

A QUASI-EXPERIMENTAL STUDY: IMPACT OF BALLOON BLOWING THERAPY ON PULMONARY FUNCTION RECOVERY AMONG PAEDIATRIC PATIENTS WITH RESPIRATORY DISORDERS

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Abstract

Introduction: Respiratory illnesses remain one of the leading causes of childhood illness and death, especially in developing nations like India. Young children are particularly vulnerable because their respiratory structures and immune systems are still maturing. Common issues—such as acute respiratory infections, asthma, and airway obstruction—frequently cause missed school days, hospital emergency visits, and risk long-term lung damage. Managing young patients is uniquely challenging because high oxygen demand coincides with limited ability to describe their symptoms, creating considerable stress for families and clinicians alike. Standard hospital care usually targets immediate medical symptoms, but there is an urgent need for non-pharmacological, supportive therapies to safeguard paediatric lung health. Balloon-blowing exercise presents an accessible, effective technique to strengthen intercostal muscles, elevate the diaphragm, and optimize ventilation. Incorporating such practical tools into routine pediatric care can improve outcomes for hospitalized children and reduce long-term respiratory complications.

Method: This study utilized a quasi-experimental, pre-test and post-test control group design. We enrolled 60 children aged 5–10 years diagnosed with respiratory conditions from hospitals in Kanpur, Uttar Pradesh, using purposive sampling. Participants were assigned equally to an experimental group (n=30) and a control group (n=30). The experimental group performed 10 balloon-blowing exercises daily for 3 days alongside standard hospital care, whereas the control group received routine hospital care alone. Data were collected via a structured observational checklist tracking respiratory rate, heart rate, oxygen saturation, and clinical symptoms. **Result:** We analyzed the data using both descriptive and inferential statistics. Comparing baseline and post-intervention scores revealed that the experimental group achieved significant improvement in clinical parameters, whereas the control group showed no significant change. **Discussion:** These results demonstrate that balloon blowing therapy significantly enhances paediatric pulmonary function by strengthening respiratory muscles and expanding lung volume. The lack of clinical change in the control group further highlights the specific efficacy of this non-drug strategy. Our findings accord with prior research indicating that play-based breathing exercises achieve better patient compliance in children than rigid conventional medical devices like incentive spirometers. Given its low cost and ease of execution, balloon blowing offers a practical adjunct therapy for resource-limited settings.

Keywords: *Balloon Blowing Therapy, Pulmonary Function, Paediatrics Respiratory Diseases, Respiratory Muscle Strengthening, Non-pharmacological Intervention, paediatrics Nursing, Lung Capacity, Hospitalized Children, Respiratory Distress.*

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INTRODUCTION

Paediatrics respiratory health is a fundamental pillar of child development, as it directly impacts an individual's ability to thrive from infancy through adolescence. The human respiratory system is an intricate, life-sustaining mechanism; however, in children, it is particularly delicate due to the rapid growth and remodelling of lung tissue. Unlike adults,

children possess a smaller thoracic cavity and immature respiratory structures, making them significantly more vulnerable to pathogens, environmental pollutants, and allergens. Respiratory illnesses remain the most common cause of morbidity in children worldwide, with infections often being the primary reason for emergency department visits and hospitalizations. These conditions, ranging from

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common viral infections to more severe states like pneumonia, bronchiolitis, and chronic asthma, can lead to respiratory distress, airway obstruction, and impaired gas exchange. When a child experiences shortness of breath, dyspnoea, or wheezing, the physiological stress is coupled with immense psychological anxiety for both the child and the caregivers. Furthermore, prolonged respiratory impairment can lead to long-term complications, such as permanent lung tissue damage or stunted development.¹ In modern clinical practice, while pharmacotherapy is essential, there is a growing emphasis on non-pharmacological, rehabilitative, and promotive interventions that can improve airway clearance and lung mechanics. Balloon blowing therapy stands out as a pioneering, play-based approach in paediatrics nursing. By utilizing the child's natural inclination for play, this therapy encourages deep inspiration and controlled expiration, which effectively engages the intercostal muscles and the diaphragm. Integrating such simple, low-cost, and non-invasive exercises into routine paediatrics care provides a strategic advantage in promoting pulmonary function. Such interventions not only facilitate faster clinical recovery but also empower children by involving them actively in their own healing process, thereby bridging the gap between acute medical treatment and holistic recovery.^{4,6}

