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Risk Factors of Bronchial Asthma in Children Between Age Group Of 5 To 14 Years in A Tertiary Care Centre

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ABSTRACT

Background: Bronchial asthma is a prevalent chronic respiratory disease in children, with inflammation and hyperresponsiveness of the airways. The aim of this study was to assess a range of epidemiological, clinical, and environmental risk factors involved in pediatric bronchial asthma.

Methods: One hundred children aged between 5 and 14 years old with clinically diagnosed bronchial asthma and another 100 age- and sex-matched healthy controls were examined for two years (Dec 2020 – Dec 2022). Extended clinical, hematologic, and environmental investigations were carried out.

Results: Asthma was more common in boys (M:F ratio 1.7:1), especially in the age group of 5–7 years. Mean hemoglobin concentration was not altered, but total leukocyte number, eosinophil number, platelet number, and ESR were raised significantly in asthmatics, reflecting chronic airway inflammation. There was a strong genetic component with a threefold increased risk in children with a family history of asthma. Allergic rhinitis proved to be the most important risk factor (8-fold risk) followed by atopic dermatitis and dust environment exposure. Cold temperatures and air conditioner use worsened symptoms, but pollen, mold, animal dander, and smoke exposure were not significant. Low birth weight and bottle feeding were associated with increased asthma risk, but exclusive breastfeeding was protective.

Conclusion: This research highlights the multifactorial etiology of childhood asthma, with genetic predisposition, allergic rhinitis, and environmental factors being crucial determinants. Early identification and control of risk factors, breastfeeding promotion, and allergen avoidance are critical measures to curb disease burden.

Keywords: *Bronchial asthma, children, allergic rhinitis, eosinophilia, risk factors, breastfeeding.*

1. INTRODUCTION

Bronchial asthma is a chronic inflammatory airway disease with recurring airflow obstruction and enhanced bronchial responsiveness to a broad spectrum of stimuli. It is manifested by variable respiratory symptoms of wheezing, breathlessness, chest tightness, and coughing of varying intensity and frequency over time, typically with variable expiratory airflow limitation [1]. Asthma is a major global public health problem, affecting nearly 300 million individuals in all sections of society, with an anticipated increase of 100 million cases by the year 2025. In India alone, an estimated 20 to 28 million individuals are said to live with asthma, and the estimated prevalence among children aged 5 to 11 years is 10% to 15%.

Asthma is a leading cause of childhood morbidity, a frequent cause of hospitalization, recurrent emergency utilization, and school absenteeism [2,3]. Although it is a burden, asthma in children is underdiagnosed and undertreated, particularly because of low awareness, social misconceptions, and lack of recognition by caregivers and health professionals [4].

Asthma prevalence is also geographically heterogeneous, driven by a complex interplay of environmental exposures, genetic susceptibility, and infections—viral respiratory infections particularly [5]. Historically an urbanization and wealth disease, asthma is increasingly being reported from rural settings as well, possibly through lifestyle changes and modernization. Several environmental and lifestyle factors have been implicated in the causation and triggering of asthma, such as indoor and outdoor air pollution, passive smoking exposure, exposure to allergens such as pollen and animal dander, use of biomass fuels, and proximity to roads or industrial areas [6,7,8,9]. In addition, variations in ambient temperature, humidity, periods of seasonal transition, emotional stress, and specific food or drug exposures can also be significant asthma attack triggers.

With such a multifactorial aetiology, recognition of the linked risk factors becomes important for early diagnosis, preventive intervention, and optimal management. Observing the increasing trend in consultation and hospitalization for asthma, the Sriram Chandra Bhanja Medical College and Sardar Vallabhbhai Patel Post Graduate Institute of Pediatrics (SCB MCH & SVPPGIP), Cuttack—a tertiary care centre of Odisha—started a specialized Pediatric Allergy, Asthma & Respiratory (PAAR) Clinic to upgrade patient care through specialist evaluation and follow-up.

This investigation was conducted to scientifically assess the different risk factors causing bronchial asthma in children aged 5 to 14 years at this third-level referral hospital. By correlating the factors with frequency and severity of asthma attacks, the results seek to provide inputs towards the knowledge of the disease, site-specific interventions, and quality of life among the affected children.

