

Effect of Massage Therapy in Relieving Respiratory Problems in Children with Lower Respiratory Tract Infection

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Abstract

Background: Respiratory tract infections are the most widespread diseases among children throughout the world. In addition to the medical treatment of respiratory tract infections, massage is one of non-pharmacological techniques utilized to optimize respiratory system. Massage therapy consists of five steps: effleurage, petrissage, tapotement, friction and vibration which improves lung function and promotes relaxation. **The study aimed** to evaluate the effect of massage therapy in relieving respiratory problems in children with lower respiratory tract infection. **Subjects and Method:** A quasi-experimental research design was performed on sixty children aged between 3-6 years who admitted to Chest Inpatient Unit of Pediatric Medical Department at Tanta Main University Hospital. They were divided into two groups. Control group who received traditional treatment and the intervention group who received traditional treatment and massage therapy. **Two tools** were used for data collection: **Sociodemographic characteristics** of children which include two parts and **Children' respiratory outcomes** record related to massage therapy. **Results:** It was found that respiratory status of children in the intervention group had improved from severe to mild after the third day of massage therapy. **Conclusion:** Application of massage therapy improved oxygen saturation and respiratory distress in children with lower respiratory tract infection. **Recommendation:** Massage therapy ought to be added into nursing care for children with lower respiratory tract infection.

Keywords: Massage Therapy, effleurage, petrissage, tapotement, friction and vibration, respiratory tract infections and children

Introduction

Lower respiratory tract infection is a broad problem which includes different diseases as acute bronchitis, pneumonia, acute exacerbations of chronic obstructive pulmonary disease/chronic bronchitis and acute exacerbation of bronchiectasis. It is considered one of the common clinical problems in children. Globally, respiratory infection lead to morbidity and mortality in young children. Worldwide, millions die from respiratory diseases each year, with

the majority of these deaths occurring in children under the age of five. Lower respiratory tract infection is more fatal than upper respiratory infection. ⁽¹⁾ According to the Global Burden of Disease represent that it is the third and fourth most common causes of death, ⁽²⁾ and it remains the commonest cause of under-5 mortalities. ^(3,4)

When there is an infection in the lungs, more specifically in the lower airways, lower respiratory tract infection can occur.

Although a virus is typically responsible for this infection, other common organisms such as bacteria can also be to cause it. The main warning sign is a cough, which can be extremely severe. Cough of the child may be moist or dry. Even if it is a wet cough, child may not be able to cough up mucus. Other symptoms include: fever, tightness in the chest or chest pain, breathing quickly or in an irregular pattern, difficulty catching the breath and wheezing. ⁽³⁾ Malnutrition, age, vaccination status, low birth weight, ineffective therapies and air pollution are several factors that increase the occurrence of lower respiratory tract infection in children. ⁽⁵⁻⁷⁾

Diagnosis can be done by medical history, physical examination, Nose swab, X-ray , blood test for signs of inflammation or signs of infection and bronchoscopy that can be detected to establish diagnoses , the main cause of the diseases and type of care provided to the child . If the child has a lower respiratory tract infection caused by a virus, we will make the following recommendations: Get plenty of clear fluids, rest, control the fever with or non-steroidal anti-inflammatory drugs. If the disease caused by bacteria, we would likely give antibiotics to fight the infection and may need to hospitalization. ⁽⁸⁻¹²⁾

Nursing as a profession can be practiced in many unique and different ways. Nursing care can be provided through conventional means in traditional settings or practiced in domains labeled as alternative or complementary. The nurse must be aware with other complementary therapies and how to apply them. ⁽¹²⁾

Treatment not only by medication, but it can be achieved also with complementary therapy. One of these therapies is massage. All therapies are recommended to be combined with medical treatment for relieving symptoms and enhance child health. Massage therapy is one of non-pharmacological treatment which may stimulate arterial, venous, capillary, lymphatic circulation, activate circulatory system, and improve respiratory system by decreasing the workload of the heart. ⁽⁵⁾

Massage therapy includes of five steps such as effleurage, petrissage, tapotement, friction and vibration, which improves lung function, encourage relaxation, enhance healing process and well-being. It focuses on relaxing the muscles engaged in breathing and avoids activating the trigger points. ⁽¹⁾ It works by manually stimulating particular body locations known as acupoints, which are mostly found on the fingers, hands, arms, head, abdomen and back. Pediatric massage manipulation can unblock meridians, promote the circulation and strengthen resistance to pathogens by using various manual techniques at specified locations on the surface of the body. ⁽¹³⁾

