www.ijarp.com ISSN 2456-9992 Page: 01-08

International Journal Advanced Research Publications

Review Article

Volume: 02
Issue: 07

CRITICAL REVIEW PAPER

PREVALENCE OF ABO AND RH BLOOD GROUPS IN THE MOHALI REGION.

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Article Received: 19 June 2026, Article Revised: 09 July 2026, Published on: 29 July 2026

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Doi: https://doi-doi.org/101555/ijarp.4987

1. INTRODUCTION

Determining the frequency of ABO and Rh blood groups in a defined population remains one of the most practical and enduring exercises in transfusion medicine, informing blood-bank inventory planning, donor recruitment strategy, and emergency preparedness. The thesis under review reports a descriptive, cross-sectional study of 500 individuals attending a blood bank in the Mohali region of Punjab, India, aiming to establish local ABO and Rh(D) frequencies and to compare them against national and global patterns. This review paper evaluates the study's conceptual grounding, methodological soundness, statistical treatment, and the coherence of its conclusions, and situates the work within the broader Indian and international literature on blood group epidemiology.

2. Summary of the Study

2.1 Rationale and Objectives

The introduction chapter builds a reasonably thorough case for the clinical and public-health relevance of ABO/Rh typing, covering transfusion compatibility, hemolytic disease of the newborn, disease associations (cardiovascular risk, gastric cancer, malaria protection, COVID-19 susceptibility), forensic and anthropological applications, and the genetic basis of both systems. However, the rationale section explicitly frames the study as addressing a data gap in "Jammu and Kashmir," a region that does not correspond to the study's actual setting in Mohali, Punjab. This appears to be a residual, uncorrected reference carried over from a different source document or template, and it is the most significant internal inconsistency in

the thesis. The four stated objectives, by contrast, are appropriately scoped to the actual study: determining ABO frequencies, Rh(D) distribution, the combined ABO/Rh distribution, and any association between gender and blood group.

2.2 Methodology Overview

The study is a descriptive cross-sectional design conducted over six months at a blood bank, enrolling 500 consenting individuals of all ages and both sexes who presented for donation or blood grouping. Approximately 2–3 mL of venous blood was collected under aseptic conditions into EDTA vials, and ABO/Rh typing was performed using the standard slide agglutination method with commercial Anti-A, Anti-B, and Anti-D antisera. Data on age, gender, ABO group, and Rh factor were recorded in a structured format. Statistical comparisons (implied chi-square or similar categorical tests, though the specific test is not named) were used to assess whether the observed distributions departed from chance and whether gender was associated with blood group.

2.3 Key Findings

Among the 500 individuals, blood group O was the most frequent (180 cases, 36%), followed by B (170, 34%), A (110, 22%), and AB (40, 8%). For the Rh system, 460 individuals (92%) were Rh-positive and 40 (8%) were Rh-negative. In the combined ABO/Rh cross-tabulation, O-positive was the single most common phenotype (165 cases) and AB-negative the rarest (5 cases). The sample comprised 300 males (60%) and 200 females (40%). The distribution of ABO groups and of Rh type were each reported as statistically significant ($p < 0.05$, with Rh reported at $p = 0.001$), the combined ABO/Rh association was reported as significant ($p = 0.04$), while the association between gender and blood group distribution was not significant ($p = 0.08$).

Table 1 summarizes the ABO distribution reported in the thesis.

Blood Group	N (of 500)	Percentage	Rank
O	180	36%	1st (most common)
B	170	34%	2nd
A	110	22%	3rd
AB	40	8%	4th (least common)

3. Critical Analysis

3.1 Literature Review and Background

The review of literature chapter cites a reasonably broad set of foundational and contemporary sources (Landsteiner's original 1901 description of the ABO system, Mourant et al.'s global surveys, Avent and Reid on the Rh system, and several India-specific studies by

Agrawal, Das, and Sharma). However, the entries are written in a strikingly uniform six-sentence template for nearly every citation — study, finding, a generic statement of importance, and a closing remark about the work being "widely cited" or a "key reference." This formulaic repetition suggests the literature review was assembled with limited critical synthesis or comparative analysis between studies, rather than a genuine appraisal of methodological differences, sample sizes, or population characteristics across the cited works. A stronger review would group studies thematically (global surveys, Indian regional surveys, disease-association studies) and explicitly compare their findings against one another rather than presenting them as a sequential, largely undifferentiated list.

3.2 Reference List Quality

A closer inspection of the reference list reveals a notable duplication problem: references 29 through 32 (Issitt & Anstee, Daniels, Sandler & Flegel, and Harmening) are verbatim repeats of references 24 through 27, and reference 33 duplicates elements of an earlier Klein & Anstee citation. This kind of duplication is a common artifact of reference-list assembly errors and should be corrected, both to maintain academic rigor and because it slightly inflates the apparent breadth of sources consulted. Aside from this issue, the reference list is otherwise extensive (77 in-text-cited sources plus a longer supplementary list), drawing on established immunohematology textbooks (Daniels, Mollison, Race & Sanger) alongside primary research articles, which is appropriate for a thesis of this kind.