2. METHODS

Study Design and Setting

The study was carried out as a descriptive study in the Sriram Chandra Bhanja (SCB) Medical College and Hospital in collaboration with the Sardar Vallabhbhai Patel Post Graduate Institute of Pediatrics (SVPPGIP), Cuttack, Odisha. The study was carried out among children between 5 and 14 years of age with respiratory symptoms indicative of bronchial asthma that were reported during the period from December 2020 to December 2022.

Study Population

The research involved 200 children who were equally divided into two groups: 100 children with a diagnosis of bronchial asthma and 100 age-matched controls who complained of respiratory symptoms but did not meet the diagnostic criteria for asthma. All study participants were selected from the inpatient and outpatient departments of the aforementioned institutions within the study duration. Cases and controls were chosen based on clinical presentation and satisfaction of diagnostic criteria for bronchial asthma.

Inclusion and Exclusion Criteria

Children of 5-14 years age with symptoms of cough, wheeze, or respiratory distress and fulfilling diagnostic criteria for bronchial asthma were included as a case group. Likewise, children not fulfilling the criteria of asthma diagnosis but otherwise healthy individuals were recruited for the control group. Those with diagnoses of tuberculosis in children, chronic lung disease with interstitial lung disease, bronchiectasis, or congenital heart disease were excluded in order to control confounding factors that might impact respiratory outcomes.

Data Collection Procedure

After approval by the Institutional Ethics Committee of SCB Medical College and SVP PGIP, informed consent was taken from parents or guardians of all the children who were enrolled. Information was gathered through a pre-designed structured pro forma, which comprised information about the child's medical history, presenting symptoms, clinical presentation, and investigations related to the problem. A uniform pattern of data collection was maintained through this standardized method in both the inpatient and outpatient departments.

Statistical Analysis

All the data gathered were first entered into Microsoft Excel 2013 spreadsheets and then analyzed with the Statistical Package for the Social Sciences (SPSS) software, version 21. Descriptive statistical techniques were used to describe the baseline characteristics and risk factors between the two groups. An alpha level of 5% was used to establish statistical significance, and any p-value of less than 0.05 was taken as statistically significant in the context of variable association.

3. RESULTS

Key Risk Factors for Bronchial Asthma in Children (5–14 Years)

Table 1: Significant Demographic and Clinical Risk Factors

Risk Factor	Cases (%)	Controls (%)	Odds Ratio (95% CI)	p-value
Parental asthma	48%	21%	3.473 (1.866–6.461)	0.0001
Atopic dermatitis	31%	18%	2.047 (1.054–3.973)	0.033
Allergic rhinitis	61%	16%	8.212 (4.207–16.028)	0.0001
Dust mite antigen	71%	27%	6.619 (3.569–12.276)	<0.00001
Environmental dust/smoke	56%	26%	3.622 (1.995–6.576)	0.0001
LBW	52%	29%	2.652 (1.480–4.754)	0.001
Formula/bottle feed	65%	34%	3.605 (2.012–6.459)	0.0001