Significance of the study:

The most prevalent infectious diseases that affect children during infancy and childhood are lower respiratory tract infections, which cause a significant mortality and morbidity worldwide. World Health Organization reported that about 12.2 million children aged less than five years die every year, and three million of them are caused by lower respiratory tract infections. There are a rare studies about

massage therapy in pediatric population. So, massage therapy is one of a lot of modalities that recommended to be combined with medical treatment and applied for children with respiratory tract infections to relieve symptoms and reduce time to discharge. ⁽⁵⁾

Aim of the study:

The study aimed to evaluate the effect of massage therapy in relieving respiratory problems in children with lower respiratory tract infection.

Research hypothesis:

Respiratory problems of children with lower respiratory tract infection are expected to be relieved after application of massage therapy.

Subjects and Method

Research Design:

A quasi-experimental research design was utilized in the current study.

Setting:

The study was carried out at the Chest Inpatient Unit of Medical Department at Tanta Main University Hospital. This unit consists of two wards and each ward contains six beds, one monitor and six flowmeters. There is one flowmeter beside each bed.

Subjects:

A purposive sampling of sixty children participated in the study and was divided into two groups. Intervention group (30) who received massage therapy beside routine treatment. Other group was control (30) who received routine care only. Two groups had the following criteria:

Inclusion criteria

- Age between 3 and 6years.

- Admission to the hospital with the diagnosis of acute lower respiratory tract infection.
- First day of admission.
- Absence of any chronic illness.
- There is not any infection, eczema, rash or burns on the skin.

Tools of data collection:

Two tools were used to collect the data as follows:

Tool I: Sociodemographic characteristics of children: It was developed by the researcher after review of recent literature to collect information about children. It consisted of two main parts:

Part I: Characteristics of the studied children such as age, sex, diagnosis

Part II: Medical history of the studied children including history of previous hospitalization with respiratory tract infection, frequency of hospitalization, Frequency of respiratory tract infection.

Tool II: Children' Respiratory Outcomes Record: based on preschool Respiratory Assessment Measure (PRAM) which developed by Ducharme (2008) ⁽¹⁴⁾ and was used to grade respiratory difficulty. The PRAM contains the following variables: oxygen saturation, retraction, inspiratory muscle contraction, inspiration, and wheezing. The items were scored as mild, moderate, or severe. In the PRAM, 0-3 points indicate mild, 4-7 points indicate moderate, and 8-12 points indicate severe respiratory distress.

Method:

The study was completed through the following steps:

1. Administrative process:

- Official approval for data gathering was gained from the authority of faculty of nursing to the director of pediatric medical department at Tanta Main University Hospital.

2. Ethical and legal considerations:

- Design of the study didn't cause any harm or pain to the studied sample.

- Information's confidentiality and privacy was maintained.

- Mothers' consent was obtained after explaining the aim of the study, their participation in the study was not obligatory.

- Information was obtained and only used for the purpose of the study.

- Mothers were able to withdraw their children from the study whenever they wanted at any time.

3. Tools development: Tool I, II.

4. Content validity: Five experts in the field of pediatric nursing evaluated the study's tools for content validity and modifications were made in accordance.

5. Reliability of the developed tool was tested through the internal consistency. The value of Cronbach's alpha coefficient is 0.881.

6. Pilot study: Six children (10%) from the study sample were used in a pilot study to assess the clarity of the study tools; after this, the children were excluded from the study

Phases of the actual study:

The study was conducted through three phases:

1. Assessment phase: It was done by the researcher for all studied children to assess who was meet the inclusion criteria and to

explain the purpose of the study to gain their cooperation. The initial assessment of respiratory status such as nasal flaring, chest retraction, respiratory rate, heart rate, lung auscultation. It includes:

a. Gather information about the studied children.

b. Assess respiratory status of the studied children. (Tool II).

2. Implementation phase:

Chest and back massage were performed to the children for 15 minutes by the researcher in the morning, afternoon, three days by selecting a time frame, when the children felt relaxed. Lubrication was being used while massaging. Effleurage, petrissage, friction, tapotement, and vibration techniques were used during massage therapy. Whereas the control group of children were received only routine care.

