing system. It is based on the

presence or absence of A and B antigens on red blood cells and corresponding antibodies in plasma, classifying blood into four main groups: A, B, AB, and O (Landsteiner, 1900; Decastello, 1902; Dean, 2005). Specific carbohydrate moieties present on the surface of red blood cells (RBCs) determine an individual's blood group. These carbohydrate structures can bind to particular antigens, influencing an individual's receptiveness to certain diseases (Dean, 2005; Reid and Mohandas, 2004). In India, the most common blood

group is O+ve, followed by B+ve, A+ve, and AB+ve, which account for about 37%, 33%, 22%, and 5% of the population, respectively (Agrawal et al., 2014).

Genetic variations associated with different blood groups can affect an individual's susceptibility to certain disorders (Sircar, 2008; Imran et al., 2024). Studies have shown that individuals with the O blood group may have a higher risk of developing Noise-Induced Hearing Loss (NIHL) (Lashley, 2005; Imran et al., 2024). The internal auditory artery supports cochlear function by maintaining endocochlear potentials (Chow et al., 2016). The ABO blood group system affects hearing through variations in glycoproteins like von Willebrand Factor and thrombospondin. Individuals with blood group O have lower von Willebrand Factor levels, leading to altered cochlear function and greater susceptibility to hearing impairment (Salt et al., 1987; Koster et al., 1995; Takayama et al., 2018). The present study was designed to explore the relationship between ABO blood group and Non-Syndromic Hearing Loss (NSHL) among hearing-impaired men and women from South India.

2. MATERIALS AND METHODS

2.1 Participants

Ninety-four individuals with hearing loss were recruited, including 51 males and 43 females. ABO grouping was analysed by the blood agglutination method using a commercially available anti-serum kit (Spanclone, ARKRAY Healthcare, Surat, India). Institute Review Board of the All India Institute of Speech and Hearing (AIISH), Mysore, approved the ethical clearance for Bio-Behavioural Research involving Human subjects (Approval No. SH/IRB/P.10/2025-26; Dt. 02-09-2025). All participants were fully informed about the objectives and procedures of the study, and written informed consent was obtained from each participant prior to inclusion. Pure tone audiometry (PTA) was performed using Piano (Inventis, USA) and Avant ARC (MedRX, USA) audiometers to assess each individual's hearing thresholds for standardized acoustic stimuli presented through both air and bone conduction pathways. Subjects with only NSHL were included in this study, and those with severe medical conditions were excluded.

2.2 Data analysis

Data were analyzed using the Statistical Package for the Social Sciences (SPSS) version 21.0 (IBM Corp., Armonk, USA). The chi-square test was used to verify the association between blood group

frequencies across genders.

3. RESULTS

Out of 94 patients investigated, 51 (54.26%) patients aged between 17 and 70 years (Mean age 39.82 ± 13.72 SD) were males, and 43 (45.74%) patients aged between 15 and 65 years (Mean age 35.95 ± 13.87 SD) were females. Among the total participants, 93 were Rhesus (Rh)-D positive, while one patient was Rh-D negative (B-ve). The distribution of the ABO blood group in relation to gender is shown in Table 1. Pure-tone audiometric (PTA) thresholds, categorised into Mild (MI), Moderate (MD), Moderately Severe (MS), Severe (S), and Profound (P), were compared with ABO blood groups, as shown in Figures 1 & 2. There was no significant relationship between ABO blood group and the degree of hearing loss (Table 2).

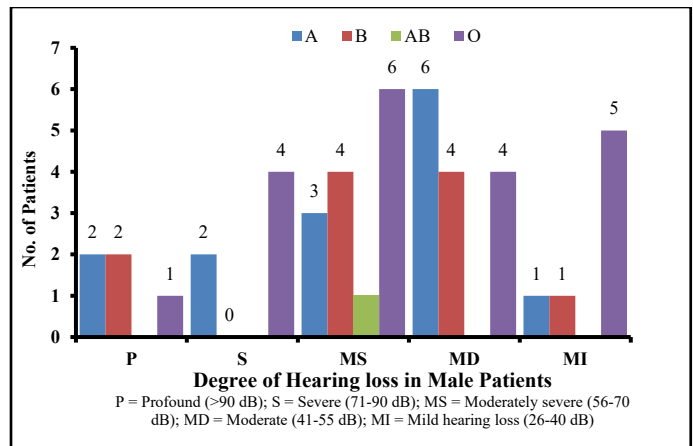


Figure 1: Distribution of ABO blood group in male subjects across different degrees of Hearing Loss.

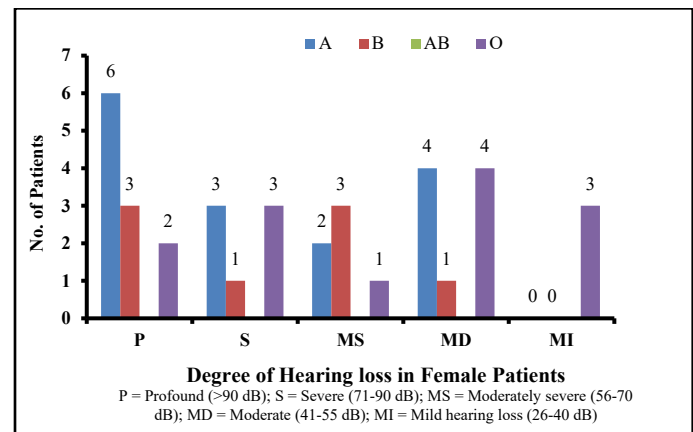


Figure 2: Distribution of ABO blood group in female subjects across different degrees of Hearing Loss.