BACKGROUND OF THE STUDY

The global burden of paediatrics respiratory diseases is a significant public health challenge, particularly in developing nations like India, where environmental conditions and socio-economic factors heavily influence child health outcomes. According to global health statistics, India contributes to a substantial percentage of the world's respiratory disease burden,^{1,7} with lower respiratory tract infections remaining a leading cause of mortality among children under the age of five. This high incidence is often linked to the "first-time exposure" of a child's developing immune system to a wide array of pathogens, worsened by rising levels of air pollution, dust, and domestic smoke. Research indicates that prenatal exposure to smoking and poor indoor air quality significantly hinders lung development,³ predisposing children to chronic respiratory issues throughout their youth.

In the Indian context, the World Health Organization (WHO) has highlighted the severity of this issue, noting that a significant portion of total annual deaths in the country is attributable to respiratory conditions. The persistent struggle with dyspnoea, coughing, and recurrent school absenteeism creates a cycle of reduced physical activity and diminished quality of life. Traditional medical approaches, such as incentive spirometry, are often difficult for children aged 5-10 years to understand or accept, frequently leading to

fear and non-compliance. Consequently, clinical research has shifted toward identifying "promotive" measures that are culturally relevant and physiologically effective.^{5,10} Balloon blowing therapy has emerged as a promising solution in this domain. Based on physiological principles, the act of blowing against resistance strengthens the respiratory musculature and improves lung compliance. Evidence from various clinical studies across Asia suggests that children who engage in regular, supervised balloon exercises exhibit improved oxygen saturation, reduced respiratory rates, and faster resolution of chest retractions. By framing this intervention as a therapeutic play activity, healthcare professionals can effectively address both the physical requirements of pulmonary rehabilitation and the emotional needs of the hospitalized child.

Methods

Study design and Setting

This study employed a Quasi-Experimental, Pre-test and Post-test Control Group design. The research was conducted in the paediatrics departments of selected hospitals in Kanpur, Uttar Pradesh, chosen for their high volume of paediatrics respiratory cases and the feasibility of implementing the intervention.

Participants and Sampling

A Purposive Sampling Technique was utilized to select 60 children aged 5–10 years diagnosed with respiratory diseases. Participants were divided into two groups: the Experimental Group (n=30) and the Control Group (n=30).

Inclusion Criteria:

Children aged 5–10 years
Diagnosed with respiratory diseases;
Able to understand and communicate in Hindi;
Willing to participate.

Exclusion Criteria:

Children with critical illnesses
congenital disorders of the mouth, nose, or palate;
those physically unable to perform balloon-blowing exercises.

Data Collection Tool

A structured observational checklist was developed to assess pulmonary function. It included 10 parameters: respiratory rate, heart rate, nasal flaring, breath sounds, chest retraction, oxygen saturation, air entry, dyspnoea, use of accessory muscles, and cough. The tool was validated by five experts in child health nursing and paediatrics (95% consensus achieved). Reliability was established using the inter-rater method, yielding a correlation coefficient of 0.7.

TOOL-II: OBSERVATIONAL CHECKLIST

Title: Assessment of Pulmonary Function among Children with Respiratory Disease

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Instruction: Please observe the child and tick (✓) the appropriate column based on the clinical findings.

S.No	Parameters	Very Effective (4)	Moderately Effective (3)	Mild Effective (2)	Not Effective (1)
1	Respiratory Rate	18-25 (5-7y) / 12-20 (8-10y)	26-28 (5-7y) / 21-23 (8-10y)	29-30 (5-7y) / 24-26 (8-10y)	>30 (5-7y) / >26 (8-10y)
2	Heart Rate	75-118 (5-7y) / 60-100 (8-10y)	119-124 (5-7y) / 101-105 (8-10y)	125-130 (5-7y) / 106-110 (8-10y)	>130 (5-7y) / >110 (8-10y)
3	Accessory Muscle Use	Abdominal/Shoulder/Rib	Shoulder/Rib/Mild Abd	Rib/Shoulder	Rib Muscles only
4	Nasal Flaring	Absent	Mild Exertion	Moderate Exertion	Severe Exertion
5	Cough	Absent	Present (w/ Sputum)	Present (Moderate)	Present (Severe)
6	Breath Sounds	Normal	Mild Adventitious	Moderate Adventitious	Severe Adventitious
7	Air Entry	Bilateral Clear	Unilateral Diminished	Bilateral Diminished	Bilateral Decreased
8	Chest Retraction	Absent	Just Visible	Subcostal	Intercostal
9	Dyspnea	Absent	Mild	Moderate	Severe
10	Oxygen Saturation	98% - 100%	96% - 97%	90% - 95%	< 90%