Massage Therapy Steps:

1. Giving accurate information to the child about the steps of the procedure.

2. Placing the child in lying position while protecting privacy (supine and prone).

3. Warming up hands.

4. Application of Effleurage, petrissage, friction, tapotement, and vibration techniques in respective order. ⁽¹⁾

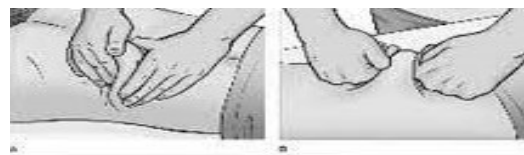
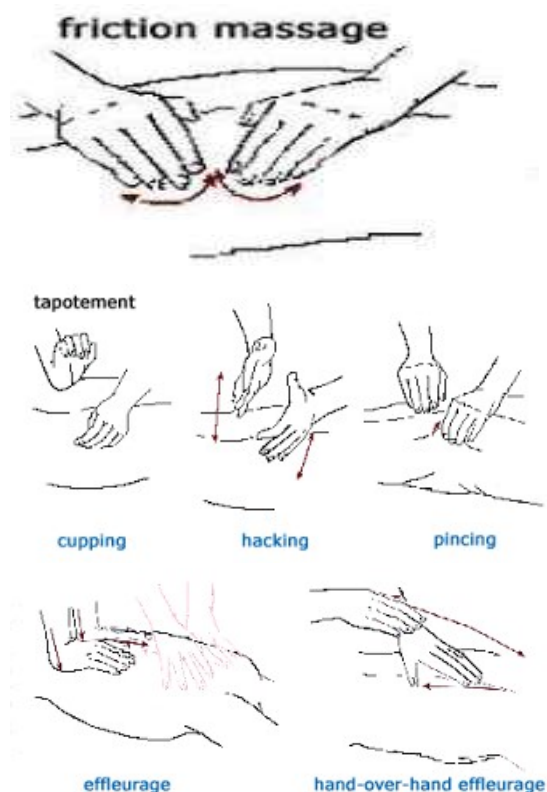
-Effleurage, which is frequently used to start a massage therapy. It is given with gentle pressure and carried out on a variety of body parts with flat hands and fingers.

-Petrissages include stretching, kneading and squeezing soft tissues and underlying muscles. It stretches and loosens muscle fibers while lifting tissues away from structures to release tension.

-Frictions are precise movements made with only the fingers or thumbs on small parts of the body, forward and backward. Frictions are applied both deep and superficial dependent on the desired results.

-Tapotement: it uses different techniques, as percussion that uses the fingers, cupped hands and loose fists. It involves also hacking which strikes the body with the outside edges of your hands in line with your little finger, as well as cupping where you strike the skin using a cupping shape of your hands.

-Vibration massage technique is a delicate, trembling movement is used with hands or fingers. It can be used to stimulate soft tissues in the body. ⁽¹⁾



Effectiveness of massage therapy on respiratory status among children with lower respiratory tract infection. ⁽¹⁾

5. Completion of chest and back massage in 15 minutes.
6. Covering body areas beyond the scope of massage therapy.
7. Keeping the massage area warm after massage therapy by covering with a towel.
8. Application two times daily for the duration of three days.
9. Maintaining communication with the child during the procedure.
10. Termination of the procedure.
11. Recording completed procedure.
12. Determining interrupted procedures for any reason and exclusion of the child from the study.

3. Evaluation phase:

Respiratory functions of the children were re-assessed every day after the intervention for three days and at the end of the third day using PRAM for both intervention and control group.

Results

Table (1): Reveals that nearly two thirds of children (63% and 66.7%) were from 3 to less than 4 years old in the intervention and control group respectively. Regarding sex, the table shows that 53.3% and 60% of children were males in intervention and control group respectively. It was found that the diagnosis of 86.7% and 93.3% of children is pneumonia while the rest of them have bronchitis in both intervention and control group respectively.

Regarding current medications of children in the intervention group, most of them (83.3%) were treated with antibiotics, 66.7% take bronchodilators, 73.3% take mucolytic, and all of them were treated with corticosteroids. As regards children in the control group, 90% of them take antibiotics, 80% take bronchodilators, 83.3% take mucolytic, and all of them take corticosteroids.

