

## Effect of Chest Percussion Post Nebulizer on Respiratory Status among Infants with Pneumonia

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### Abstract

**Background:** Pneumonia is the highly prevalent cause of children's mortality below five years. Using chest percussion could help in management of pneumonia. **Aim:** this study aimed to evaluate the effect of chest percussion post nebulizer on respiratory status among infants with pneumonia. **Research design:** The aim of this study was achieved through utilizing a quasi-experimental research design. **Sample:** 90 infants with pneumonia were admitted to pediatric in-patient medical department at Minia university hospital for obstetrics and Pediatrics and they were separated into two equal groups (control and study). **Tools:** A structured interview questionnaire tool which comprising of sociodemographic data and medical data of infants. Respiratory status assessment scale which consist of clinical parameters and bio-physiological parameters. **Results:** Total Mean score of clinical parameters and physiological measurement for infants with pneumonia was statistically significance improved in study group than the control group after application of chest percussion. **Conclusion:** Chest percussion application had a meaningful role in improving of respiratory condition among infants with pneumonia. **Recommendations:** Providing training courses for pediatric nurses about the appropriate technique of chest percussion for infants with pneumonia. Future studies should be planned to enrich further evidence based practices about chest percussion effect for infants suffering from pneumonia.

*Keywords:* Chest percussion, Infants, Pneumonia, Post nebulizer, Respiratory status

### Introduction

Pneumonia is a kind of acute respiratory infection caused by bacteria, and viruses that affect the lungs. Pneumonia remains the second most prevalent cause for mortality in infants and young children in the world, accounting about 14% of fatalities in children below the age of five. There are practically 1.2 million cases of pneumonia among under five years children and 740.000 -180 000 died in 2019 (WHO, 2022 and Kang et al., 2023).

Pneumonia may be grouped into several categories based on a variety of characteristics, including the disease's severity, anatomical pattern, etiological causes, and typical and atypical patterns. Accordingly the onset and course of disease, pneumonia can be acute or chronic. WHO labeled pneumonia depending on severity to very severe, severe, and non-severe (WHO,2022). Additional pneumonia can be classified to community acquired and hospital acquired pneumonia viral, bacterial, fungal, aspiration, or lobar pneumonia, bronchial pneumonia, or interstitial pneumonia (Beletew et al., 2020). Pneumonia poses a major threat to children's health and a financial strain on healthcare resources because of the high number of children affected. There have been several studies undertaken worldwide to pinpoint risk factors of pneumonia in infants, for example: low birth weight, malnutrition, indoor air pollution, parental smoking, lack of immunization, overcrowding a shared kitchen, not exclusively breastfeeding, and maternal education (Shan et al.2019 and Kasundriya,et al.,2020).

Huckleberry and Wilson (2021) added that clinical manifestations of pneumonia varied and depend on etiologic agents, immune status, severity of disease, and the child's age. It is characterized by presence of fever, difficulty breathing with cough, and tachypnea which accompanied by crackles on auscultation Besides, WHO had developed guidelines for tachypnea that consider the main indicator for clinical

diagnosis for lower respiratory tract infections especially pneumonia. Infants may refuse feeding and grunting breathing. Chest X ray is the most important diagnostic procedures in young children with fever and respiratory symptoms (Ayan, et al., 2021).

Pneumonia can be classified according to severity: mild and moderate pneumonia, which can be cured at home with oral amoxicillin, and severe pneumonia, which calls for hospital treatment and parental medications. Despite advancements in the treatment of pediatric pneumonia, death, and morbidity rates are still high, particularly in environments with limited resources (Bhat, et al., 2021)

Nursing care procedures for pneumonia must prioritize close observation and proactive therapeutic response. Consequently, nursing care should concentrate on keeping an eye on the child's respiratory condition, ensuring sufficient sleep, sustaining a patent airway, facilitating breathing efforts, managing fever, avoiding dehydration, giving nutrition, skin and oral care, providing treatment, performing chest physiotherapy, delivering oxygenation, assisting in diagnostic procedures, and securing psychological support for both children and their parents. Then, complications should be avoided (Liu, et al., 2021).

Chest percussion is a sort of chest physiotherapy that uses physical techniques to clear sputum and prevent hyperinflation, atelectasis, and airway obstruction in the lungs. By reducing the pace of proteolytic tissue destruction, passive chest treatment is also accountable for eliminating contaminated secretions (Rizvi, et al., 2022). Additionally, chest percussion results in the conduction of vibrations along the thoracic cavity, which aids in the expulsion of highly adhering mucus from the airways, clearing them of obstructions and lowering airway resistance. When infants are capable of swallowing the sputum or coughing it out, the airways is evacuated (Behrman, et al., 2016).

