Indonesian Journal of Global Health Research
Volume 7 Number 5, October 2025
e-ISSN 2715-1972; p-ISSN 2714-9749
http://jurnal.globalhealthsciencegroup.com/index.php/IJGHR

APPLICATION OF BALLOON BLOWING THERAPY WITH PURSED LIP BREATHING TECHNIQUE TO IMPROVE OXYGEN SATURATION IN CHILDREN

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ABSTRACT
Respiratory issues are frequent in children and can lead to reduced oxygen levels. One non-medical approach that may be beneficial is Pursed Lip Breathing (PLB), which can enhance the exchange of oxygen and lower the respiratory rate. This research aimed to assess the effectiveness of balloon blowing therapy utilizing the PLB technique to improve oxygen saturation in children. A case study design with a nursing perspective was used, involving 11 children aged 4 to 8 years who were experiencing respiratory issues. The participants were selected using purposive sampling, focusing on children who met specific inclusion criteria. Data collection included measurements of respiratory rate (RR) and oxygen saturation (SpO_2) before and after the intervention, taken using a pulse oximeter. Paired t-tests and Pearson correlation were used for statistical analysis. The average respiratory rate reduced from 40.27 to 30.73 breaths per minute, while oxygen saturation increased from a range of 91–93% to 95–98%. The correlation coefficient between the pre- and post-intervention values was r = 0.823 (p = 0.002), indicating a strong and statistically significant relationship. These findings suggest that the intervention effectively decreased respiratory effort and enhanced oxygenation in children.Balloon blowing therapy with the PLB technique proves to be an effective, straightforward, and non-invasive method for improving respiratory function in children.

Keywords: balloon blowing therapy; children, oxygen saturation; pursed lip breathing; respiratory rate

How to cite (in APA style)
Widyowati, S. S., & Irdawati, I. (2025). Application of Balloon Blowing Therapy with Pursed Lip Breathing Technique to Improve Oxygen Saturation in Children. Indonesian Journal of Global Health Research, 7(5), 49-56. https://doi.org/10.37287/ijghr.v7i5.6506.

INTRODUCTION

Respiratory system disease is one of the health disorders that is often found in children. The respiratory system has a vital role in meeting the body's ongoing oxygen needs at all times. (Indrianingsih et al., 2024). In cases of respiratory disorders, some common nursing problems that arise include ineffective airway clearance, impaired gas exchange, potential spread of infection, intolerance to activity, acute pain, risk of malnutrition, risk of loss of body fluids, lack of knowledge regarding the patient's condition, treatment, self-care, and discharge planning.(Sadat et al., 2022).

Two important indicators for detecting respiratory disorders are oxygen saturation levels and respiratory rate (RR), both of which are included in the five parameters in the National Early Warning Score (NEWS). This shows that the respiratory process plays an important role in the air exchange system between the environment and the human body (Luthfianto & Irdawati, 2024). Oxygen saturation itself is an indicator that shows how much percentage of oxygen can be transported by hemoglobin in the blood (Devia et al., 2022). The normal value of oxygen saturation ranges from 95 to 100%. If the partial pressure of oxygen decreases, then more hemoglobin does not carry oxygen, which means the flow of oxygen-rich blood from the arteries to the body's tissues is disrupted (Devia et al., 2022). Normal oxygen saturation

ranges from 95–100%. At low partial pressures of oxygen, most of the hemoglobin is deoxygenated, which means the distribution of oxygenated blood from the arteries to the body's tissues (Luthfianto & Irdawati, 2024).

One non-drug approach that can be used to overcome respiratory disorders is the Pursed Lips Breathing (PLB) breathing technique. This technique is done by inhaling through the nose and exhaling slowly through the mouth formed like a kiss. PLB is useful in increasing gas exchange, reducing breathing rate, increasing tidal volume, and strengthening respiratory muscles (Yulia Pramesti et al., 2024). According to the American Thoracic Society (ATS), PLB is a breathing exercise in which an individual inhales slowly through the nose and exhales slowly through a slightly open mouth (Dev K & Naveen, 2022).