Table (2): Presents that nearly two thirds of children in the intervention group and nearly three quarters of them in the control group were previously hospitalized with respiratory tract infection. The frequency of hospitalization for 72.7% of children in the intervention group compared to 77.8% of them in the control group were only one time. In addition, 27.3% and 22.2% of them in both intervention and control group were previously hospitalized two times respectively.

In relation to frequency of lower respiratory tract infection of children in the intervention group, 43.3%, 36.7%, and 20% of them suffered from lower respiratory tract infections once in three months, once in six months, and once in twelve months respectively. Regarding control group, more than one third of children (40%) suffered from lower respiratory tract infections once in three months, 43.3% were once in six months, and only 16.7% suffered once in twelve months.

Table (3): Presents that oxygen saturation of nearly half of children in the intervention group was $\leq 91\%$ on admission before the implementation of massage therapy and increased to $\geq 95\%$ in

the majority of them at 3rd day of massage therapy with statistically significant difference with P value <0.001 . In the control group, oxygen saturation was between 92-94% in more than half of children on admission. It became 92-94% in the most of children at the 3rd day with statistically significant difference which P value <0.001 .

As regards suprasternal retraction in children of the intervention group, it was present in 66.7% of them before intervention and it was absent in 96.7% of them at the end of 3rd day with statistically significant difference as P value <0.001 . Furthermore, suprasternal retraction was present in 60% of children in the control group on admission and 46.7% of them at the end of 3rd day with statistically significant difference as P value 0.019.

The table additionally shows that inspiratory muscle contraction was present in nearly one third of children (36.7% and 33.3%) on admission in both intervention and control groups respectively. It was absent in 100% and 76.7% of them at the end of 3rd day in both intervention and control group respectively. Air entry was decreased at base in more than three quarters of children (76.7%) in the intervention group on admission and was normal in 100% of them at the end of 3rd day. In the control group, most of children (83.3%) had decreased air entry at based on admission, while it was normal in 36.7% of them at the end of 3rd day. In addition, wheezing was present in all children in control and intervention group before massage therapy. While it was absent in the majority of them (93.3%) at the end of

3rd day. In relation to control group, it was absent in 23.3 % of them at the end of 3rd day with statistically significant difference.

Table (4): Shows that 63.3% of children in intervention and control group had moderate respiratory distress on admission, while 96.7% in intervention group and 53.3% of them in control group had mild respiratory distress at the end of 3rd day. The table also indicates a decrease in the total mean score of children regarding their total PRAM score with in three days in both intervention and control groups with statistically significant difference as P value < 0.001. The total mean scores of children's respiratory distress in the intervention group were 4.20±3.52, 1.57±2.69, and 0.23±0.82 compared to 5.63±2.82, 5.13±2.83, and 4.13±3.09 in the control group at the end of 1st, 2nd, and 3rd day respectively.

Table (1): Percentage distribution of the children regarding to their sociodemographic characteristics

Sociodemographic characteristics	Intervention Group (n = 30)		Control Group (n = 30)		χ^2	p
	No	%	No	%		
Age						
3 - <4	19	63.3	20	66.7	1.286	MC _p = 0.529
4 - <5	9	30.0	6	20.0		
5 – 6	2	6.7	4	13.3		
Sex						
Male	16	53.3	18	60.0	0.271	0.602
Female	14	46.7	12	40.0		
Diagnosis						
Bronchitis	4	13.3	2	6.7	0.741	FE _p = 0.671
Pneumonia	26	86.7	28	93.3		
Current Medications						
Antibiotics	25	83.3	27	90.0	0.577	FE _p =0.706
Bronchodilators	20	66.7	24	80.0	1.364	0.243
Mucolytics	22	73.3	25	83.3	0.884	0.347
Corticosteroids	30	100.0	30	100.0	—	—

 χ^2 : Chi square test

MC: Monte Carlo

FE: Fisher Exact

p: p value for comparing between the two studied groups.