A range of therapeutic techniques is being used by pediatric nurses to address pneumonia. On the other hand, a comprehensive review found that although chest physical therapy may help treat pneumonia, there remains much to be learned about this illness, and more research must be done. As a result, chest physiotherapy is frequently used to treat the condition, although there is little evidence to support it (Hassan & Amer, 2020).

### Significance of the Study

Worldwide, in children under the age of five, pneumonia is still the most prevalent reason of hospitalization and mortality. Nearly 150 million new cases of pneumonia exist yearly among children under the age of five in underdeveloped nations around the world, recording greater than 95 % of all new cases. Pneumonia will result in hospitalization for among 11 and 20 million children, with an estimated 1.2 million deaths per year. The prevalence of pneumonia is expected to be 0.28 episodes per child-year globally. As stated by health statistics of WHO & UNICEF (2022), the mortality rate of pneumonia in Egyptian children under 5 years is 21/1,000 live births, accounting for 11% of children of the same age (Abdel Baseer & Sakhr, 2021 and WHO, 2022).

Chaves, et al., 2019 added that chest percussion is an important adjunctive techniques that are thought to enhance the clearance of mucus from the airway and helping in management of most respiratory diseases mainly pneumonia in children and moreover, chest percussion is believed to help eliminate tracheobronchial secretions, exudates of inflammation, and airways blockages, thereby diminishing airway resistance, enhancing gas exchange, and making breathing easier. Likewise, recent Egyptian research held by Hassan and Amar (2020) to investigate the effect of chest percussion on respiratory condition for infants suffering from pneumonia at Abu Elrish Children's Hospital reported that chest percussion significantly improved the respiratory status for infants afflicted by pneumonia.

The systematic review by Burelli (2016) showed that chest physiotherapy has imperative results in managing pneumonia, however, the literature is still lacking, and additional researches on this technique is required. Nurses play vital role in applying this procedure, and they should become skilled in the technique. Therefore, the present research aimed to evaluate the effect of chest percussion post-nebulizer on respiratory status among infants with pneumonia.

### Aim of the Study

The research aimed to evaluate the effect of chest percussion post nebulizer on respiratory status among infants with pneumonia.

### Research hypotheses: -

H1: Infants who apply chest percussion post nebulizer will have the lower pediatric respiratory clinical parameter scores compared to infants in the control group.

H2: Infants who apply chest percussion post nebulizer will have better bio physiologic measures stability score compared to infants in the control group.

### Research design: -

A quasi-experimental approach was established in the present research.

### Sample: -

A purposive sample consisted of 90 infants with pneumonia. Infants were partitioned into equal groups (study & control). According the flow rate of children with pneumonia during 2020 was 1500 cases; 300 cases were under the age of one year, the sample size was estimated by the Isaac & Micheal (1995) formula, which is treated as

$$N = (n \times 30) \div (100)$$

$$N = \text{sample size}$$

$$n = \text{Total number of infant}$$

$$N = (n \times 30) \div (100)$$

$$N = (300 \times 30) \div (100)$$

$N = 90$  (45 infant for study and 45 infant for control group).

### Inclusion criteria:

Conscious infants with pneumonia.

Age between 1-12 months.

Infants are prescribed nebulization therapy.

### Exclusion criteria:

Infants who have congenital anomalies.

Infants who have a contraindication for applying chest percussion.

### Setting: -

The current research took place in the paediatric in-patient medical department at Minia University Hospital for Obstetric and Pediatric (MUHOP).

### Study tools:

Two tools were utilized in present research:-

A structured interview questionnaire is used to collect data pertinent to the study and included the following parts:

**Part (1):** Demographic data of infant such as age, gender and residence

**Part (2):** Medical data about an infant with pneumonia: weight, temperature, , previous episode of pneumonia, immunization status, frequency of admission at hospital for pneumonia, hospital stay, type of inhalation therapy, oxygen source, oxygen methods, and oxygen duration.

### Tool (II) Respiratory status assessment scale:

It adopted by Monica, (2012) and modified by the researcher and contained two portions:-

**(A): Clinical parameters:** It involved breathing difficulty, flaring nose, air entry, chest retraction, cough, breathing sounds, and a Capillary refill test. It was done by inspection and auscultation.

Clinical parameters scoring system:

Zero score referred normal condition, from score one to five indicated mild distress, while moderate distress score started from six score to ten and severe distress score was from eleven to fourteen.