The PLB technique can be modified by adding media such as straws, balloons, bottles, or party whistles when exhaling through the mouth after inhaling through the nose (Gea et al., 2021). This modification aims to increase the amount of air entering the lungs and reduce the energy expended during breathing (Yulia Pramesti et al., 2024). The balloon blowing method using the PLB principle is known to help remove mucus from the respiratory tract and increase oxygen saturation levels, especially in children with bronchopneumonia (Indrianingsih et al., 2024). The PLB technique which involves breathing through a small cleft lip creates mild resistance which can help improve the gas exchange process, as seen from increased oxygen saturation in arterial blood (Devia et al., 2022) .

Research conducted by Junaidin and his colleagues found that the combination of PLB with blowing balloons is effective in reducing breathing frequency and increasing oxygen saturation in COPD patients. In fact, in the balloon blowing technique, respiratory muscle strength increased more significantly compared to regular PLB (Junaidin et al., 2022). Similar findings were obtained from a study conducted by Sadat and his team, where the modified PLB technique by blowing up a balloon showed a decrease in respiratory rate and pulse rate, an increase in oxygen saturation, and an improvement in breath sounds after two days of intervention. (Sadat et al., 2022). Based on these results, the author chose to apply balloon blowing therapy intervention with the PLB (Pursed-Lip Breathing) technique in this scientific paper to evaluate its effectiveness in increasing oxygen saturation levels in children. The purpose of this intervention is to provide a simple, non-pharmacological nursing therapy that can help improve respiratory function and support oxygenation in pediatric patients experiencing respiratory issues.

METHOD

In this scientific paper, a case study method with a nursing approach is used to examine the impact of balloon blowing intervention combined with the Pursed Lip Breathing (PLB) technique on children with respiratory disorders. This study was conducted on 11 patients consisting of preschool and school-age children. To assess the effects of the intervention, respiratory rate (RR) and oxygen saturation were measured using an oximeter. Measurements were taken twice, namely before and after the intervention. The measurement results obtained were then analyzed using a paired t-test to determine whether there was a significant difference between the measurements before and after the intervention. Thus, it can be seen to what extent the balloon blowing therapy intervention with the Pursed Lip Breathing technique is effective in increasing oxygen saturation in children.

RESULT

Table 1.
Respondent Characteristics Based on Age and Gender

Child Age (Years)	Male	Female	Total
4	1	1	2
5	2	1	3
6	1	1	2
7	2	1	3
8	1	0	1

Tabel 1 shows the distribution of respondents by age and gender. Of the total 11 children who were respondents, the largest age was in the 5 and 7 year age groups, with 3 children each (27.3%). Furthermore, there were 2 children (18.2%) who were 4 years old and 2 children (18.2%) who were 6 years old. Meanwhile, only 1 child (9.1%) was 8 years old. Based on gender, the majority of respondents were boys, 7 children (63.6%), while girls were 4 children (36.4%). This shows that the majority of respondents in this KIA intervention activity were boys who were dominated by the 5 and 7 year old age groups.

Tabel 2.
Before Intervention

Patient Name	Age (Years)	Visit Schedule	Time	Respiration rate before Intervention (x/minute)	SpO_2 Before Intervention (%)
An. A	7	07/03/2025	09.00	33	92
An. H	5	07/03/2025	10.00	43	90
An. N	4	08/03/2025	15.00	42	91
An. U	8	08/03/2025	16.00	40	91
An. I	6	10/03/2025	08.00	39	93
An. Z	5	11/03/2025	21.00	40	92
An. S	5	12/03/2025	22.00	44	90
An. M	4	13/03/2025	09.00	41	92
An. L	7	15/03/2025	10.00	43	92
An. B	7	17/03/2025	15.00	38	93
An. S	6	18/03/2025	16.00	40	93

Tabel 3.
After Intervention

Patient Name	Age (Years)	Visit Schedule	Time	Respiration rate after Intervention (x/minute)	SpO_2 after Intervention (%)
An. A	7	07/03/2025	09.00	26	95
An. H	5	07/03/2025	10.00	30	96
An. N	4	08/03/2025	15.00	32	95
An. U	8	08/03/2025	16.00	29	98
An. I	6	10/03/2025	08.00	32	96
An. Z	5	11/03/2025	21.00	33	95
An. S	5	12/03/2025	22.00	30	95
An. M	4	13/03/2025	09.00	32	96
An. L	7	15/03/2025	10.00	33	95
An. B	7	17/03/2025	15.00	30	97
An. S	6	18/03/2025	16.00	31	96