Table (2): Percentage distribution of the children regarding to their medical history

Medical history of the children:	Intervention (n = 30)		Control (n = 30)		χ^2	p
	No	%	No	%		
History of previous hospitalization with respiratory tract infection						
Yes	19	63.3	21	70.0	0.300	0.584
No	11	36.7	9	30.0		
If yes: frequency of hospitalization						
1	8	72.7	7	77.8	0.067	FE p= 1.000
2	3	27.3	2	22.2		
Frequency of lower respiratory tract infection						
Once in 3 months	13	43.3	12	40.0	0.298	0.862
Once in 6 months	11	36.7	13	43.3		
Once in 12 months	6	20.0	5	16.7		

 χ^2 : Chi square test

FE: Fisher Exact

p: p value for comparing between the two studied groups

Table (3): Percentage distribution of the children regarding Preschool Respiratory Assessment Measure (PRAM) items in intervention and control group before and after three days of massage therapy

Respiratory Outcomes	Intervention (n = 30)								Control (n = 30)								Test of Sig. (p ₁)	Test of Sig. (p ₂)	Test of Sig. (p ₃)	Test of Sig. (p ₄)
	Pre		1 st		2 nd		3 rd		Pre		1 st		2 nd		3 rd					
	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%				
Oxygen saturation																	0.601 (0.438)	6.471 p= (0.052)	23.880* p= <0.001*)	38.146* p= <0.001*)
≥ 95%	0	0.0	8	26.7	21	70.0	27	90.0	0	0.0	1	3.3	3	10.0	4	13.3				
92-94%	14	46.7	16	53.3	9	30.0	3	10.0	17	56.7	20	66.7	24	80.0	25	83.3				
≤ 91%	16	53.3	6	20.0	0	0.0	0	0.0	13	43.3	9	30.0	3	10.0	1	3.3				
Fr(p_o)	57.215* (<0.001*)								18.641* (<0.001*)											
Suprasternal retraction																	0.287 (0.592)	3.270 (0.071)	8.531* (0.003*)	15.022* (<0.001*)
Absent	10	33.3	19	63.3	24	80.0	29	96.7	12	40.0	12	40.0	13	43.3	16	53.3				
Present	20	66.7	11	36.7	6	20.0	1	3.3	18	60.0	18	60.0	17	56.7	14	46.7				
Q (p_o)	38.129* (<0.001*)								9.923* (0.019*)											
Inspiratory muscle contraction																	0.073 (0.787)	0.317 (0.573)	1.491 (0.222)	7.925* (^{FE} p= 0.011*)
Absent	19	63.3	22	73.3	25	83.3	30	100.0	20	66.7	20	66.7	21	70.0	23	76.7				
Present	11	36.7	8	26.7	5	16.7	0	0.0	10	33.3	10	33.3	9	30.0	7	23.3				
Q (p_o)	22.0* (<0.001*)								7.20 (0.066)											

Continue. Table (3): Percentage distribution of the children regarding Preschool Respiratory Assessment Measure (PRAM) items in intervention and control group before and after three days of massage therapy

Respiratory Outcomes	Intervention (n=30)								Control (n=30)								Test of Sig. (p1)	Test of Sig. (p2)	Test of Sig. (p3)	Test of Sig. (p4)	
	Pre		1 st		2 nd		3 rd		Pre		1 st		2 nd		3 rd						
	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%					
Inspiration(Air entry)																					
Normal	0	0.0	2	6.7	24	80.0	30	100.0	1	3.3	1	3.3	2	6.7	11	36.7		1.820	1.707	35.437*	30.482*
Decrease at base	23	76.7	22	73.3	6	20.0	0	0.0	25	83.3	26	86.7	25	83.3	16	53.3	p=	p=	p=	p	
Widespread decrease	7	23.3	6	20.0	0	0.0	0	0.0	4	13.3	3	10.0	3	10.0	3	10.0	(0.501)	(0.461)	<0.001*	<0.001*	
Absent/minimal	0	0.0	2	6.7	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0)	
Fr (p0)	83.815* (<0.001*)								27.176* (<0.001*)												
Wheezing																					
Absent	0	0.0	12	40.0	20	66.7	28	93.3	0	0.0	0	0.0	2	6.7	7	23.3		0.278	15.005*	28.727*	30.667*
Expiratory only	19	63.3	10	33.3	10	33.3	2	6.7	17	56.7	17	56.7	15	50.0	13	43.3	(0.598)	(0.001*)	(0.001*)	(0.001*)	
Inspiratory ± expiratory	11	36.7	8	26.7	0	0.0	0	0.0	13	43.3	13	43.3	13	43.3	10	33.3				(*)	
Audible without stethoscope\silent chest	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0					
Fr (p0)	70.440* (<0.001*)								25.500* (<0.001*)												