3.3 Methodological Strengths and Weaknesses

The slide agglutination method for ABO and Rh(D) typing is a well-established, low-cost, and widely used technique appropriate for a descriptive prevalence study of this scale, and the inclusion criteria (all ages, both sexes, consenting donors or patients) support a reasonably representative sample of blood-bank attendees. The exclusion of hemolyzed or contaminated samples and those with incomplete details is good practice.

Nonetheless, several limitations constrain the strength of the conclusions. First, the sample was drawn exclusively from individuals presenting to a single blood bank, which is not equivalent to a random population sample; blood donors and patients requiring transfusion are self-selected groups that may not reflect the true demographic or genetic composition of the broader Mohali population, a point the discussion chapter acknowledges only briefly. Second, the marked gender imbalance (60% male, 40% female) is typical of blood-donor populations but limits the generalizability of any subgroup comparisons by sex, and the underlying reason offered — greater male participation in donation — is a plausible but unverified explanation rather than a finding derived from the data itself. Third, the slide

method, while practical, is acknowledged in the thesis's own limitations section as subject to human error and unable to resolve weak D or partial D variants, which the introduction chapter itself describes at length as clinically important; the study does not report how many, if any, ambiguous typing results were encountered. Fourth, no molecular confirmation (e.g., PCR-based genotyping) was performed, despite the introduction's substantial discussion of molecular methods, creating a mismatch between the depth of background covered and the technical scope actually applied in the study.

3.4 Statistical Analysis

The reported p-values for the ABO distribution, Rh distribution, and combined ABO/Rh distribution are presented as evidence that these distributions are unlikely to have arisen by chance. This framing, however, somewhat misapplies statistical significance testing: a chi-square (or equivalent) goodness-of-fit test comparing observed group frequencies against an assumption of equal frequencies will predictably return a significant result in a sample of 500, since there is no biological reason to expect the four ABO groups to occur with equal frequency in the first place. A more informative analysis would have compared the observed local frequencies against previously published regional or national reference frequencies to test whether Mohali's distribution differs meaningfully from expectation, rather than testing only whether the four categories differ from one another. The gender-by-blood-group comparison ($p = 00.08$, reported as not significant) is a more appropriately framed test of association, though the specific statistical test used is not named anywhere in the methodology chapter, which is a reporting omission that should be corrected for reproducibility.

3.5 Results Interpretation and Internal Consistency

The reported summary tables are internally consistent: the ABO totals ($110 + 170 + 40 + 180 = 500$) and the Rh totals ($460 + 40 = 500$) both sum correctly, and the combined ABO/Rh cross-tabulation totals also reconcile with the marginal totals in the individual ABO and Rh tables. This internal consistency is a modest but meaningful indicator of careful data handling. The appended patient-level results listing (individual patient IDs, gender, ABO group, Rh type) further supports the transparency of the underlying dataset, allowing a reader in principle to recompute the summary statistics independently.

3.6 Discussion and Conclusion

The discussion chapter appropriately contextualizes the O- and B-predominant pattern against prior Indian studies (Agrawal et al., Sharma et al.), and correctly notes that this differs somewhat from the B-then-O pattern more commonly reported at the national level, attributing

the difference to regional genetic and ethnic factors — a reasonable, if underdeveloped, interpretation that could have been strengthened by reference to Punjab-specific prior studies (e.g., Sidhu's work on Punjab population blood groups, which does appear in the reference list but is not discussed in the body text). The conclusion chapter is largely a restatement of the results and discussion rather than an independent synthesis, and, as with the introduction, does not revisit or correct the earlier Jammu and Kashmir framing, leaving that inconsistency unresolved throughout the document.

4. Strengths of the Study

- Reasonably large sample size (500) for a single-center descriptive prevalence study, allowing stable percentage estimates for common blood groups.
- Clear, replicable methodology using a standard, validated serological technique appropriate to the study's scale and setting.
- Internally consistent data: reported subtotals and cross-tabulations reconcile correctly, and a full patient-level results listing is provided for transparency.
- Findings are compared against relevant prior Indian literature, situating the regional results within a broader context.
- A dedicated limitations section demonstrates appropriate self-awareness of the study's methodological constraints.

5. Weaknesses and Limitations

- An uncorrected geographic inconsistency: the stated rationale references a data gap in Jammu and Kashmir, while the actual study was conducted in Mohali, Punjab.
- A literature review composed of highly formulaic, repetitive summaries rather than comparative critical analysis.
- Duplicate entries in the reference list (references 29–33 substantially repeat references 24–28).
- Statistical tests for ABO and Rh distribution compare group frequencies to an implicit equal-frequency null, which is not the most informative test available and is likely to be significant regardless of the true underlying pattern.
- The specific statistical test(s) used are not named in the methodology chapter, limiting reproducibility.
- Single-center, self-selected sample (blood donors and patients) rather than a random population sample, and marked gender imbalance.