### B) Bio physiological Measurement:

It comprised of respiratory rate, heart rate, respiratory rate, and oxygen saturation by using inspection, palpation, auscultation, and pulse oximetry

The scoring system of Bio physiological Measurement (BPM):

- 0 – Normal BPM
- 1-3 – Mild or moderate alteration of BPM
- 4- 6 – Severe alteration of BPM

**Validity:**

Five Pediatric Nursing and Medicine to test the content validity from Minia and Cairo university. Tools were reviewed for topic coverage, item sequencing, clearness, relevance, applicability, format and length. Minor changes have been done such as rephrasing of certain sentences based on the suggestions of experts.

**Reliability:**

Internal consistency of respiratory status scale was estimated though Cronbach's alpha test which was 0.81 that means excellent reliability.

**Pilot Study: -**

The researcher had carried out a pilot study for 10 % (9 infants) of the overall number of participants to evaluate study tools regarding their clarity, appropriateness and essential duration for accomplishing them. The pilot study findings were adopted for validating outlined data analysis and statistical and techniques. The study's instruments were successfully finished with absence of troubles, reinforcing its validity. This research included patients who took part in the pilot study as a part of its overall sample.

**Ethical Consideration**

An initial written primary consent had been acquired from the research ethical committee affiliated to Faculty of Nursing at Minia University. The mothers of infants in study were provided with a thorough explanation of the research's goal and nature, and were asked to give written consent to ensure their cooperation and acceptance. Additionally, participants were being notified that their involvement in the research was being entirely optional. Also, mothers were being informed that they could leave the research whenever they wanted without giving justifications and it would not have any impact on care of their infants. Participants mothers' confidentiality was being ensured to everyone.

**Procedure**

**Preparatory phase:-**

After obtaining formal permissions from the director of MUHOP, brief introduction was given to the infants' mothers implicating the research and written consent was obtained from them. Infants those who met the inclusion criteria were selected for the study and alienated in to equal two groups. The period of study was from January 2022 to June 2022.

**Results:**

**Table (1): Demographic Characteristics of infants in study and control group (n=90).**

Demographic characteristics	Group				χ <sup>2</sup>	P-value
	Study (N=45)		Control(N=45)			
	No.	%	No.	%		
<b>Infant's Age/month</b>						
1< 6	14	31.2	16	35.6	0.82	0.65
6 -12	31	<b>68.8</b>	29	<b>64.4</b>		
<b>Mean ± SD</b>	7.4 ± 2.4 Month		7.5 ± 2.2 Month		t = 0.19	0.78
<b>Residence</b>						
Rural	38	<b>84.4</b>	40	<b>88.9</b>	0.75	0.53
Urban	7	15.6	5	11.1		

Regarding personal data related to infants, table (1) reveals that 68.8% of infants in the intervention group and 64.4% in the control group ages ranged from 6 -12 months with a mean age 7.4 ± 2.4 and 7.5 ± 2.2 months in both groups respectively. The highest percentage of infants (84.4 % &88.9% respectively) came from rural areas in both groups.

Data from the mothers and their infants in the control group were collected first, and they received routine care. The researcher collected the personal data of the mothers and their infants on an individual basis at their bedside area.

**Control group:**

Assessing respiratory status scale for infants with pneumonia which included clinical parameters and bio physiological parameters and the scores were noticed continuously for 4days and at admission. Each child was observed at the evening shift ending to evaluate the chest status after the standard care which took 25-35 minutes. Also, infant's weight, and body temperature were measured on admission day and through 4 days for each infant at the end evening shift. Infants in control group were not received chest percussion sessions after nebulizer session.

**Study group :- ( Application of chest percussion)**

The researcher measured infant weight, temperature, respiratory status assessment scale which included clinical parameters and bio physiological measurements at admission pre the chest percussion and over 4 days after end of each evening shift after application of chest percussion post nebulizer session. chest percussion should be before infant feeding or after feeding with 2 hours and post nebulizer session as per doctor's order (atrovent or pulmicort inhalation therapy., et ale), the researcher used clapping technique which supported by cupped hand for 1-5 minutes in 5 positions (left and Right Front upper lobes, Right and left Front lower lobes, Right and left Middle lobes, Right and left Back upper lobes, Right and left Back lower lobes) 2 times/day throughout four days, and then each infant was detected by using respiratory status scale which evaluated at the end of evening shift through 4 days post chest percussion

**Statistical Analysis**

Statistical package for social science (SPSS version 28.0) was adopted to tabulate and statistically analyze the gathered data. Besides, statistical analysis involved percentages (%), means, standard deviation (SD). Additionally, Chi-square test was being utilized for accurately testing the statistical significance differences between control and study group .The quantitative data were compared by performing an independent t-test for comparisons between the control and study group. As associations between demographic variables and clinical parameters of Respiratory condition and bio-physiological parameters measurements were analyzed using Pearson. Statistical significance was set at p < 0.05.