χ^2 : Chi square test

FE: Fisher Exact

Q: Cochran's test

Fr: Friedman test

p₀: p value for comparing between the studied periods in each group

p₁: p value for comparing between the two studied groups in Pre

p₂: p value for comparing between the two studied groups in 1st

p₃: p value for comparing between the two studied groups in 2nd

p₄: p value for comparing between the two studied groups in 3rd

*: Statistically significant at $p \leq 0.05$

Table (4): Total percentage and mean score of the children regarding total PRAM score on admission and at the end of 1st, 2nd, and 3rd day in intervention and control group before and after massage therapy

Total PRAM score	Intervention (n = 30)								Control (n = 30)								Test of Sig. (p ₁)	Test of Sig. (p ₂)	Test of Sig. (p ₃)	Test of Sig. (p ₄)
	Pre		1 st		2 nd		3 rd		Pre		1 st		2 nd		3 rd					
	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%				
Mild (0-3)	0	0.0	19	63.3	24	80.0	29	96.7	1	3.3	12	40.0	13	43.3	16	53.3	$\chi^2=1.009$ p=(1.000)	$\chi^2=4.076$ p=(0.130)	$\chi^2=13.365^*$ p=(0.001*)	$\chi^2=15.434^*$ p(<0.001*)
Moderate (4-7)	19	63.3	3	10.0	6	20.0	1	3.3	19	63.3	8	26.7	8	26.7	7	23.3				
Severe (8-12)	11	36.7	8	26.7	0	0.0	0	0.0	10	33.3	10	33.3	9	30.0	7	23.3				
Fr (p₀)	72.40* (<0.001*)								37.071* (<0.001*)											
p₅			<0.001*		<0.001*		<0.001*				0.028*		0.009*		<0.001*					
Total Score	4.0 – 9.0		0.0 – 10.0		0.0 – 7.0		0.0 – 4.0		3.0 – 9.0		1.0 – 10.0		0.0 – 10.0		0.0 – 10.0		U=397.0 (0.419)	U=308.0* (0.033*)	U=149.50* (<0.001*)	U=84.50* (<0.001*)
Min. – Max.	6.20±2.04		4.20±3.52		1.57±2.69		0.23±0.82		5.83 ± 2.0		5.63±2.82		5.13±2.83		4.13±3.09					
Mean ± SD.																				
Fr (p₀)	79.0* (<0.001*)								48.333* (<0.001*)											
p₅			0.057		<0.001*		<0.001*				0.764		0.032*		<0.001*					

SD: Standard deviation U: Mann Whitney test χ^2 : Chi square test Fr: Friedman test

p₀: p value for comparing between the studied periods in each group

p₅: p value for comparing between the studied periods and Pre.

p₁: p value for comparing between the two studied groups in **Pre**

p₂: p value for comparing between the two studied groups in **1st**

p₃: p value for comparing between the two studied groups in **2nd**

p₄: p value for comparing between the two studied groups in **3rd**

*: Statistically significant at p ≤ 0.05

Discussion

Infections of the lower respiratory tract, which include the trachea and alveolar sacs, affect the airways below the level of the larynx. It can be characterized in a variety of ways. It includes acute bronchitis, bronchiolitis, and influenza, whereas acute infections that affect the alveolar sacs can include pneumonia. Medical chest massage is a great tool for the treatment and prevention of respiratory symptoms. This massage relaxes the thoracic muscles. It speeds up healing, makes breathing easier as encourages deeper breathing, increases resistance to respiratory diseases, loosening the intercostal muscles allowing the rib cage to expand and improve posture.⁽¹⁵⁾

The finding of the current study demonstrated that nearly two thirds of children were from 3 to less than 4 years old in the intervention and control group. Most of them were treated with antibiotics in intervention group. These results were in agree with the study of **Alsac (2019)**⁽⁵⁾ who mentioned that the mean age of children was 3 years and all them in the massage therapy received antibiotics therapy. The current study mentioned also that most and majority of children were diagnosed as pneumonia in both intervention and control group respectively while the rest of them were diagnosed with bronchitis in both intervention and control group. These results were disagreeing with **Alsac (2019)**⁽⁵⁾ who found that most of children were diagnosed with bronchitis.