4. DISCUSSION

Human Diaspora possesses the same blood group systems; however, the distribution of specific

Table 1: Frequency of ABO blood group based on gender (n = 94)

ABO	Male	Female	Total	Chi square	p-value
	N (%)	N (%)	N (%)		
O	21 (41.18)	17 (39.53)	38 (40.4)		
A	14 (27.45)	17 (39.53)	31 (33.0)	2.548	0.4665*
B	15 (29.41)	9 (20.93)	24 (25.5)		
AB	1 (1.96)	0 (0.00)	01 (1.06)		
Total	51	43	94 (100)		

*P<0.05 is not-significant

Table 2: Relation of ABO blood group with degree of hearing loss

ABO blood group	A (%)	B (%)	AB (%)	O (%)	Chi square	p-value
Profound	8 (9.76)	5 (6.10)	0	3 (3.66)		
Severe	5 (6.10)	1 (1.22)	0	7 (8.54)		
Moderately severe	5 (6.10)	7 (8.54)	1 (1.22)	7 (8.54)	17.4	0.1352*
Moderate	10 (12.20)	5 (6.10)	0	8 (9.76)		
Mild	1 (1.22)	1 (1.22)	0	8 (9.76)		

*P<0.05 is not-significant

blood types varies across different races, ethnic groups, socio-economic classes, and regions of the world (Prabhu et al., 2018). Studies from southern India have reported blood group 'O' as the most prevalent, followed by 'B', 'A', and 'AB' (Das et al., 2001; Patidar and Dhiman, 2021).

In the present study, blood group O+ve was the most common type (40.4%), followed by A+ve (33.0%), B+ve (25.5%), and AB+ve (1.06%). The distribution pattern was similar in both sexes, with males showing a slightly higher proportion of blood group O+ve (41.18%) and females showing a marginally higher proportion of blood group A+ve (39.53%). The chi-square test revealed no statistically significant difference in blood group distribution between males and females ($\chi^2 = 2.548$, $p = 0.4665$). This indicates that the ABO blood group distribution is independent of sex in the studied population. The findings align with previous reports from various regions of India and other populations, where the predominance of blood group O and absence of sex-based variation have been consistently observed (Agrawal et al., 2014; Patidar and Dhiman, 2021).

While looking at PTA, blood group O+ve showed higher frequencies in the MS, MD, and MI categories, while blood group A+ve was relatively more frequent in the MD group. Blood group B+ve were distributed evenly but less prominently across

categories. Among females, blood group A+ve predominated in the P (Profound) and MD groups, whereas blood group O+ve was more common in the S (Severe), MD, and MI groups. The near absence of blood group AB in both sexes underscores its general rarity in most populations. From a genetic perspective, the ABO system is governed by autosomal alleles located on chromosome 9, which explains the absence of sex-related differences (Yamamoto et al., 1990; Periyavan et al., 2010). The minor variations observed between blood groups could be attributed to regional genetic heterogeneity, differences in sample size, and population structure (Daniels, 2013).

Prabhu et al. (2018) observed that individuals with blood group O exhibited reduced otoacoustic emissions (OAE), suggesting hearing loss associated with outer hair cell dysfunction. Yang et al. (2021) further reported that individuals with the O blood group may have a higher risk of cochlear and/or neural dysfunction compared to those with non-O blood groups. Consistent with these findings, Tyagi and Feotia (2023) found noise-induced hearing loss (NIHL) to be significantly more frequent among individuals with blood group O, while Uddin et al. (2024) reported a higher prevalence of sensorineural hearing loss (SNHL) in the O blood group.

The individuals with non-O blood groups (A, B, AB) generally exhibit higher circulating levels of von

Willebrand factor (vWF) and Factor VIII, whereas those with blood group O have approximately 25–35% lower concentrations of these coagulation proteins (Jenkins & O'Donnell, 2006; Takayama et al., 2014). This hematological difference has physiological implications, as reduced vWF levels may contribute to microvascular fragility, impaired perfusion, and increased susceptibility to cochlear ischemia because the cochlea is a highly vascular sensory organ with no collateral blood supply, making its function critically dependent on uninterrupted microcirculation (Song et al., 2015). Individuals with blood group O may be at elevated risk of cochlear synaptopathy and/or brainstem neural dysfunction compared to those with other blood groups (Kamalakaran et al., 2023).

5. CONCLUSION

This study examined the association between ABO and Rh blood group systems and pure tone audiometry outcomes. In accordance with earlier studies, individuals with blood group O showed greater susceptibility to auditory dysfunction, potentially due to lower vWF and Factor VIII levels that may compromise cochlear microcirculation, reinforcing a biologically plausible association with greater risk of hearing loss.

List of Abbreviations

AIISH - All India Institute of Speech and Hearing; SNHL - Sensorineural Hearing Loss; NSHL - Non-Syndromic Hearing Loss; PTA - Pure tone audiometry; SPSS - Statistical Packages for the Social Sciences; USA – United States of America; MI – Mild; MD – Moderate; MS-Moderately Severe; S – Severe; P – Profound; OAE – Oto-Acoustic Emission; RBC - Red Blood Cells

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Conflict of interest

The authors declare that there is no conflict of interest regarding the publication of this manuscript.

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