

DIFFERENCES IN THE EFFECTS OF PURSED LIPS BREATHING AND CHEST PHYSIOTHERAPY ON OXYGEN SATURATION IN TODDLERS SUFFERING FROM PNEUMONIA

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ABSTRACT

Background: Pneumonia is an acute respiratory infection that attacks the lungs or alveoli and often occurs in toddlers, especially infants. Pneumonia is caused by viruses, bacteria, fungi, exposure to chemicals or damage to lung physiology. Pneumonia causes high mortality rates in children under five because it results in disruption of oxygenation status in the form of a decrease in oxygen saturation caused by accumulation of secretions. This condition raises the nursing problem of impaired gas exchange and ineffective airway clearance. Non-pharmacological measures to increase oxygen saturation are pursed lips breathing and chest physiotherapy. The aim of the research was to determine the difference in the effect of pursed lips breathing and chest physiotherapy on oxygen saturation in toddlers with pneumonia in the Purbaratu Tasikmalaya Health Center working area.

Method: This study used a quasi-experimental design with two intervention groups, pretest and posttest without a control group, with a sample size of 22 respondents who were divided into 2 intervention groups with sampling using a purposive sampling technique. Data analysis was univariate and bivariate in the form of paired tests and independent t-tests.

Results: The results of the study showed that there was a difference in the effect of pursed lips breathing and chest physiotherapy on oxygen saturation in toddlers with pneumonia with a p value of 0.002 ($p < 0.05$).

Conclusion: This study shows that pursed lips breathing and chest physiotherapy can increase oxygen saturation in toddlers with pneumonia. The implication of this research could be an intervention that applies the principles of atraumatic care in providing pursed lips breathing and chest physiotherapy to overcome the nursing problems of gas exchange disorders and ineffective airway clearance in increasing oxygen saturation values.

Keywords: Toddlers; Chest Physiotherapy; Pneumonia; Pursed Lips Breathing

INTRODUCTION

The toddler years are the most important period of growth and development. Children are particularly vulnerable to infectious diseases such as malaria, AIDS, diarrhea and pneumonia (Akbar et al., 2021). Based on data from World Health Organization (2021), pneumonia accounts for 14% of under-five deaths in the world and resulted in 740,180 under-fives dying in 2019.

According to, UNICEF (2019) Pneumonia in children is the cause of up to 800,000 deaths worldwide. Most deaths due to pneumonia occur in children under 2 years of age and 153,000 deaths occur in children aged 1 month. The prevalence of childhood

pneumonia in 2018 in Indonesia was 4.8% with pneumonia cases in children <1 year old at 3.8% and aged 1-4 years at 5.0%. West Java is ranked 10th with coverage of 31.2%. Child mortality due to pneumonia in babies is twice as high as in children aged 1-4 years (Kementerian Kesehatan RI, 2020). There are 1,367 children under five with 3 deaths due to pneumonia in Tasikmalaya City in 2022. Tasikmalaya City consists of 23 Community Health Centers, Purbaratu U Health Center is one of the community health centers with high pneumonia coverage, namely 79.57% with 167 children under five suffering from pneumonia. (Dinas Kesehatan Kota Tasikmalaya, 2022).

Risk factors for pneumonia in children include premature birth, inadequate breastfeeding, incomplete immunization, especially measles immunization, anemia, climate change, poor parenting patterns, malnutrition, low economic status, overcrowding, lack of kitchen ventilation, house pollution, and passive smoking (Nurhaeni et al., 2018). Meanwhile, the most common causes of pneumonia in children are viruses and bacteria (Rueda et al., 2022). The signs and symptoms of pneumonia namely coughing, dyspnea and cyanosis as well as decreased oxygen saturation (Indonesian Ministry of Health, 2022).

Efforts that can be made to minimize the number of pneumonias is with pharmacological and non-pharmacological therapy. Pharmacological therapy that can be given to toddlers suffering from pneumonia is oxygen and antibiotics. Meanwhile, non-pharmacological therapy includes pursed lips breathing and chest physiotherapy. Pursed lips breathing is a process of increasing the alveolar level in each lung lobe and can increase air flow during expiration (Dev K & Naveen, 2022). The mechanism of pursed lips breathing is to increase air flow during expiration and activate the cilia on the respiratory tract mucosa so that it can clean secretions from the respiratory tract and optimize gas exchange resulting in increased oxygen saturation. (Muliasari & Indrawati, 2018). Chest physiotherapy is a therapy used to treat most respiratory diseases in children with neuromuscular diseases or chronic respiratory diseases (Sangadah & Kartawidjaja, 2020). Chest physiotherapy aims to clear tracheobronchial secretions, so that it can help reduce airway resistance, help make breathing easier, clear inflammatory exudates and increase gas output resulting in increased oxygen saturation in children (Chaves et al., 2019).