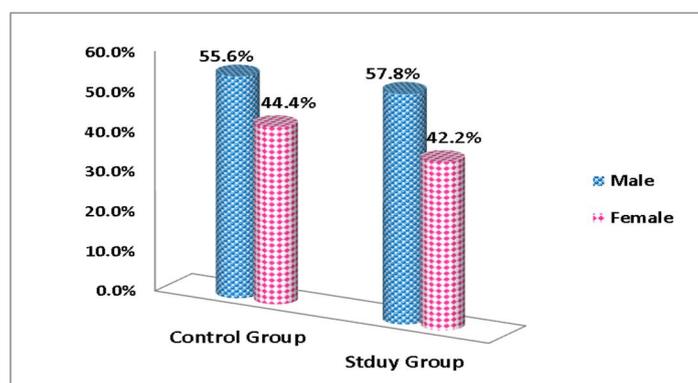


Figure (1) Infant's Gender in control and study group (n=90).

Figure (1): illustrates that more than half (57.8 % & 55.6%) of infants were males in both groups respectively

Table (2): Selected Medical data of infants in study and control group (n=90).

Items Medical data	Group				χ <sup>2</sup> test	P-value
	Study (N=45)		Control (N=45)			
	No.	%	No.	%		
<b>Weight at admission</b>						
Below normal	35	77.8	41	91.1	3.2	.019
Normal weight	4	8.8	1	6.6		
Above normal weight	6	13.4	3	2.3		
<b>Mean ± SD</b>	7.1±1.5		6.5±1.6		-1.7	0.09
<b>Temperature at admission</b>						
Normal	17	37.8	9	20	3.4	.06
Above Normal	28	62.2	36	80		
<b>Mean ± SD</b>	37.9± 0.81		38.2± 0.75		t=1.6	1.04
<b>Infant's Immunization:</b>						
Up to date	33	73.3	29	64.4	1.5	0.45
Delayed due to illness	12	26.7	16	35.6		
<b>Oxygen Duration</b>						
Less than 7 days	38	84.4	15	33.3	50.2	0.000***
More than 7 days	7	15.6	30	66.7		
<b>Mean ± SD</b>	4.8± 1.8		8.4±2.3		t=8.13	0.000***
<b>Oxygen Methods</b>						
Nasal	30	66.7	26	57.8	.75	0.5
Mask	15	33.3	19	42.2		
<b>Type inhalation therapy</b>						
Atrovent	1	2.2	1	2.2	1	0.6
Pulmcort	1	2.2	0	0		
All of above	43	95.6	44	97.7		

Table (2) proves that more than three quarters (77.8 %) of children in the intervention group and 91.1 % in the control group were below the normal weight as the mean weight was 7.1±1.5 kg and 6.5±1.6 kg in both groups respectively. Also this table demonstrates that 62.2% and 80% of infants had fever with mean of 37.9± 0.81 and 38.2± 0.75 in the study and control group, respectively. It also 73.3% of infants in study group and 64.4 % of infants in control group received all their immunizations completely according to the Egyptian obligatory immunizations schedule at the time. In addition, 84.4% of infants in the study group received oxygen therapy for less than 7 days but 66.7% of infants in control group received oxygen more than 7 days and the mean of their oxygen therapy duration was 4.8± 1.8 and 8.4±2.3, respectively with high significant. In addition, 66.7% and 57.8% of infants in the study and control groups received oxygen therapy by nasal cannula, respectively while 95.6% and 97.7% received atrovent and Pulmcort inhalation therapy as management for pneumonia, respectively.

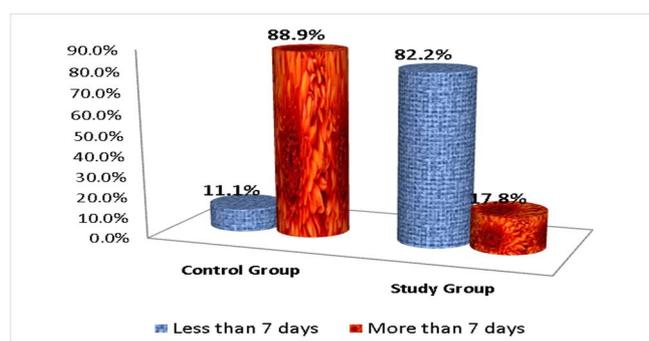


Figure (2): Infants' current stay in the hospital due to pneumonia in control and study group (n=90).