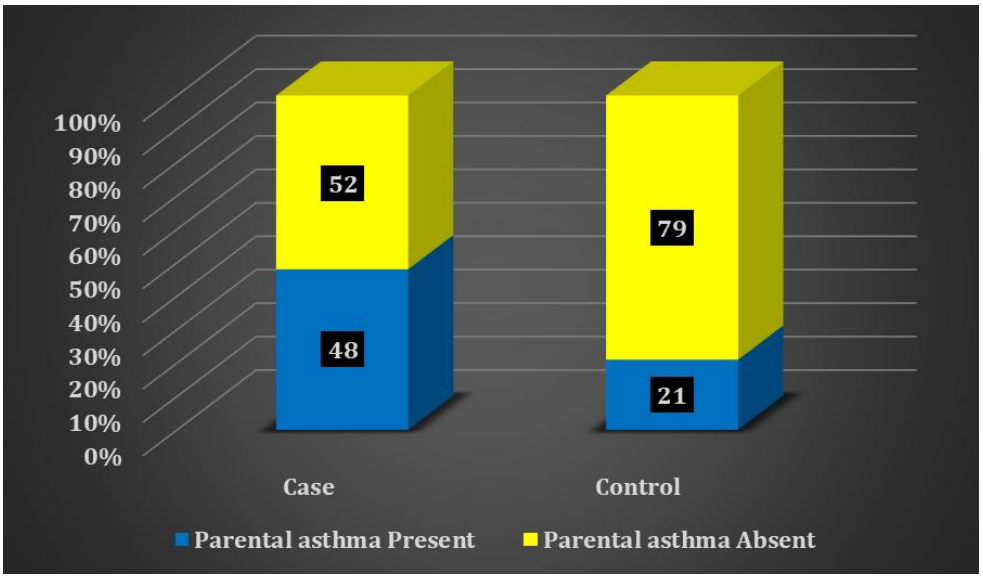
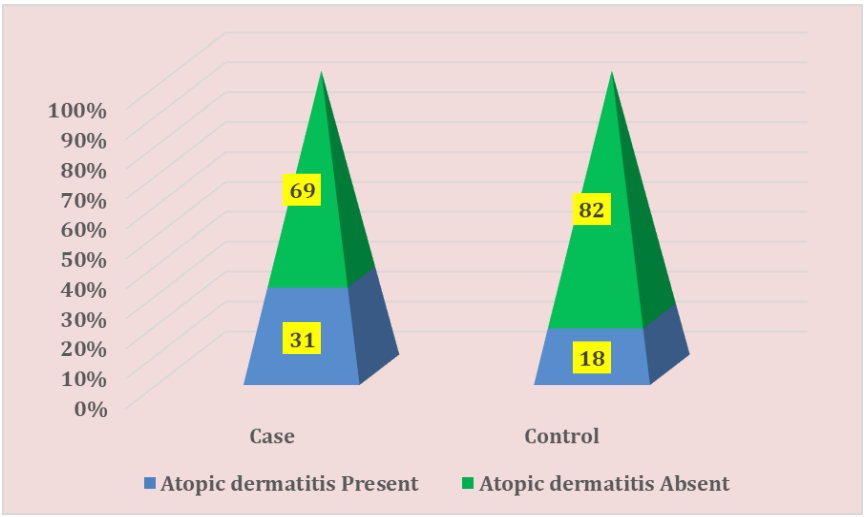
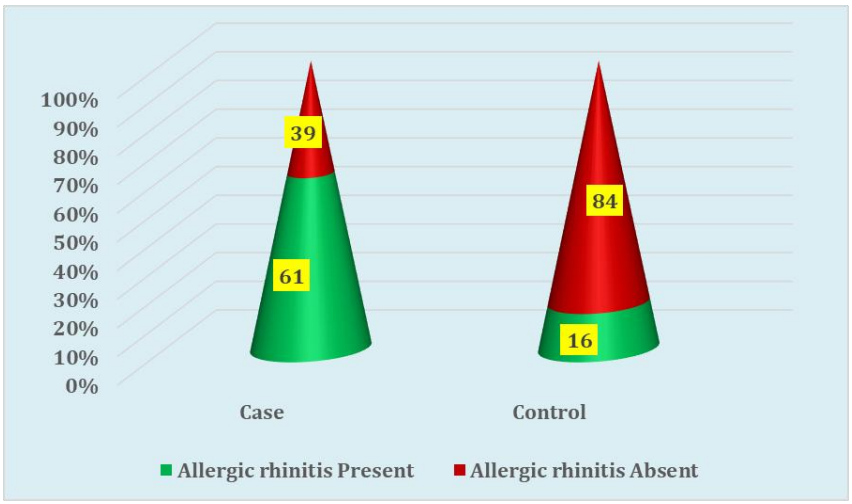


Figure 1: Parental asthma as a risk factor (bar diagram).



2(i): Atopic dermatitis



2(ii): Allergic rhinitis distribution

Figure 2(i)-(ii): Atopic dermatitis and allergic rhinitis distribution.