Research related to the act of pursed lips breathing which uses a balloon blowing game and chest physiotherapy (clapping, vibrating,

postural drainage and effective coughing) has never been carried out in the Purbaratu Tasikmalaya Health Center working area. So the formulation of the problem in this research is how different the influence of the pursed lips breathing method is with chest physiotherapy on oxygen saturation in toddler pneumonia in the Purbaratu Tasikmalaya Health Center working area. The specific objectives of this research are to analyze oxygen saturation before and after giving pursed lips breathing, analyzing oxygen saturation before and after giving chest physiotherapy, analyzing changes in oxygen saturation after giving pursed lips breathing and chest physiotherapy for toddlers with pneumonia.

METHODS

This research is quantitative research with a quasi-experimental research design with a two-group pretest and posttest without control group design. The population in this study was 167 children diagnosed with pneumonia in the Purbaratu Community Health Center working area, with a total sample of 22 respondents consisting of 11 people in the pursed lips breathing group and 11 people in the chest physiotherapy group using a purposive sampling technique based on the inclusion criteria, namely: 1) pneumonia patients aged 1-5 years, patients with a decrease in oxygen saturation between 93%-95%, 3) pneumonia patients whose parents allow and are willing to be respondents, 4) pneumonia patients who are able or willing to play a role in providing pursed lips breathing therapy and chest physiotherapy. The exclusion criteria are: 1) pneumonia patients whose condition worsens, 2) pneumonia patients with coughing for more than 2 weeks, 3) pneumonia patients who change domicile.

The independent variable is the effect of pursed lips breathing and chest physiotherapy, while the dependent variable is oxygen saturation. The research instrument

used an observation sheet in the form of a child's oxygen saturation record to measure oxygen saturation before and after being given pursed lips breathing and chest physiotherapy. As well as calibrated oximetry, balloon blowing games. Data analysis used univariate analysis in the form of frequency distribution and bivariate in the form of paired t test and independent t-test. This research has undergone an ethical test at the Tasikmalaya Health Polytechnic Ethics Committee and received a certificate of ethical suitability, Description of Ethical Approval "Ethical Approval" with Ethics Number DP.04.03/F.XXVI.20/128/2023.

RESULTS AND DISCUSSION

RESULTS

Table 1. Characteristics of respondents

Characteristics	n	Percentage (%)
Age		
<3 years	10	45.5
>3 years	12	54.5
Gender		
Man	13	59.1
Woman	9	40.9
Parental education		
elementary school	1	4.5
JUNIOR HIGH SCHOOL	6	27.3
SENIOR HIGH SCHOOL	13	59.1
S1	2	9.1
Parents' job		
Civil servants	3	13.6
Work alone	7	31.8
IRT	12	54.5
Parental Income		
<Rp. 1,000,000	8	36.4
IDR 1,000,000-2,500,000	11	50.0
>Rp 2,500,000	3	13.6
Total	22	100.0

Table 1 shows that of the 22 respondents, the majority of children were >3 years old, 12 respondents (54.5%), the majority of children were male, namely 13 respondents (59.1%), 13 respondents had a high school education level (59.1%). %, parents' occupation as housewives was 12 respondents (54.5%) and parents' monthly income was Rp. 1,000,000-2,500,000 as many as 11 respondents (50.0%).

Table 2. Oxygen Saturation Analysis before and after Pursed Lips Breathing

Variable	n	Mean	Elementary school	p
SPO2 Pre PLB	11	93.4	0.82	0,000
SPO2 Post PLB	11	96.2	0.98	

Table 2 shows that of the 22 respondents, the average oxygen saturation value before being given pursed lips breathing was 93.4% with a standard deviation value of 0.82 and after being given pursed lips breathing was 96.2% with a standard deviation value of 0.982. and a P value of 0.000 which shows that there is an effect of giving Pursed lips breathing on increasing oxygen saturation.

Table 3. Oxygen Saturation Analysis before and after Chest Physiotherapy

Variable	n	Mean	Elementary school	p
SPO2 Pre Chest Physiotherapy	11	93.9	1.04	0,000
SPO2 Post Chest Physiotherapy	11	97.7	1.10	

Table 3 shows that of the 22 respondents, the average oxygen saturation value before being given chest physiotherapy was 93.9% with a standard deviation of 1.04 and after being given chest physiotherapy was 97.7% with a standard deviation value of 1.10, and The P-value is 0.000, which indicates that there is an effect of chest physiotherapy on increasing oxygen saturation.