Figure (2) shows that infants' current stay in the hospital due to pneumonia in the study group decreased after the implementation of chest percussion for infants whereas The highest percent of infants (82.2%) in the study group there a current stay in the hospital was less than 7 days with the mean day was 6.1±1.5 day, while 88.9% of infants in control group their current stay in the hospital was more than 7 days with a mean day of was 10.5±2.5.

Table (3): Mean of body temperature and body weight of infants through intervention days in study and control group N=90.

Item	Study N=45	Control N=45	t	P
<b>Infant Body Temperature</b>				
At admission	37.9± 0.81	38.2± 0.75	1.6	1.04
1 <sup>st</sup> day	37.4± .50	37.7± .60	2.85	<b>.005</b>
2 <sup>nd</sup> day	37.0 ± .36	37.3± .43	3.44	<b>.001</b>
3 <sup>rd</sup> day	36.9 ± .29	37.0 ± .39	88	.35
4 <sup>th</sup> day	37.0± .21	37.1± .46	88	.54
<b>Infant Body Weight</b>				
At admission	7.1±1.5 kg	6.5±1.6 kg	-1.7	.09
1 <sup>st</sup> day	7.1±1.5 kg	6.5±1.6 kg	-1.7	.09
2 <sup>nd</sup> day	7.1±1.5 kg	6.5±1.6 kg	-1.7	.09
3 <sup>rd</sup> day	7.1±1.5 kg	6.5±1.6 kg	-1.7	.09
4 <sup>th</sup> day	7.1±1.5 kg	6.5±1.6 kg	-1.7	.09

\*Significant at P≤0.05 \*\* highly significant at P≤0.01 \*\*\* Very high significant at P≤0.001

Table (3) illustrate that the mean of temperature among infants was improved at first and second days after the chest percussion at a significance level asp < .05. Also show that no significant difference among the study and control group related to the mean of the infant<sup>s</sup> weight through the intervention days.

Table 4: Level of clinical parameters respiratory distress among infants in control and study group through intervention days (n = 90).

level of clinical parameters respiratory distress per day	Control(N=45)		Study (N=45)		X <sup>2</sup>	P-value
	No.	%	No.	%		
<b>Pre admission Day 0</b>						
Moderate distress	35	77.8	34	75.5	.06	0.8
Sever distress	10	22.2	11	24.4		
<b>Day 1 post</b>						
Mild distress	0	0	3	6.7	3.34	0.18
Moderate distress	34	75.5	37	82.2		
Sever distress	7	15.5	5	11.1		
<b>Day 2 post</b>						
Mild distress	19	42.2	33	<b>73.3</b>	11	<b>.004</b>
Moderate distress	15	33.3	10	22.2		
Sever distress	11	<b>24.5</b>	2	4.5		
<b>Day 3 post</b>						
Normal	0	0	3	6.7	27.3	<b>.0001</b>
Mild distress	25	55.6	42	<b>93.3</b>		
Moderate distress	13	28.9	0	0		
Sever distress	7	<b>15.5</b>	0	<b>0</b>		
<b>Day 4 post</b>						
Normal	0	<b>0</b>	16	<b>35.5</b>	29.1	<b>.0001</b>
Mild distress	32	71.1	29	64.4		
Moderate distress	8	17.8	0	0		
Sever distress	5	11.1	0	0		

\*Significant at P≤0.05 \*\* highly significant at P≤0.01 \*\*\* Very high significant at P≤0.001

Regarding clinical parameters respiratory distress levels on the admission day before chest percussion, and on the 1st day from intervention, table (4) points out that infants in control and Study groups (77.8%, 75.5%&75.5%, 82.2% respectively) had moderate level of respiratory distress with no significant difference between the both groups. While on the second day, the highest percentage (73.3%) of the experimental group had mild respiratory distress in parallel with 24.5% of them in the control group had severe level of respiratory distress. As shown in this table, on the 3rd day 93.3% of infants had a mild level of respiratory distress in the experimental group compared to 15.5% of the control group had severe respiratory distress. On the fourth day, 35.5% of participants in the study group who had a normal respiratory status while 11.1% of infants in the control group had a severe level of respiratory distress. There were statistically significant differences between the two groups on the second, third and fourth day after application of chest percussion where p < .0001