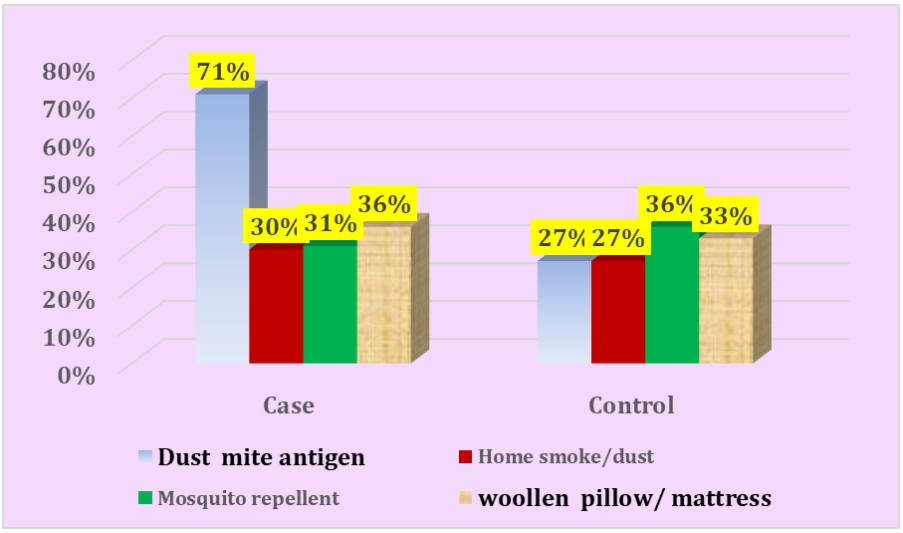
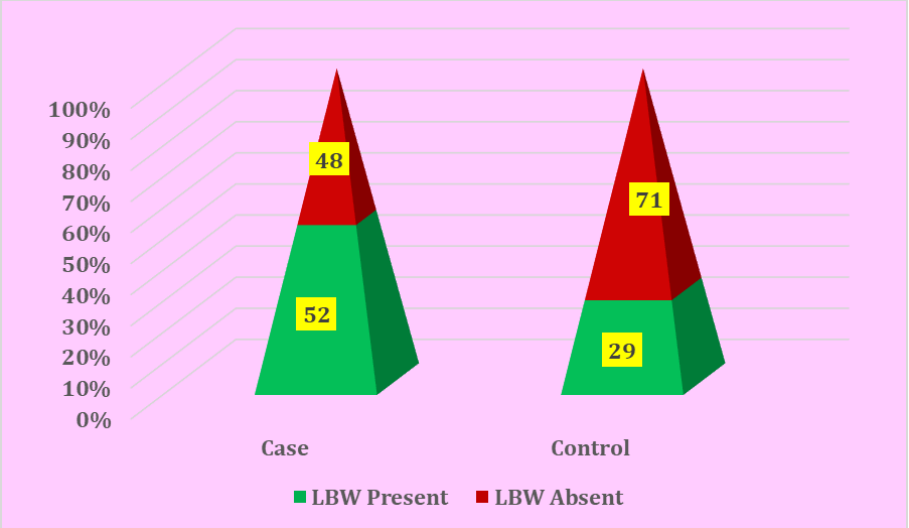
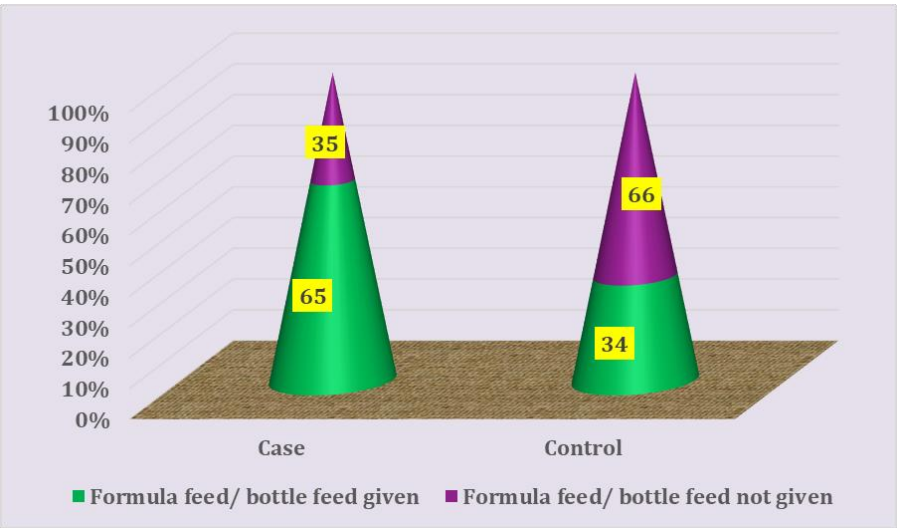


Figure 3: Dust mite antigen association (bar diagram).



4(i): LBW



4(ii): Formula feeding risks

Figure 4(i)-(ii): LBW and formula feeding risks.

Genetic predisposition (parental asthma), atopy (allergic rhinitis, atopic dermatitis), and environmental triggers (dust mites, smoke) were strongly associated with asthma. Early-life factors (LBW, formula feeding) also showed significant correlations.

