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Original Research Article

ASSOCIATION OF ABO BLOOD GROUPS WITH ANIMAL BITE VICTIM PROFILES IN A TERTIARY CARE ANTI-RABIES CLINIC

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ABSTRACT

Background: The ABO blood group system has been associated with susceptibility to several infectious and non-infectious conditions; however, its relationship with animal bite victim profiles has not been well studied. The Objective is to assess the distribution of ABO blood groups among animal bite victims attending a tertiary care Anti-Rabies Clinic and to examine associations between ABO blood groups and selected bite-related characteristics.

Materials and Methods: A cross-sectional observational study was conducted at the Anti-Rabies Clinic of a tertiary care hospital in North India from May-June 2026. A total of 235 animal bite victims with known or confirmed ABO blood group status and complete bite-related information were included. Sociodemographic details, bite characteristics, type of biting animal, WHO exposure category, and blood group status were recorded using a semi-structured questionnaire. ABO and Rh blood grouping were performed by the slide agglutination method. Data were analyzed using descriptive statistics and chi-square tests.

Results: Among 235 participants, most were males (68.1%) and belonged to the 18–35 years age group (39.1%). Dog bites were the most common type of bite (69.4%), and most exposures were WHO Category III (70.2%). The most frequent blood group was B+ (36.2%), followed by O+ (29.4%), A+ (23.0%), AB+ (7.2%), O− (3.0%), and A− (1.3%). ABO blood group showed statistically significant associations with the type of biting animal (χ^2 = 107.524, $p < 0.001$; Cramer's V = 0.478) and WHO category of bite (χ^2 = 74.560, $p < 0.001$; Cramer's V = 0.563). No significant association was observed with previous history of animal bite, time of bite, anatomical site, number of wounds, or clinical severity.

Conclusion: ABO blood groups were significantly associated with the type of biting animal and WHO exposure category among animal bite victims, while no significant association was found with several other bite-related variables. Larger multicentric studies with community controls are recommended to clarify whether ABO blood group independently influences animal bite patterns or severity.

Keywords: ABO Blood-Group System, Anti-Rabies Vaccines, Rabies, Post-Exposure Prophylaxis , Cross-Sectional Studies.

INTRODUCTION

In 1900, Karl Landsteiner identified the ABO blood group system, which is characterized by specific antigens on red blood cells that influence blood compatibility. This system consists of four primary antigens: A, B, AB, and O. These antigens, which are oligosaccharides, are present on red blood cells and various tissues, playing a vital role in ensuring compatibility for blood transfusions and organ transplants.[1,2,3]

In India, the distribution of ABO blood groups shows that group O is the most widespread, comprising about 34-39% of the population. Blood group B follows closely, representing approximately 29-34%. Group A accounts for around 22-23%, while AB is the least common, found in about 6-10% of people. The majority of the population, over 90%, is Rh-positive, although there are regional differences in these patterns across the country.[4-7]

Research has previously demonstrated notable connections between ABO blood groups and the likelihood of developing various diseases. The ABO blood group system is associated with cardiovascular conditions, where individuals with non-O blood types face a greater risk of thrombosis and myocardial infarction due to molecular interactions involving endothelial and platelet-derived glycoproteins. Furthermore, ABO blood groups are linked to different types of cancer and infectious diseases, including COVID-19, where individuals with group AB might be more susceptible, while those with group O appear to have a lower risk. There is also evidence suggesting a relationship between ABO blood groups and type 2 diabetes mellitus, with certain blood types exhibiting a higher prevalence. Extensive cohort studies emphasize these connections across a range of conditions, such as musculoskeletal, genitourinary, and infectious diseases, underscoring the significant influence of ABO blood groups on disease susceptibility and outcomes.[8-12]

In India, factors such as being male, residing in cities, and coming into contact with stray dogs contribute significantly to the risk of animal bites. Stray dogs are the main culprits for both bites and the spread of rabies. The danger is further increased by inadequate cleaning of wounds and limited availability of post-exposure prophylaxis. Children face a higher risk due to their behaviour and frequent interactions with dogs.[13,14]

Research has previously examined the link between ABO blood types and vulnerability to infectious diseases, identifying connections with illnesses like malaria, tuberculosis, and COVID-19. Nonetheless, there is a scarcity of direct studies on the relationship between blood types and susceptibility to animal bites. Most research on animal bites has concentrated on epidemiological aspects and treatment methods rather than the impact of blood types.[15-17]

To our knowledge, no prior study has systematically examined the association between ABO blood groups and animal bite victim profiles, including bite severity and animal type. Understanding such associations may inform risk stratification and prevention strategies.