**Table 5: Total Mean score of clinical parameters among Infants in study and control group in four days (n=90).**

Day	Control (N=45)	Study (N=45)	t-test	P-value
<b>Day 0 pre intervention</b>				
Mean ±SD	9.4± 1.4	9.3±1.6	.342	0.733
<b>Day 1 post intervention</b>				
Mean ±SD	8.8± 1.8	8.3± 1.6	1.3	0.192
<b>Day 2 post intervention</b>				
Mean ±SD	7.9± 2.9	5.8± 2.2	3.6	<b>.0001***</b>
<b>Day 3 post intervention</b>				
Mean ±SD	6.9 ± 2.6	3.4± 1.8	7.4	<b>.0001***</b>
<b>Day 4 post intervention</b>				
	6 ±2.4	1.6±1.5	10.18	<b>.0001***</b>

It was apparent from **Table 5** the total mean score of clinical parameters related to respiratory condition increased pre chest percussion, admission day and at 1<sup>st</sup> day from application of chest percussion with no significant difference between the both groups while decreased at 2<sup>nd</sup> , 3<sup>rd</sup> and 4<sup>th</sup> days after chest percussion with a very statistically differences between both groups as p < .0001.

**Table 6 :Comparison between total mean score of heart rate, respiratory rate and oxygen saturation in control and study group in four days(n=45).**

Day	Control (N=45)	study (N=45)	t	p
<b>Day 0 pre intervention</b>				
HR0	139.3 ±6.5	137.1±6.4	1.5	.1
RR0	55.8±3.8	54±3.9	2.2	<b>.03</b>
O2saturation0	85.8±1.5	85.7±1.3	.361	.7
<b>Day1 post</b>				
HR1	137.1±6.4	132.6±6.1	3.8	<b>.0001</b>
RR1	53.9±3.4	50.6±2.5	5.2	<b>.0001</b>
O2saturation1	85.9±1.3	86.1±1.1	-.84	.4
<b>Day2 post</b>				
HR2	133.5±4.8	128.5±6.4	4.1	<b>.0001</b>
RR2	50.6±3.6	47.2±3.1	4.6	<b>.0001</b>
O2saturation2	88.9±1.8	90.7±1.2	-5.4	<b>.0001</b>
<b>Day 3 post</b>				
HR3	130.7±7.4	123.8±7	4.5	<b>.0001</b>
RR3	47.7±4.5	42.5±4.09	5.6	<b>.0001</b>
O2saturation3	90.2±1.9	92.8±3.1	-4.6	<b>.0001</b>
<b>Day4 post</b>				
HR4	129.8±7.9	119.4±7.5	6.3	<b>.0001</b>
RR4	46.5±4.5	40.5±3.6	6.8	<b>.0001</b>
O2saturation4	92.1±95.8	95.8±2.3	-6.9	<b>.0001</b>

\*Significant at P≤0.05 \*\* Highly significant at P≤0.01 \*\*\* Very high significant at P≤0.001

**Table 6** demonstrates that the total score mean of HR, RR and O2sat in infants was enhanced at 1<sup>st</sup> 2<sup>nd</sup> ,3<sup>rd</sup> and 4<sup>th</sup> days after chest percussion at level of a significance as p < .0001. While no difference was detected at admission day before chest percussion application except RR.

**Table 7: Levels of Bio-physiological parameters among infants in control and study group over intervention days (n = 90).**

Levels of Bio-physiological parameters per day	Control (N=45)		study (N=45)		X <sup>2</sup>	P-value
	No.	%	No.	%		
<b>Admission Day 0 Pre</b>						
Mild/ Moderate altered BMP	3	6.7	9	20	3.4	.06
Sever altered BMP	42	93.3	36	80		
<b>Day 1 post</b>						
Mild/ Moderate altered BMP	8	17.8	19	42.2	6.4	<b>.01**</b>
Sever altered BMP	37	<b>82.2</b>	26	<b>57.8</b>		
<b>Day 2 post</b>						
Normal	0	0	3	6.7	10.3	<b>.006**</b>
Mild/ Moderate altered BMP	30	66.7	38	84.4		
Sever altered BMP	15	<b>33.3</b>	4	<b>8.9</b>		
<b>Day 3 post</b>						
Normal	2	4.5	21	<b>46.7</b>	25	<b>.000***</b>
Mild/ Moderate altered BMP	36	80	24	53.3		
Sever altered BMP	7	<b>15.5</b>	0	0		
<b>Day 4 post</b>						
Normal	9	20	31	<b>67.3</b>	23.14	<b>.000***</b>
Mild/ Moderate altered BMP	32	71.1	14	30.4		
Sever altered BMP	4	<b>8.9</b>	0	0		

\*Significant at P≤0.05 \*\* highly significant at P≤0.01 \*\*\* Very high significant at P≤0.001