Scoring-

- **Total Score:** [Min: 10, Max: 40]
- **Interpretation:** **31 – 40:** Very Effective (Pulmonary function improved), **21 – 30:** Moderately Effective, **11 – 20:** Mild Effective, **10 & below:** Not Effective

Data Collection Procedure

Following ethical approval, informed consent was obtained from parents. In the pre-test, pulmonary function was assessed for both groups. The Experimental Group was taught and supervised in balloon-blowing therapy (30 minutes daily for 3 days). The Control Group received standard hospital care. A post-test assessment was conducted on the 4th day to evaluate the effectiveness of the therapy.

Data Analysis
Data were analysed using descriptive statistics (frequency, percentage, mean, SD) and inferential statistics. A Paired 't'-test compared pre-test/post-test scores within groups, and an Unpaired 't'-test was used to compare the effectiveness between the experimental and control groups. Chi-square tests were applied to find associations with demographic variables.

Ethical Considerations

The study was conducted with formal permission from the institutional ethical committee and hospital authorities. Written informed consent was obtained from the parents of all participants, ensuring anonymity, confidentiality, and the right to withdraw at any time.

Result and Findings

The findings revealed that before the intervention, both groups had similar respiratory health statuses. However, post-test analysis showed that 66.6% of children in the experimental group reached a "Very Effective" level of pulmonary function, whereas the control group showed no significant improvement (t-value 6.08, p<0.05). A significant association was found between the therapy's effectiveness and the

father's occupation and the child's previous experience with balloon exercises.

Table 1: Comparison of Pre-test and Post-test Pulmonary Function Levels

Level of Effectiveness	Control (Pre)	Control (Post)	Exp. (Pre)	Exp. (Post)
Very Effective	0%	0%	0%	66.6%
Moderately Effective	50%	50%	33.3%	16.6%
Mild Effective	50%	50%	50%	16.6%
Not Effective	0%	0%	16.6%	0%
Total	100%	100%	100%	100%

In the control group, the distribution of pulmonary function levels remained stagnant between the pre-test and post-test assessments. Specifically, 50% of the subjects were categorized as "Moderately Effective" and 50% as "Mild Effective" in both stages. No subjects were found in the "Very Effective" category, and no changes were observed, confirming that without the intervention (balloon therapy), there was no improvement in pulmonary function among these children. A significant shift in pulmonary function levels was observed in the experimental group following the intervention. Pre-test: At the baseline, 16.6% of the children were categorized as "Not Effective," while 33.3% were "Moderately Effective" and 50% were "Mild Effective." Post-test: After the implementation of balloon therapy, a remarkable transformation occurred. The majority of the subjects (66.6%) achieved the "Very Effective" level. Furthermore, the percentage of subjects in the "Not Effective" category dropped to 0%, indicating that every participant showed improvement.

The data clearly demonstrates that balloon therapy had a positive impact on the pulmonary function of children with respiratory diseases. While the control group showed no progress, the experimental group exhibited a substantial shift toward higher effectiveness levels (from 'Not Effective' and 'Mild' towards 'Very Effective'), proving the clinical effectiveness of the balloon-blowing intervention.