In this context, we carried out a cross-sectional observational study to evaluate how common each ABO blood group is among animal bite victims visiting an Anti-Rabies Clinic (ARC) at a tertiary care center. We also examined the link between ABO blood groups and different factors related to animal bites.

MATERIALS AND METHODS

This was a cross-sectional, single-centre observational study conducted at the Anti-Rabies Clinic of a tertiary care hospital in North India. A total of 235 animal bite victims attending the clinic during the study period were enrolled after fulfilling the eligibility criteria. The study was conducted in May-June 2026 after obtaining approval from the Institutional Ethics Committee, Government Medical College, Patiala, Punjab, registered with NECRBHR, DHR Reg. No. EC/NEW/INST/2023/PB/0383, vide letter no. 9(310)2026/15045 dated 10/04/2026. Clinical trial registration was not applicable.

All animal bite victims attending the Anti-Rabies Clinic during the study period, irrespective of age and sex, were considered eligible for inclusion if they had known or confirmed ABO blood group status and complete bite-related information. Patients who did not provide consent were excluded from the study. Data were collected using a semi-structured questionnaire that included sociodemographic details, animal bite-related characteristics, and blood group information.

Blood group testing was performed free of cost for all patients at the clinic by trained healthcare staff using the SPANCLONE blood grouping kit manufactured by ARKRAY Healthcare Pvt. Ltd., Lot No. 4000033074, manufactured on 17 January 2026 and expiring on 17 January 2028. ABO and Rh blood grouping was performed by the slide agglutination method using SPANCLONE Anti-A, Anti-B, and Anti-D monoclonal blood grouping antisera, according to the manufacturer's instructions. One drop each of anti-A, anti-B, and anti-D reagent was placed separately on a clean glass slide, followed by the addition of one drop of the participant's blood sample to each reagent. The blood and reagent were mixed uniformly using separate applicator sticks and observed macroscopically for agglutination within the recommended time period. Agglutination with anti-A and/or anti-B reagents was used to determine the ABO blood group, while agglutination with anti-D reagent was interpreted as Rh (D) positive. Absence of agglutination with anti-D was recorded as Rh (D)

negative. Standard biosafety precautions were followed during sample handling, and results were interpreted as per the manufacturer's package insert and standard immunohematology procedures.[18–20]

The collected data were entered into Microsoft Excel 2021 and cleaned before analysis. Descriptive and inferential statistical methods were used to analyse the data. Descriptive statistics were applied to summarize sociodemographic characteristics, animal bite-related variables, and ABO/Rh blood group distribution. Inferential statistics were used to assess associations between blood group status and selected bite-related variables.

RESULTS

The Conceptual Study Design is given in [Figure 1].

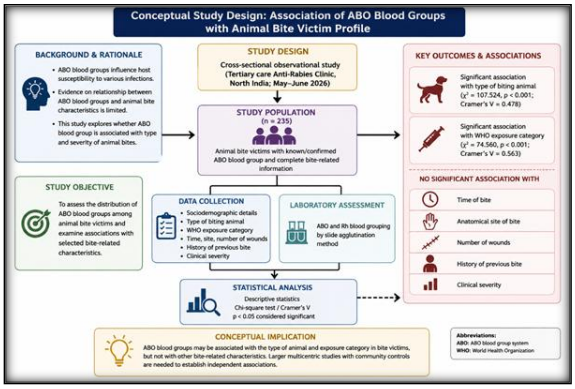

Figure 1: Conceptual framework showing study design, data collection, and analysis of ABO blood groups in animal bite victims, highlighting key significant and non-significant associations.

Sociodemographic characteristics of animal bite victims

Among the 235 animal bite victims, the majority belonged to the 18–35 years age group (n = 92, 39.1%), followed by <18 years (n = 51, 21.7%), 36–50 years (n = 47, 20.0%), 51–65 years (n = 29, 12.3%), and >65 years (n = 16, 6.8%) age groups.

Males were predominant (n = 160, 68.1%) compared to females (n = 75, 31.9%).

Most participants were from urban areas (n = 147, 62.6%), followed by rural (n = 71, 30.2%), semi-urban (n = 12, 5.1%), and semi-rural areas (n = 5, 2.1%).

Regarding socioeconomic status, Class I was the most common (n = 93, 39.6%), followed by Class II (n = 69, 29.4%), Class III (n = 50, 21.3%), Class IV (n = 18, 7.7%), and Class V (n = 5, 2.1%).

Characteristics of animal bite incidents

Bites occurred most frequently in the evening (n = 82, 34.9%), followed by morning (n = 69, 29.4%), night (n = 43, 18.3%), and afternoon (n = 41, 17.4%).