As regard levels of Bio-physiological parameters on day of admission before chest percussion, table 7 shows that majority of infants in control and intervention groups (93.3%& 80% respectively) had sever altered level of BMP with no significant difference between the both groups. Pertaining to the 1<sup>st</sup> day, 42.2%of the intervention group had mild/ moderate altered BMP compared to 82.2% of infants in the control group had severe altered level of BMP. As enlightened in that table, at 2<sup>nd</sup> day 84.4%of infants had mild/ moderate altered BMP in the intervention compared to 33.3% of infants in control group had severe altered level of BMP. As

described in that Table, at 3rd and 4th days nearly half and more than two thirds of infants (46.7%&67.3% respectively) had normal BMP condition in the intervention compared to 15.5% &8.9 respectively of infants in control groups had severe altered BMP. There was very significant differences between both groups at the 1<sup>st</sup>, 2<sup>nd</sup>, 3<sup>rd</sup> & 4<sup>th</sup> days after applying of chest percussion at p < .0001.

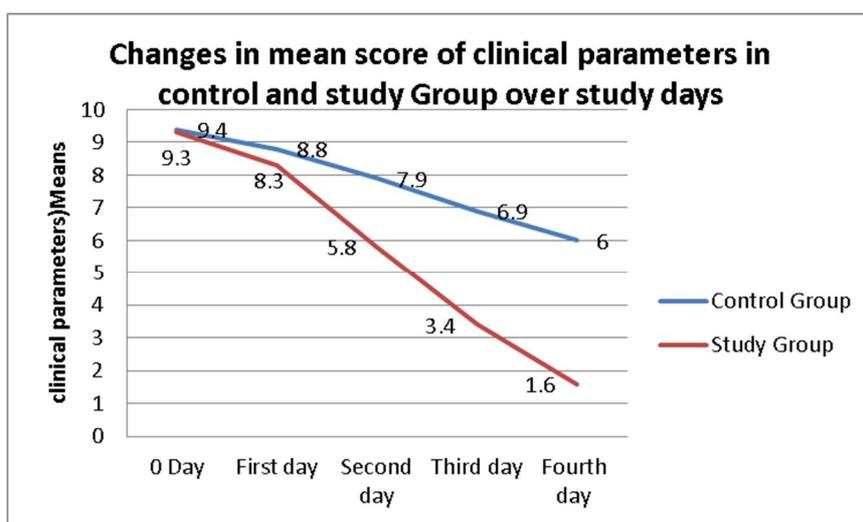


Figure 3: Clinical parameters mean scores changes among infants in study and control groups throughout the intervention days.

Figure (3) reveals that the total mean of Clinical parameters decreased to the lowest number rapidly among study infants than control infants thoroughly study days.

Table 8 :- Correlations between Total Clinical parameters respiratory score, infant age, Hospital Stay and HR,RR,O2 sat after application of chest percussion post nebulizer on infants in study group(n=45).

		Age	Hospital Stay	Clinical parameters	HR	RR	O2 Sat
Age	R		-.026-	.085	.337*	-.046-	.208
	P-Value		.864	.578	.024	.762	.170
Hospital Stay	R	-.026-		.328*	-.123-	.094	-.055-
	P-Value	.864		.028	.419	.538	.719
Clinical parameters	R	.085	.328*		.232	.465**	.273
	P-Value	.578	.028		.126	.001	.070
HR	R	.337*	-.123-	.232		-.039-	.760**
	P-Value	.024	.419	.126		.798	.000
RR	R	-.046-	.094	.465**	-.039-		-.152-
	P-Value	.762	.538	.001	.798		.320
O2 Sat	R	.208	-.055-	.273	.760**	-.152-	
	P-Value	.170	.719	.070	.000	.320	

\*\* . Correlation is significant at the 0.01 level (2-tailed).

\* . Correlation is significant at the 0.05 level (2-tailed).

As shown in Table 8 there were statistically significant positive correlations between infants' age and heart rate, there was a statistically positive correlation between clinical parameter and infant s' hospital stay and respiratory rate , there was a statistically positive correlation between heart rate and oxygen saturation after application of chest percussion post nebulizer on infants.

Discussion

Pertaining to personal data of the studied infants, The present research proved that greater than half of infants in the intervention and control group their age varied from 6-12 months old with a mean age was 7.4 ± 2.4 and 7.5 ± 2.2 months in the both groups respectively.This findings is concordant with recent Egyptian study accomplished by Hassan and Amer (2020) who evaluated the effect of chest percussion on respiratory outcome for 100 infants suffering from pneumonia; the authors documented that greater than two thirds of infants their ages varied from 6 to 12 months with mean age 7.4 ± 3.7 & 7.5 ± 3.7 respectively in intervention and study group.