The finding of the present study revealed that nearly two thirds of children in the intervention group were previously hospitalized with respiratory tract infection. Nearly three quarters of children were hospitalized only one time in both

groups. These results were in disharmony with the result of **Martina (2015)**⁽¹⁾ who found that more than half of children had no history of previous hospitalization with respiratory tract infection and less than one quarter of them were hospitalized only one time.

Regarding oxygen saturation, it was found that oxygen saturation of nearly half of children in the intervention group was $\leq 91\%$ on admission before the implementation of massage therapy and increased to $\geq 95\%$ in the majority of them at 3rd day of massage therapy with statistically significant difference. In the control group, oxygen saturation was between 92-94% in more than half of children on admission, while it became 92-94% in the most of children in the 3rd day with statistically significant difference. This was in agreement with **Radzlejowski et al. (2023)**⁽¹⁶⁾ who mentioned that oxygen saturation in the massage group was significantly higher than children in the control group and there was a strongly significant difference between the groups and massage therapy improves respiratory functions and resulting in increased oxygen saturation. In addition, massage therapy conducted over 3 weeks positively influenced levels of SaO₂.

The current study found significantly higher oxygen saturation in the massage groups compared to the control group after massage therapy. This was in agreement with **Shanmugam and Kathyayini (2017)**⁽¹⁷⁾ who found in intragroup analysis a significantly higher mean oxygen saturation after the sessions compared to before the sessions among the three groups. In addition, massage stimulates the parasympathetic system so that it slows

down the breathing rate and provides a relaxing effect and improves lung function.

As regards suprasternal retraction in children of the intervention group, it was present in nearly two thirds of them before intervention and was absent in majority of them at the end of 3rd day with statistically significant difference. Furthermore, suprasternal retraction was present in nearly two thirds of children in the control group on admission and nearly half of them at the end of 3rd day with statistically significant difference. In addition, wheezing was present in all children in control and intervention group before massage therapy. While in intervention group, it was absent in the majority of them at the end of 3rd day. In relation to control group, it was absent in nearly one quarter of them at the end of 3rd day with statistically significant difference. These findings were in agree with study of **Martina (2015)** ⁽¹⁾ who found that the mean value of chest retraction and lung auscultation were decrease in study group after application of massage therapy than in control group.

The present study indicates that there is a decrease in the total mean score of children regarding their total PRAM score with in three days in intervention more than control groups with statistically significant difference. These result were in accordance with the study of **Alsac (2019)**⁽⁵⁾ who found that the mean PRAM score in the intervention group was significantly lower than children in the control group and there was a strongly significant difference between the groups.

As regard respiratory distress, it was found that nearly two thirds of children have moderate respiratory distress in the study group on admission. While

most of children in the study group and nearly half of them had mild respiratory distress in the control group after three days of massage therapy. This result was in harmony with study of **Asrawaty et al. (2020)** ⁽¹⁸⁾ and **Fadilah and Noviani (2022)** ⁽¹⁹⁾ who's findings showed a highly statistically significant difference in lung function scores between pre and posttest. In the posttest of the study group, the result shows that massage therapy was significantly effective in improving lung functions. These results were in agreement with **Zhou (2020)** ⁽¹³⁾ who mentioned that evidence of pediatric massage therapy for restoring pediatric lung function will include the improvement of pulmonary function and adverse effect, and with **Trybulec et al. (2023)** ⁽²⁰⁾ who said that the deep tissue massage performed within the chest area improve ability of the chest to expansion.

Conclusion

Considering the results of the current study, it can be concluded that application of massage therapy improved oxygen saturation and respiratory distress in children with lower respiratory tract infection.

Recommendation

- Massage therapy ought to be added into nursing care for children with lower respiratory tract infection.
- Training programs should be conducted frequently to nurses regarding application of Massage therapy and its effects on improving oxygen saturation and decrease respiratory distress in children with lower respiratory tract infection.
- Conducting an educational training program for parents on application of massage therapy for their children with lower respiratory tract infection.

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