Most victims had single-site involvement (n = 155, 65.9%), while multiple sites were reported in n = 80 (34.1%).

The most common bite location was the lower limb (n = 139, 59.1%), followed by the upper limb (n = 71, 30.2%), trunk (n = 12, 5.1%), and head (n = 5, 2.1%).

Regarding wound count, single-wound cases were most common (n = 155, 66.0%), followed by two wounds (n = 35, 14.9%) and multiple wounds (n = 45, 19.1%).

Dog bites were the most frequent (n = 163, 69.4%), followed by cat bites (n = 42, 17.9%) and bites from other/unknown animals (n = 30, 12.8%). Most bites were from stray animals (n = 161, 68.5% of cases).

Injury severity was mostly moderate (n = 137, 58.3%), followed by mild (n = 57, 24.3%) and severe (n = 41, 17.4%) injuries.

According to the WHO classification, Category III exposure was predominant (n = 165, 70.2%), while Category II accounted for n = 70 (29.8%).

Most bites were sudden/unprovoked (n = 148, 63.0%), while the remaining were provoked or playful.

Table 1: Sociodemographic characteristics of animal bite victims

Characteristic	Category	Count (N=235)	Percentage (%)
Age Group	<18	51	21.7%
	18-35	92	39.1%
	36-50	47	20.0%
	51-65	29	12.3%
	>65	16	6.8%
Gender	Female	75	31.9%
	Male	160	68.1%
Area of Residence	Rural	71	30.2%
	Semi-Rural	5	2.1%
	Semi Urban	12	5.1%
	Urban	147	62.6%
Socioeconomic Status	Class I (Upper)	93	39.6%
	Class II (Upper middle)	69	29.4%
	Class III (Middle)	50	21.3%
	Class IV (Lower middle)	18	7.7%
	Class V (Lower)	5	2.1%

Table 2: Characteristics of bite

Characteristic / Category	Count (N)	Percentage (%)
Time of dog bite		

Evening (17:00-21:00PM)	82	34.9%
Morning (6:00AM-10:00AM)	69	29.4%
Night (21:00PM-6:00AM)	43	18.3%
Afternoon (12:00-17:00PM)	41	17.4%
Extent of bite		
Single	155	65.9%
Multiple	80	34.1%
Area of bite (in case of multiple site of bite, ticks multiple)		
Lower limb	139	59.1%
Upper limb	71	30.2%
Trunk	12	5.1%
Head	5	2.1%
Head, Lower limb	3	1.3%
Neck	2	0.9%
Trunk, Lower limb	1	0.4%
Head, Upper limb	1	0.4%
Upper limb, Lower limb, Genitals	1	0.4%
Total number of wounds		
1	155	66.0%
2	35	14.89%
3	18	7.7%
>3	27	11.4%
Biting animal		
Dog	163	69.36%
Cat	42	17.87%
Others	30	12.76%
Type		
Stray	161	68.5%
Pet	74	31.5%
Severity of bite		
Moderate: Shallow, Single puncture wound, Slight bleeding	137	58.3%
Mild: Superficial scratches, Minor bruising, No bleeding	57	24.3%
Severe: Deep puncture wounds, heavy bleeding	41	17.4%
Category		
Cat III	165	70.21%
Cat II	70	29.78%
Nature of attack		
Sudden (UNPROVOKED)	148	63.0%
While playing (PLAYFUL)	40	17.0%
Animal stimulation by human (PROVOKED)	26	11.1%
While taking care of dog (PLAYFUL)	11	4.7%
While feeding (PLAYFUL)	10	4.3%

Distribution of ABO blood groups among victims

The distribution of ABO blood groups was as follows:

B+ : n = 85 (36.2%)
O+ : n = 69 (29.4%)
A+ : n = 54 (23.0%)
AB+ : n = 17 (7.2%)
O− : n = 7 (3.0%)
A− : n = 3 (1.3%)

Overall, Rh-positive blood groups predominated among the victims.

Table 3: Distribution of ABO blood groups among victims

Blood Group	Number of Victims	Prevalence (%)
B+	85	36.17
O+	69	29.36
A+	54	22.98
AB+	17	7.23
O-	7	2.98
A-	3	1.28

Distribution of bite-related characteristics across ABO blood groups

The distribution of the bite characteristics varied across the ABO blood groups.

Dog bites were most frequent across all groups, particularly in the B (n = 78, ~ 91.8 %) and O (n = 54, ~ 78.3 %) groups, whereas cat bites were relatively more frequent in the A group (n = 28, ~51.9%) than in the others.