- No molecular confirmation of ABO/Rh typing and no reporting of weak D or ambiguous typing cases, despite the introduction's emphasis on their clinical importance.

6. Significance and Practical Implications

Despite these limitations, the thesis provides a usable, internally consistent regional dataset that can inform local blood-bank planning in Mohali. The identification of O-positive as the most common phenotype and AB-negative as the rarest is directly actionable for inventory management and for prioritizing outreach for rare-type donors. The finding that gender was not significantly associated with blood group distribution is consistent with the expected biology of ABO/Rh inheritance, which is autosomal and not sex-linked, and serves as a useful internal validity check on the dataset. As a piece of regional epidemiological surveillance, the study fills a legitimate practical need, even though its analytical framing could be strengthened considerably.

7. Recommendations for Revision

A small number of targeted revisions would substantially improve the rigor and internal coherence of this thesis without requiring new data collection. First, the rationale section in Chapter 1 should be corrected to reference Mohali rather than Jammu and Kashmir, and any other template-inherited regional references should be checked throughout the document for similar residual errors. Second, the methodology chapter should explicitly name the statistical test(s) applied (for example, a chi-square goodness-of-fit test versus a specified reference distribution, or a test of association such as chi-square or Fisher's exact test for the gender comparison), and should state the reference or expected frequencies against which the ABO and Rh distributions were tested, since testing against an implicit equal-frequency assumption is of limited scientific value. Third, the reference list should be de-duplicated, and the literature review would benefit from being reorganized thematically — separating foundational immunohematology references, global epidemiological surveys, India-specific and Punjab-specific regional studies, and disease-association literature — with explicit comparative commentary connecting the present findings to each thematic cluster rather than a uniform sequential summary. Finally, the discussion could more directly engage with the one Punjab-specific reference already present in the bibliography (Sidhu, 2003) to strengthen the regional comparison that is the thesis's core contribution.

8. CONCLUSION

This thesis reports a straightforward, well-populated descriptive survey of ABO and Rh blood

group prevalence in the Mohali region, finding O (36%) and B (34%) to be the dominant ABO groups and Rh-positive individuals to comprise 92% of the sample, broadly consistent with patterns reported elsewhere in India. The work's principal value lies in its regional specificity and its internally consistent, transparently reported dataset. Its main weaknesses are conceptual and editorial rather than data-related: an unresolved geographic inconsistency between the stated rationale and the actual study site, a literature review that summarizes rather than critically compares prior work, duplicated references, and a statistical framing that tests for equal group frequencies rather than for a meaningful comparison against established regional or national benchmarks. Addressing these issues — correcting the rationale section, naming the specific statistical tests used, removing duplicate references, and reframing the significance testing around comparison with prior regional data — would meaningfully strengthen the thesis without requiring any additional data collection.

REFERENCES

1. Landsteiner, K. (1901). Über Agglutinationserscheinungen normalen menschlichen Blutes. Wiener Klinische Wochenschrift, 14, 1132–1134. (Original description of the ABO system.)
2. Mourant, A. E., Kopeć, A. C., & Domaniewska-Sobczak, K. (1976). The Distribution of the Human Blood Groups and Other Polymorphisms (2nd ed.). Oxford University Press.
3. Landsteiner, K., & Wiener, A. S. (1941). Studies on an agglutinogen (Rh) in human blood reacting with anti-Rhesus sera and with human isoantibodies. Journal of Experimental Medicine, 74(4), 309–320.
4. Avent, N. D., & Reid, M. E. (2000). The Rh blood group system: A review. Blood, 95(2), 375–387.
5. Westhoff, C. M. (2004). The Rh blood group system in review: A new face for the next decade. Transfusion, 44(11), 1663–1673.
6. Daniels, G. (2005). The molecular genetics of blood group polymorphism. Transplant Immunology, 14(3–4), 143–153.
7. Agrawal, A., Tiwari, A. K., Mehta, N., Bhattacharya, P., Wankhede, R., Tulsiani, S., & Kamath, S. (2014). ABO and Rh(D) group distribution and gene frequency: The first multicentric study in India. Asian Journal of Transfusion Science, 8(2), 121–125.
8. Patidar, G. K., et al. (2021). Distribution of ABO and Rh(D) blood groups in India: A systematic review. ISBT Science Series, 16(1), 20–35.
9. Periyavan, S., Sangeetha, S. K., Marimuthu, P., Manjunath, B. K., & Seema, D. M. (2010).

Distribution of ABO and Rhesus-D blood groups in and around Bangalore. Asian Journal of Transfusion Science, 4(1), 41.

10. Chandra, T., & Gupta, A. (2012). Frequency of ABO and rhesus blood groups in blood donors. Asian Journal of Transfusion Science, 6(1), 52–53.