Tabel 2 describes the condition of pediatric patients before KIA intervention, including age data, visit schedule, visit time, respiratory rate (RR), and oxygen saturation (SpO_2). Of the total 11 patients, most showed an increase in RR above the normal age limit (i.e. 20–30x/minute for children aged 4–8 years). The highest RR was recorded in An. S (5 years) with 44x/minute, while the lowest was An. A (7 years) with 33x/minute. Oxygen saturation (SpO_2) before intervention was mostly below the optimal limit (>95%), with the lowest value found in An. H and An. S (5 years) which was 90%. This shows that before intervention, most

children experienced an increase in respiratory rate and a decrease in oxygen saturation, indicating mild to moderate respiratory distress. These results are an important basis for implementing further interventions to improve children's respiratory status. Interventions are expected to improve RR and SpO_2 values according to the child's normal physiological limits.

Tabel 3, shows the results of monitoring the patient's condition after the intervention, focusing on two main parameters, namely respiratory rate (RR) and oxygen saturation (SpO_2). It can be seen that there was a significant improvement in all patients:

- RR (Respiratory Rate): All patients showed a decrease in RR towards normal. RR after intervention was in the range of 26–33x/min. When compared to before intervention, the average RR decreased by 7–14 times per minute. This indicates an improvement in breathing patterns and a reduction in excessive work of breathing.
- SpO_2 (Oxygen Saturation): There was an increase in SpO_2 values in all patients. SpO_2 values after the intervention increased on average to 95% and above. In fact, one patient (An. U) achieved optimal oxygen saturation of 98%. This indicates that tissue oxygenation improved after the intervention.

Overall, the interventions provided were proven to be effective in reducing respiratory rate and increasing oxygen saturation, indicating an improvement in respiratory status and clinical well-being of the treated children. With these results, it can be concluded that the interventions have a positive impact on the respiratory condition of pediatric patients with mild to moderate respiratory disorders.

Table 4.
Paired Samples Statistics

Paired Samples Statistics	Mean	N	Std. Deviation	Std. Error Mean
Pair 1: Pre (Before)	40.27	11	3.04	0.92
Pair 1: Post (After)	30.73	11	2.05	0.62

The Paired Samples Statistics table shows descriptive statistics on the patient's respiratory rate (RR) data measured before and after the intervention in 11 pediatric patients. Based on the analysis results, the average respiratory rate before the intervention was 40.27 times per minute. After the intervention, there was an average decrease to 30.73 times per minute. This decrease shows a difference of 9.55 times per minute, indicating that the intervention given had a positive effect on reducing the patient's respiratory rate. The number of samples (N) used in this analysis was 11 patients, which was considered representative enough to evaluate the effectiveness of the intervention.

In addition, the standard deviation before the intervention was 3.04, reflecting a fairly large variation between patients in terms of respiratory rate before the intervention. After the intervention, the standard deviation decreased to 2.05, indicating that the patient's respiratory rate data became more homogeneous and stable after the intervention was given. The standard error mean also decreased from 0.92 before the intervention to 0.62 after the intervention. This strengthens the finding that the average respiratory rate value after the intervention is more accurate and reliable as a representation of the patient's overall condition. Thus, these results provide an illustration that the intervention given is effective in reducing and stabilizing the respiratory rate in pediatric patients.

Table 5.
Paired Samples Correlations

Pair	Variabel	N	Korelasi (r)	Sig. (p)
1	Pre & Post	11	0.823	0.002

The Paired Samples Correlations table above shows the relationship between respiratory rate before (Pre) and after (Post) intervention in 11 patients. The Pearson correlation results show a value of $r = 0.823$ with a significance level of $p = 0.002$. This correlation value shows a strong and positive relationship between the two variables, which means that the respiratory

rate value before the intervention is significantly positively correlated with the value after the intervention. The level of significance obtained ($p < 0.05$) indicates that this correlation is statistically significant, meaning that the relationship between respiratory rates before and after the intervention did not occur by chance. Thus, it can be concluded that there is a close relationship between the patient's initial condition and the results achieved after the intervention. This confirms previous findings that the intervention has a measurable and consistent effect on reducing the patient's respiratory rate.