Lower limb involvement remained the most common site across all blood groups, ranging from n = 29 to n = 67 (53–76%) depending on group distribution.

Category III exposure was predominant across all blood groups, particularly in B (n = 63) and O (n = 52) groups.

Overall, while variations were observed across blood groups, these were descriptive distributions

and were further evaluated in the inferential analysis.

Table 4: Distribution of bite-related characteristics across ABO blood groups

Factor	Category	A (n=57)	B (n=85)	AB (n=17)	O (n=76)
Previous H/O animal bite	No	40 (70.2%)	59 (69.4%)	10 (58.8%)	47 (61.8%)
	Yes	17 (29.8%)	26 (30.6%)	7 (41.2%)	29 (38.2%)
Time of bite	Afternoon (12:00-17:00PM)	3 (5.3%)	15 (17.6%)	2 (11.8%)	21 (27.6%)
	Evening (17:00-21:00PM)	21 (36.8%)	30 (35.3%)	6 (35.3%)	25 (32.9%)
	Morning (6:00AM-10:00AM)	19 (33.3%)	25 (29.4%)	4 (23.5%)	21 (27.6%)
	Night (21:00PM-6:00AM)	14 (24.6%)	15 (17.6%)	5 (29.4%)	9 (11.8%)
Area of bite	Head/Neck	2 (3.5%)	2 (2.4%)	1 (5.9%)	2 (2.6%)
	Lower limb	38 (66.7%)	47 (55.3%)	13 (76.5%)	41 (53.9%)
	Multiple/Other	1 (1.8%)	4 (4.7%)	0 (0.0%)	1 (1.3%)
	Trunk	2 (3.5%)	3 (3.5%)	0 (0.0%)	7 (9.2%)
	Upper limb	14 (24.6%)	29 (34.1%)	3 (17.6%)	25 (32.9%)
Total number of wounds	1	37 (64.9%)	60 (70.6%)	11 (64.7%)	47 (61.8%)
	2	9 (15.78%)	8 (9.4%)	3 (17.64%)	15 (19.73%)
	3	3 (5.26%)	6 (7.05%)	1 (5.88%)	8 (10.52%)
	4	4 (7.01%)	6 (7.05%)	0	2 (2.63%)
	5	1 (1.75%)	1 (1.17%)	1 (5.88%)	1 (1.31%)
	6	1 (1.75%)	1 (1.17%)	0	0
	7	0	2 (2.35%)	0	1 (1.31%)
	12	2 (3.5%)	1 (1.17%)	1 (5.88%)	2 (2.63%)
Biting animal	Cat	30 (52.6%)	5 (5.9%)	2 (11.8%)	5 (6.6%)
	Dog	20 (35.1%)	78 (91.8%)	5 (29.4%)	60 (78.9%)
	Other/Unknown	7 (12.3%)	2 (2.4%)	10 (58.8%)	11 (14.5%)
Severity of bite	Mild	14 (24.6%)	18 (21.2%)	2 (11.8%)	23 (30.3%)
	Moderate	36 (63.2%)	46 (54.1%)	13 (76.5%)	42 (55.3%)
	Severe	7 (12.3%)	21 (24.7%)	2 (11.8%)	11 (14.5%)
Category of bite	Category II	40	10	10	10
	Category III	17	75	7	66

Association between ABO blood groups and bite-related factors

No statistically significant association was observed between the ABO blood group and:

Previous history of animal bite ($\chi^2 = 1.854$, $p = 0.6032$)

Time of bite ($\chi^2 = 14.54$, $p = 0.1044$)

Site of bite ($\chi^2 = 11.395$, $p = 0.4954$)

Number of wounds ($\chi^2 = 14.375$, $p = 0.8529$)

Severity of bite ($\chi^2 = 8.266$, $p = 0.2192$)

A statistically significant association was observed between:

Type of biting animal $\chi^2 = 107.524$, $df = 6$, $p < 0.001$

Cramer's V = 0.478 (moderate to strong association)

WHO category of bite $\chi^2 = 74.560$, $df = 3$, $p < 0.001$

Cramer's V = 0.563 (strong association)

Table 5: Association between ABO blood groups and bite-related factors (Chi-square analysis)

Factor	Chi-Square	df	P-Value	Significance	Cramer's V	Strength
Previous H/O animal bite	1.854	3	0.6032	Not Significant	0.089	Negligible
Time of bite	14.54	9	0.1044	Not Significant	0.144	Weak
Area of bite	11.395	12	0.4954	Not Significant	0.127	Weak
Total number of wounds	14.375	21	0.8529	Not Significant	0.143	Weak
Biting animal	107.524	6	0.00000	Significant	0.478	Strong
Severity of bite	8.266	6	0.2192	Not Significant	0.133	Weak
Category of bite	74.560	3	0.00000	Significant	0.563	Strong