Table 2: Laboratory and Physiological Parameters

Parameter	Cases (Mean ± SD)	Controls (Mean ± SD)	p-value
TLC (cells/mm³)	9380.7 ± 2168.02	8233.08 ± 1578.97	0.001
Eosinophil count	5.32 ± 1.81	4.57 ± 1.47	0.0001
ESR (mm/hr)	15.92 ± 9.02	9.61 ± 3.78	0.0001
PFT (obstruction)	57.9% abnormal	20.7% mild	<0.0001

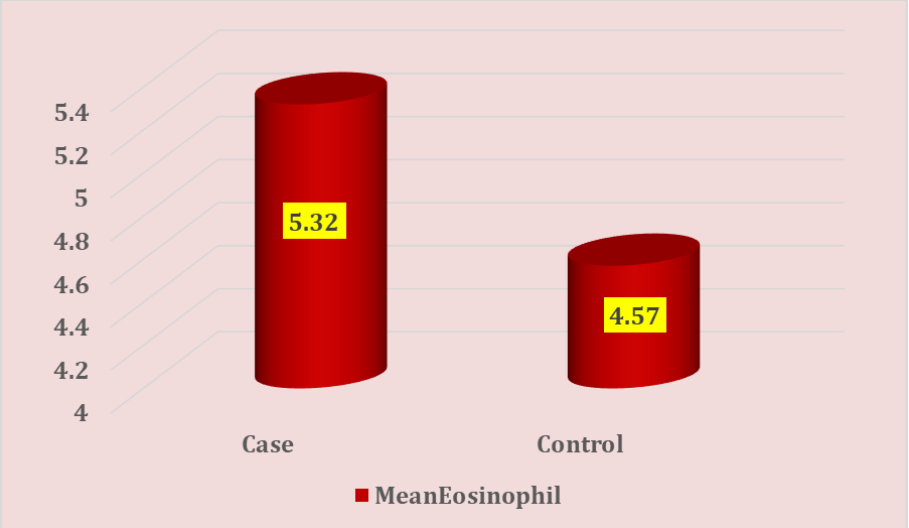


Figure 5: Eosinophil count distribution.

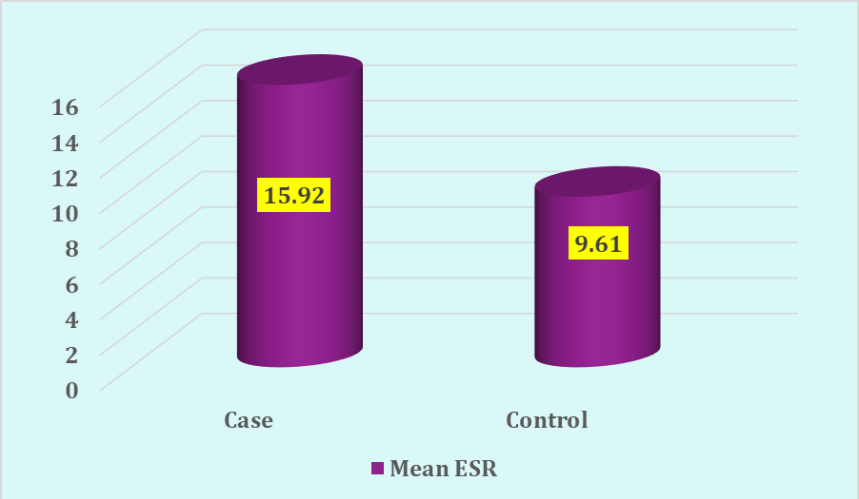


Figure 6: ESR levels in cases vs. controls.