Table 4. Oxygen Saturation Analysis after being given Pursed Lips Breathing and Chest Physiotherapy

Variable	n	Mean	Elementary school	p
SPO2 Post PLB	11	96.18	0.98	0.002
SPO2 Post Chest Physiotherapy	11	97.73	1.10	

Table 4 shows the results of the independent sample t-test, the significance value is P value = 0.002 ($p < 0.05$) so that the null hypothesis (H_0) is rejected and H_a is accepted so it can be concluded that there is a difference in changes in oxygen saturation after being given pursed lips breathing and chest physiotherapy. in toddlers suffering from pneumonia in the Purbaratu Tasikmalaya Health Center working area.

DISCUSSION

Respondent Characteristics

Children under five years of age are very susceptible to infectious diseases, especially children who experience malnutrition or inadequate growth and development. This condition can increase morbidity and mortality rates as well as result in children experiencing poor nutrition which causes the body's immune system to weaken so that children are susceptible to infectious diseases (Akbar et al., 2021).

Most of the respondents' parents' education was high school. The level of parental education is one factor that can indirectly influence the incidence of pneumonia in children. The higher the parents' education, the easier it is for parents to receive health messages and the more they understand about preventing pneumonia in children (Syani & Raharjo, 2015). Educated parents have sufficient knowledge about infant and child health services (Chandra, 2017).

Working parents can have better and broader information in caring for their children. In this study the majority of parents were housewives (54.5%). This is in line with research Utari et al. (2014), that mothers who do not work and spend 24 hours more time caring for children than mothers who work. The work status of housewives can affect children's health, because mothers who do not work have more time to care for their children.

The majority of parents of pneumonia sufferers have an income of Rp. 1,000,000-2,500,000 as many as 11 people (50.0%). People who have higher incomes will have higher levels of health service utilization. The incidence of pneumonia is twice as high in families with incomes below the minimum wage. This makes it difficult for parents to provide good housing, health services and adequate nutrition for their children. Poor food quality can cause reduced immunity and

children are susceptible to infectious diseases (Morales et al., 2023).

Analysis of oxygen saturation before and after giving Pursed Lips Breathing

The average oxygen saturation before giving pursed lips breathing was 93.4%, meaning that the oxygen saturation condition was still in the abnormal category. This theory also explains that pneumonia in toddlers is caused by increased secretions which affect the entry of oxygen into the lungs and result in inflammation and will affect oxygen levels in the blood so that it impacts gas exchange which results in decreased oxygen saturation in the child's body. (Sulisnawati et al., 2015).

Based on the results of the paired sample t-test, it was obtained that the total data was 11 respondents and the p value $< \alpha$ ($0.000 < 0.05$), it can be concluded that there is an influence on changes in oxygen saturation before and after giving pursed lips breathing to toddlers suffering from pneumonia in the Purbaratu Tasikmalaya Health Center working area. This is because when respondents do pursed lips breathing with a modified toy balloon, inspiration and expiration will take longer and can increase diffusion time and oxygen balance in the pulmonary blood capillaries and alveoli. This condition can increase oxygen saturation and help expel air trapped in the lungs, thereby allowing clean air to enter the lungs (Suprayitno, 2017). Other research results also show that giving pursed lips breathing can reduce symptoms of dyspnea (Vtwani, 2019).

Pursed lips breathing therapy is very easy and can be done independently at home because this action does not require a lot of energy, is simple, easy to do, and safe. Pursed lips breathing therapy is modified with balloon toys as an approach to the principles of atraumatic care so that children want to do therapy. Research shows that one way of implementing atraumatic care is that it is able to meet children's psychological needs, thereby reducing anxiety during

hospitalization and reducing the length of care for children (Seniwati et al., 2023). In this therapy, more oxygen is inhaled than normal breathing and the therapy is appropriate to the child's age where the child's fine motor skills have developed (Khoerunisa, 2021).

The results of this study are also in line with research Muliasari & Indrawati (2018), that by administering pursed lips breathing therapy there is an increase in air flow during expiration and activates the cilia on the respiratory tract mucosa, thereby clearing secretions from the respiratory tract and optimizing gas exchange, resulting in an increase in oxygen saturation.

Analysis of oxygen saturation before and after giving chest physiotherapy

The average oxygen saturation before chest physiotherapy was given was 93.91%, meaning that the oxygen saturation condition was still in the abnormal category. The condition of toddlers suffering from pneumonia experiences respiratory problems due to inflammation of the alveoli which can cause an increase in secretions retained in the child's lungs, thus affecting gas exchange in the child's body which causes the child's oxygen saturation to decrease (Sari et al., 2022).