DISCUSSION

The study's observation that blood groups B+ (36.17%), O+ (29.36%), and A+ (22.98%) are the most prevalent among animal bite victims closely aligns with the commonly reported ABO distribution in the Indian population, where B and O blood groups tend to predominate among the general populace. The observed blood group distribution is broadly consistent with reported ABO prevalence patterns in India though direct comparison with the local population is needed to confirm whether the sample reflects underlying community distribution. This congruence is consistent with the findings of other regional studies documenting the frequency of these blood groups, supporting the notion that the blood group distribution within the study sample reflects the underlying population distribution rather than a direct causative link to animal bite susceptibility.[4-7,21]

Our finding of a statistically significant association between blood group and type of biting animal—for example, dog bites being more common in individuals with B and O blood groups and cat bites more frequent in blood group A. This pattern may reflect population-level blood group distribution and differential exposure rather than intrinsic susceptibility. While most previous research has focused on the relationship between blood groups and susceptibility to infectious diseases (such as COVID-19 or transfusion-transmitted infections) or conditions such as cancer, direct associations between ABO blood groups and animal bite patterns have not been extensively explored. This finding represents a novel observation in the literature, as prior studies have not examined blood group associations with specific animal exposure types. However, the clinical and public health implications remain unclear and warrant further investigation with population-based controls.[22,23]

Our observation that Category III (severe) exposures were more frequent among individuals with B and O blood groups, whereas Category II bites predominated in blood group A, suggests a possible blood group-related variation in bite severity or exposure context. Importantly, this finding complements prior studies emphasizing that demographic and environmental factors (age, gender, residence, exposure circumstances) are generally more influential determinants of animal bite risk than intrinsic biological markers, such as ABO blood group. For instance, the literature has consistently demonstrated that factors such as sex and rural residence have a pronounced impact on the incidence and severity of dog bites and subsequent rabies risk, likely due to behavioural and environmental exposure patterns rather than host genetic profiles.[14,2425]

No significant correlation between ABO blood groups and previous history of animal bites, time of bite, anatomical site, total wounds, or bite severity emerged in our study, reinforcing the concept that blood groups do not uniformly influence all facets of bite incidents. This finding parallel reports in infectious disease research, where ABO blood group has shown associations with susceptibility or severity in some contexts but not others. For example, in COVID-19 research, blood groups A and B have been linked to higher susceptibility but not definitively to disease severity or mortality in many investigations. Such evidence indicates that while blood groups confer certain immunogenetic profiles that may affect interaction with pathogens or immune responses, they rarely act as sole determinants of clinical outcome severity.[26,27]

Moreover, different studies investigating ABO blood group frequencies and disease associations in diverse populations, including Saudi Arabia, Australia, and Iraq, have documented varying distributions of blood types but consistently highlighted blood group O as frequent and sometimes protective against certain diseases. In contrast, blood group A is often implicated as a risk factor for infectious and inflammatory conditions. Our findings that dog bites are strongly associated with B and O blood groups and that Cat bites are more frequent in blood group A may reflect underlying host-vector interactions influenced by blood group–related antigenicity or even population demographics where particular blood groups are predominant in communities with higher exposure to certain animals.[21,28]

In the context of animal-bite-related risks, external environmental and behavioural factors remain paramount. For example, prevention and management strategies emphasized in the literature stress improving community education, vaccination coverage, and responsible pet ownership as critical to mitigating risk and severity of bites and subsequent rabies transmission, rather than focusing on inherent host factors such as blood type.[14,24,25]

CONCLUSION

ABO group showed significant associations with type of biting animal and WHO exposure category, but not with bite timing, anatomical site, wound count, the mild/moderate/severe severity classification, or previous bite history.

Strengths and Limitations

The strengths of this study include primary data collection in a tertiary anti-rabies clinic, confirmed blood grouping, standardized bite classification, and the use of inferential statistics.

Limitations include the single-centre cross-sectional design, short study duration, modest sample size, absence of a general population control group, and potential confounding by exposure, occupation, animal contact, and health-seeking behaviour.

Recommendations

Future multicentre studies with larger samples and matched community controls are recommended to clarify whether the ABO blood group independently influences bite patterns or severity. Prevention efforts should prioritize public education, timely wound washing, complete postexposure prophylaxis, stray animal control, pet vaccination, and targeted awareness among high-risk groups, regardless of blood group.

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