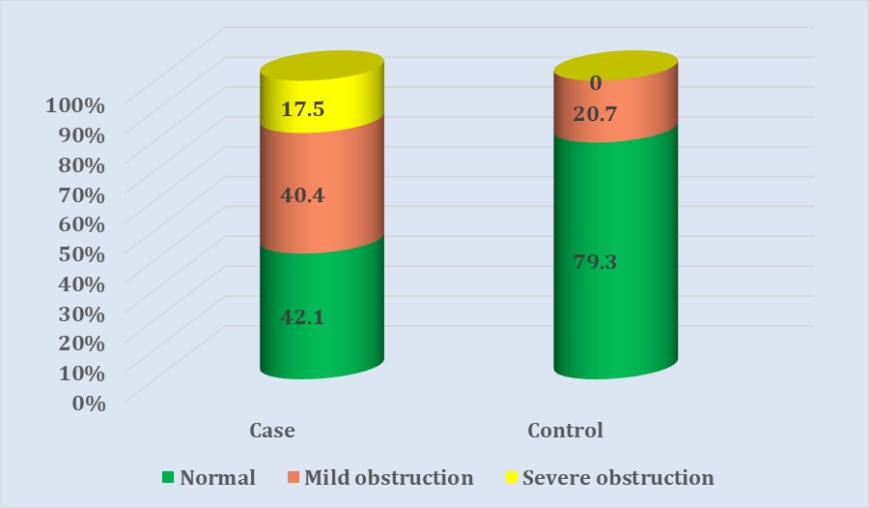


Figure 7: PFT results (normal/mild/severe obstruction).

Asthma cases exhibited elevated inflammatory markers (TLC, eosinophils, ESR) and significant pulmonary function abnormalities. Eosinophilia and ESR were particularly notable, aligning with asthma's inflammatory pathophysiology.

Key Non-Significant Factors

- Respiratory infections (pneumonia, bronchiolitis): No significant association ($p > 0.5$).
- Household factors (woolen bedding, mosquito repellents): $p > 0.4$.
- Obesity/cigarette smoke: No statistical significance ($p > 0.3$).

The study highlights genetic, atopic, and environmental triggers as major risk factors, supported by laboratory evidence of inflammation (eosinophilia, elevated ESR). Early-life exposures (LBW, formula feeding) further compounded risk. Non-significant factors suggest regional or sample-specific variations.

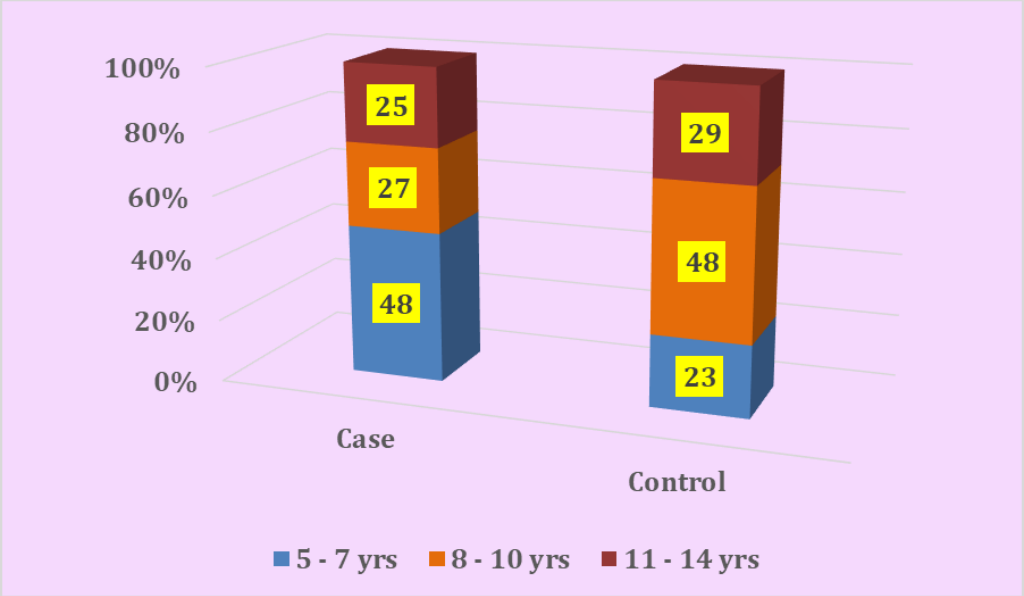


Figure 8: Age-wise distribution (peak asthma prevalence at 5–7 years).