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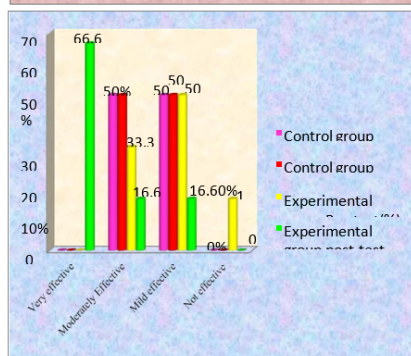
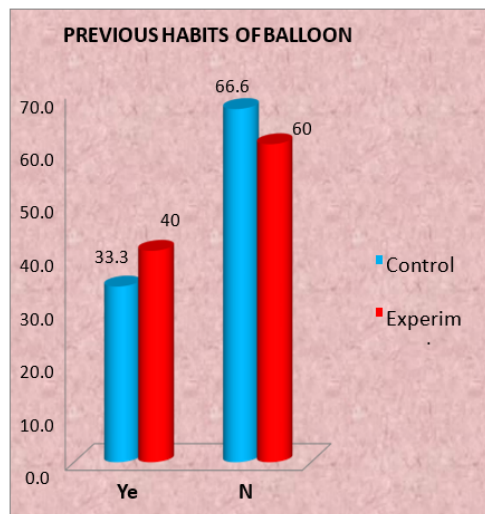


Table 2: Statistical Significance (Paired & Unpaired 't' Tests)

Group Comparison	Mean Diff	't' Value	Df	Result
Control (Pre vs Post)	0.16	1.16	29	Not Significant
Experimental (Pre vs Post)	11.47	12.08	29	Significant
Control vs Exp (Post-test)	9.64	6.08	58	Significant

Note: Significance level $p < 0.05$

The paired 't' test revealed no significant improvement in the control group ($t=1.16$, $p>0.05$), whereas the experimental group showed a highly significant improvement ($t=12.08$, $p<0.05$) following the balloon therapy. Furthermore, the unpaired 't' test between the two groups ($t=6.08$, $p<0.05$) confirms that balloon

blowing therapy is significantly more effective in promoting pulmonary function than the standard care. These findings statistically validate that the intervention is successful in enhancing the respiratory health of children."

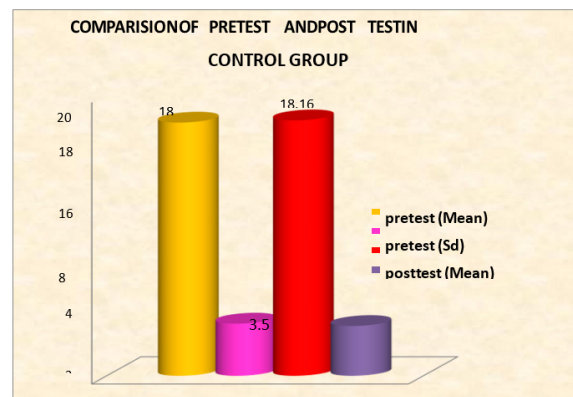


Table 3: Association of Post-Test Effectiveness with Demographic Variables

Demographic Variable	Chi-Square (Value) χ^2	p-value	Significance
Age	2.35	>0.05	Not Significant
Gender	3.51	>0.05	Not Significant
Type of Family	10.00	>0.05	Not Significant
Occupation of Father	12.91	<0.05	Significant
Previous Balloon Habits	11.95	<0.05	Significant

"Chi-square analysis reveals that most demographic variables, including age, gender, and family type, have no statistically significant association with the effectiveness of the therapy ($p > 0.05$). However, a significant association was observed between the post-test effectiveness and the occupation of the father ($p < 0.05$). Similarly, the previous habits of balloon-blowing exercises also showed a significant influence on the intervention's outcome ($p < 0.05$). This suggests that while family background and prior experience may influence results, the therapy remains largely independent of age and gender.¹⁰

Implications and Limitations

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The study serves as a model for integrating non-pharmacological, play-based pulmonary rehabilitation into routine paediatrics nursing services. The study was limited to a specific age group and urban hospital settings; the researchers faced minor challenges in ensuring consistent child cooperation during exercise sessions.

Conclusion

The present study aimed to evaluate the effectiveness of balloon therapy on the promotion of pulmonary function among children with respiratory diseases. The findings of the study demonstrate a statistically significant improvement in the pulmonary function of children in the experimental group compared to the control group, as evidenced by the significant difference in post-test scores ($t=6.08$, $p<0.05$). The results clearly indicate that regular balloon-blowing exercises serve as a simple, cost-effective, and non-pharmacological intervention to enhance respiratory health in paediatric patients. Furthermore, factors such as the occupation of the father and previous exposure to such exercises were found to influence the therapeutic outcomes. Based on these findings, it is concluded that balloon therapy is highly effective and can be integrated into the routine nursing care or home management of children suffering from respiratory conditions to improve their overall pulmonary function and quality of life.

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