After being given chest physiotherapy, the average child's oxygen saturation increased to 97.73%, meaning there was an increase in oxygen saturation. It is known that providing chest physiotherapy procedures with a combination of postural drainage, percussion, vibration and strong coughing will help remove secretions, maximize ventilation and increase oxygen use resulting in increased oxygen saturation in the body. (Wardiyah et al., 2022).

Based on the results of the Paired Sample T-test, the total number of research data obtained was 11 respondents and the p value $< \alpha$ ($0.000 < 0.05$), it can be concluded that there is an influence on changes in oxygen saturation before and after being given chest physiotherapy to toddlers suffering from

pneumonia in the work area. Purbaratu Tasikmalaya Community Health Center. Chest physiotherapy can clear the airway with a combination of postural drainage, clapping and vibration techniques. When providing chest physiotherapy by patting the child's chest repeatedly to help move secretions in the small airways towards the trachea and accompanied by coughing in the child which can increase oxygen use resulting in an increase in the child's oxygen saturation levels (Sari, 2020). Other research also shows that providing conventional chest physiotherapy shows a greater increase in peripheral oxygen saturation levels (Chaves et al., 2019).

Chest physiotherapy is one of the most effective treatments for patients with acute and chronic respiratory problems. Even though this chest physiotherapy method does not seem special, it is very effective in removing secretions and increasing ventilation in patients with impaired lung function. The benefits of chest physiotherapy for the body are that it can increase respiratory efficiency and expand the lungs, strengthen respiratory muscles, facilitate secretions to overcome airway clearance problems and patients can breathe freely and the body gets enough oxygen so that there are no problems with gas exchange disorders. (Smeltzer & Bare, 2015).

The application of chest physiotherapy is one intervention for the nursing problem of ineffective airway clearance. Airway clearance is a way to clear secretions or blockages in the respiratory tract so that the airway remains effective (Suhanda & Rusmana, 2014). Physiologically, airway clearance is ineffective because airway hypersecretion occurs and secretions are retained due to an increase in the number of cells and an increase in the size of gland cells, causing hypersecretion in the airways. In this situation, airway clearance can be caused by passive smoking, active smoking, and exposure to pollution. Thick, sticky mucus and reduced mucociliary clearance cause

airway clearance problems (Tim Pokja SPO DPP PPNI, 2021).

The results of this study are in line with research. The results of the study Desak (2020), show that there is a big influence on the clinical improvement of toddlers by providing chest physiotherapy with the result that the Respiratory Rate returns to normal, the Heart Rate returns to normal, there is an increase in oxygen saturation and the ability to expel phlegm so that the airway becomes normal.

Oxygen Saturation Analysis After Pursed Lips Breathing and Chest Physiotherapy

Based on the results of the independent t test analysis, it was obtained p value $< \alpha$ ($0.002 < 0.05$) it can be concluded that H_a is accepted and H_o is rejected with the conclusion that there is a difference in changes in oxygen saturation after being given pursed lips breathing and physiotherapy chest pneumonia in toddlers in the Purbaratu Tasikmalaya Health Center working area. When measuring oxygen saturation, it is influenced by the movement of the hand attached to the oximeter. Researchers must wait for the respondent to calm down so that the oxygen saturation results are valid. The respondents in this study were toddlers, so collaboration with parents is needed so that a pulse oximeter can be installed to measure before and after the intervention.

Based on theory and research results, it is known that pursed lips breathing and chest physiotherapy are equally effective in changing oxygen saturation in children with pneumonia, but judging from the average increase in oxygen saturation, namely the average oxygen saturation results in the pursed lips breathing group, there is a difference in the increase in oxygen saturation of 2.73%, while in the chest physiotherapy group it was 3.82%. These results indicate that chest physiotherapy is more effective because respondents in this research group had more nursing problems with ineffective airway clearance so that increasing oxygen

saturation had more of an effect in the chest physiotherapy group compared to the pursed lips breathing group.

CONCLUSION

The results of the study showed that there was an increase in oxygen saturation in both groups with a p value of 0.000, which shows that providing PLB and chest physiotherapy was able to increase oxygen saturation in toddlers with pneumonia. And research shows that there are differences in the effect of changes in oxygen saturation after being given pursed lip breathing and chest physiotherapy in toddlers with pneumonia, which shows that chest physiotherapy is more effective in increasing oxygen saturation.

The limitations of this research are the research method which does not use a control group, as well as the short frequency of administration of measures. Future research is expected to use a research design that uses a control group and extends the frequency of actions given.

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CONFLICT OF INTEREST

The implementation of this research process went well and there were no conflicts of interest.

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