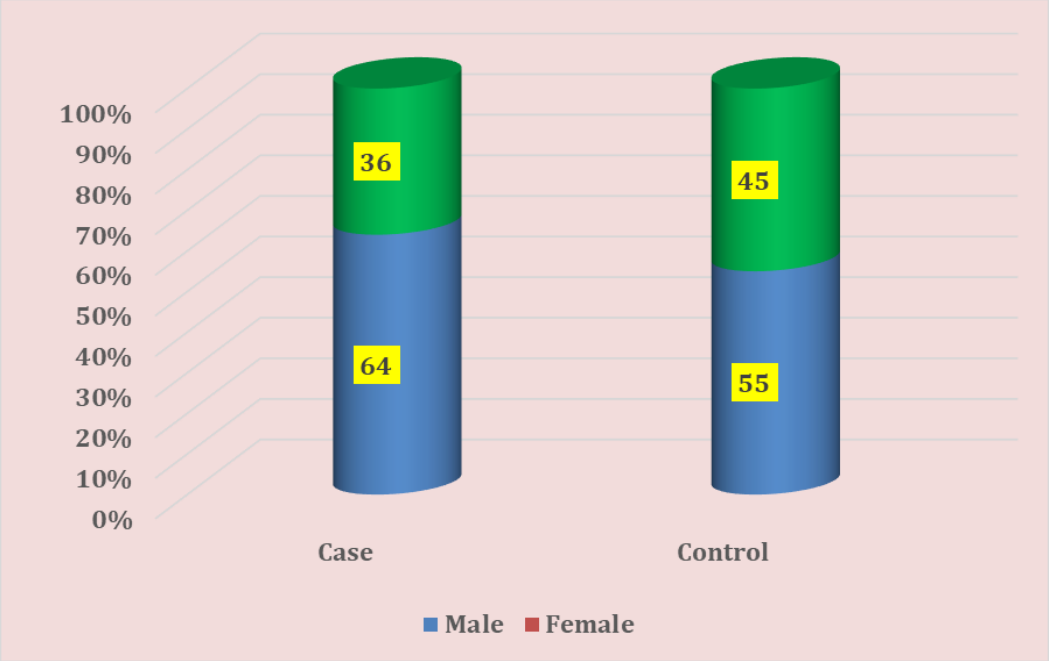


Figure 9: Male predominance (64% cases).

Figure 10: Environmental dust/smoke impact.

4. DISCUSSION

Multiple studies have reported a high rate of associated anomalies in patients with anorectal malformations, greatly affecting prognosis and outcomes. In this study, 37.3% of the patients had associated anomalies. This is in keeping with a range reported across the world—El Shazly et al. found 49% in Egypt, while Upadhyaya et al. from India noted a lower figure at 21.6% [10].

Syndromic presentation and multiple anomalies were associated with increased morbidity and mortality. For example, in the present cohort, the majority of mortalities were seen in patients with severe associated anomalies or syndromic diagnosis. This is consistent with international data; Martinez-Frias et al. reported that associated malformations were seen in 68.2% of patients with ARMs, of which a significant proportion were syndromic, particularly in high ARM types. Concurrently, in the Egyptian series (El Shazly et al.), several anomalies significantly raised the level of complexity of management and complication rate [11,12].

The VACTERL association was seen in 8.5% of our patients, similar to reports elsewhere where incidence varied from 6% to 16% based on the study population and diagnostic criteria [13].

In assessing surgical results after primary PSARP, it was observed that the presence of concomitant anomalies adversely impacted prognosis. Patients with cardiac, renal, or vertebral anomalies tended to need multidisciplinary management, had longer hospital courses, and had more postoperative complications [14].

In limited resource environments, this is aggravated. El Shazly et al. highlighted the absence of prenatal diagnosis and neonatal intensive care as significant determinants of adverse outcomes. Likewise, increased mortality in our study population could be partly explained by suboptimal neonatal care and delayed presentation, particularly in syndromic neonates [15].

5. CONCLUSION

Finally, the findings of this research emphasize that 5–14 year-old childhood bronchial asthma is predominantly found among boys, particularly aged 5–7 years, and is predominantly determined by hereditary tendency, allergic rhinitis, and environmental exposure including dust and work site proximity. The important lab findings were higher total leukocyte count, eosinophil count, platelet count, and ESR revealing underlying airway inflammation. Risk was significantly increased among those with a history of asthma, atopic dermatitis, or bottle/formula feeding alone, whereas breastfeeding alone seemed protective. Despite the lack of significant association for potential risk factors such as pollen, mold, animal dander, home smoking, and living in an urban area in this study, exposure to dust mite antigen, cold air, and change of seasons significantly added to asthma exacerbation. These results highlight the necessity of early diagnosis, genetic evaluation, environmental control, proper management of allergic rhinitis, and promotion of breastfeeding as critical components in asthma prevention and treatment.

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