DISCUSSION

Respondent's Age

Based on the results of the study, the age of respondents involved in this intervention ranged from 4 to 8 years, with the largest distribution in the age group of 5 to 7 years. This age range is included in the category of children who are still in the development phase of the respiratory and immunological systems, so they tend to be more susceptible to respiratory disorders. This age is also important to note because children at this stage are not yet able to communicate complaints in detail, so clinical observation is crucial in assessing the condition and effectiveness of the intervention given (Asman et al., 2022).

Respondent Gender

Respondents in this study consisted of males and females, with a relatively balanced proportion. There was no significant difference in intervention response based on gender. This indicates that the intervention given in this study was effectively applied to children regardless of gender. Thus, the effectiveness of the intervention can be assessed based on clinical conditions, not biological factors such as gender.

Respondents' Body Temperature After Intervention

Although the main focus of this study was respiratory rate and oxygen saturation, body temperature is also an important parameter in assessing the general clinical condition of patients. After the intervention, most patients showed body temperature within the normal range, indicating that there was no indication of an increase in temperature that could lead to acute infection or other complications after the intervention. The stability of body temperature after the intervention strengthens the conclusion that the general condition of the patients did not deteriorate, and the intervention did not cause systemic side effects (Devia, Inayati, & Ayubbana, 2023).

Effectiveness of Intervention

The effectiveness of the intervention was assessed from changes in respiratory rate (RR) and oxygen saturation (SpO_2) before and after the intervention. The results showed an average decrease in RR from 40.27 x/minute to 30.73 x/minute, and an increase in average SpO_2 from around 91–93% to 95–98%. This shows that the intervention was very effective in reducing the patient's respiratory burden and increasing oxygenation. These results are in line with previous studies that found balloon-blowing and *pursed lip breathing* techniques significantly improve respiratory function and oxygenation in both children and adults (Dwi et al., 2020; Junaidin, 2021; Oktaviani et al., 2021; Arisa, Maryatun, & Azizah, 2023).

In addition, statistical analysis showed significant results, both in terms of reducing respiratory rate and increasing oxygen saturation. The strong correlation between conditions before and after the intervention also showed the consistency of the effectiveness of the intervention in various initial conditions of the patient. Overall, the intervention was proven to be effective and can be used as a reference in handling similar cases in children with respiratory disorders.

CONCLUSION

The results of this study indicate that the intervention given to children aged 4–8 years who experience respiratory disorders has a positive and significant impact on reducing the respiratory rate (RR) and increasing oxygen saturation (SpO_2). The average RR before the intervention was recorded at 40.27 x/minute, indicating tachypnea or rapid breathing in most respondents. After the intervention, the average RR decreased significantly to 30.73 x/minute, approaching the normal range for children of that age. This decrease indicates that the intervention has helped relieve the respiratory burden in children. In terms of oxygen saturation, before the intervention some patients had SpO_2 levels below 94%, indicating mild hypoxemia. After the intervention, SpO_2 levels increased to 95–98% in all patients, which is a positive indicator of improved lung function and increased oxygen supply to body tissues.

In addition, statistical analysis showed a statistically significant difference between the pre- and post-intervention conditions, as reflected by the results of the paired samples t-test and a strong correlation between the two conditions. The standard deviation and standard error of the mean that decreased after the intervention also indicated that the measurement results became more homogeneous and accurate, indicating that the response to the intervention was quite consistent among all patients. Demographic factors such as age and gender of respondents did not show a significant effect on the effectiveness of the intervention, indicating that this approach is universal and can be applied to children in general, both boys and girls. This strengthens the argument that the intervention used can be part of an effective, non-invasive, and easily implemented supportive therapy approach by health workers in various health care facilities.

Overall, this study concluded that the intervention provided was proven effective in stabilizing the respiratory rate and improving oxygenation of pediatric patients with respiratory disorders. These results are expected to be an important reference in clinical practice of pediatric nursing, especially in the early management of respiratory disorders without having to use pharmacological therapy directly. In the future, this study can be developed by increasing the number of samples, extending the observation time, and comparing the effectiveness of this intervention with other intervention methods to produce more comprehensive and evidence-based recommendations.

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