Similarly, a research performed by Damiani and Adasme (2015) aimed at determining the effect of chest physiotherapy on admitted children with pneumonia, they recorded that the majority of children in study were under one

year. It may be due to decreased infant's immunity during this period of infant's life which characterized by the disappearance of maternal antibodies and the infant's own antibodies production. As pointed to infant's gender, the current research postulated that greater than half of infants in the study and the control group were males. This finding is well matched with study done by Gomes and Donadio (2018) who declared that the majority of infants were male.

In the same context, Hussein and Elsamman (2011), documented that 70% of infants were male. Furthermore, the current findings disagreed with the study Hassan and Amer (2020) documented that greater than half of the control and experimental groups were female.

The present study's finding highlighted that more than two thirds of infants in both groups lived in rural areas. This is due to hospital referrals from all Minia villages to Minia University Hospital for Obstetrics and Pediatrics

(MUHOP). These results were well matched with a study made by **Hussein and Elsamman (2011)** who noticed that 70% of infants in his research lived in rural areas. This result was incongruent with the study (**Hassan & Amer, 2020**) that found eighty percent of the infants in the control and experimental groups came from urban areas.

Also, the current research indicated that more than two thirds of infants in the study group and in the control group were underweight with a mean weight was  $7.1 \pm 1.5$  kg and  $6.5 \pm 1.6$  kg in both groups, respectively. From point of view of researchers that underweight infants were high risk for pneumonia than infants with normal weight, this results was agreed with the study by **Le Roux, et al., (2019)** about Lower respiratory tract infections among vaccinated children in South African, that said, the risk of lower respiratory tract infections in early infancy was greater in babies who were born prematurely or with LBW. Additionally, younger infants were more likely to require hospitalization. In the first year of life and after 6 months of age, LBW was a significant risk factor for ambulatory LRTI. This result was harmonized with the study done by **Ahmed, et al., (2021)** about determinants of community-acquired pneumonia among children under-the age of five in Aswan, who found that the final regression model, underweight was found to be the most powerful predictor of community-acquired pneumonia. In the same context, **Lestari et al., (2018)** documented that the highest percentage of infant enrolled in study were underweight.

The results of the current study also showed that the average temperature of infants with pneumonia did not change on the day of admission in each group, but it improved in the intervention group on the second and third days after regular chest percussion compared to the control group with no significant difference was shown. Also it was found that the mean of weight among infants in both group not change through fourth days. In the same line with these findings, **Hassan and Amer, (2020)** reported that infants weight don't have statistically significant difference between both groups at admission day pre and at 1st, 2nd, 3rd, and 4th days post the regular chest percussion. These findings agree with **Hassan and Amer, (2020)** who mentioned that the mean of temperature among infants was improved from third day post the regular chest percussion with a significance level  $p < .05$ .

As pointed to medical data related to studied infants, the results of the current research confirmed that the majority of infants suffering from pneumonia in the both groups received all their immunizations completely according to the Egyptian obligatory immunizations schedule at the time. These results were parallel to findings of Egyptian research achieved by **Fadl et al., (2020)**, who indicated that Most infants (86.4%) received all the recommended vaccinations for their age. In the same context, **Lestari et al., (2018)** documented that the highest percentage of infant enrolled in study received all vaccinations at time.

The following study clarified that the highest percentage of infants admitted with pneumonia to the hospital for the first time in the in the control and experimental groups. These results was consistent with a study done by **Monica, (2012)**, aimed to measure the efficacy of percussion on respiratory status in children with respiratory disorders, who stated that, infants in experimental group and the control group admitted at hospital for the first time.

The current findings presented that hospital stay was reduced among infants in experimental group and raised in

control group with stay hospital mean was being ( $6.1 \pm 1.5$  and  $10.5 \pm 2.5$  days, respectively). this clarified the effect of chest percussion on improving infants' respiratory status which diminishes their length of hospital stay.

These results were well matched with study done by **Hassan and Amer, (2020)**, who recorded that, infants hospital stay in the intervention group lower than infants in control group, with a mean of  $5.8 \pm 1.3$  &  $14.1 \pm 4.1$  days. Furthermore,, **Lestari et al., (2018)** noticed that, the average infant's hospital stay in the control group was higher than that of respondents. This study was contraindicated with the study by **Corten (2015)** about chest physiotherapy among children with bacterial pneumonia, who proved that chest physiotherapy did not affect the length of hospitalization.

The present findings displayed that infants in the study and control group received oxygen therapy, more than half received it by nasal cannula and their duration was less than 7 days and their mean was  $4.8 \pm 1.8$  while infants in the control group stayed more than 7 days with was  $8.4 \pm 2.3$  with significant difference between both groups. This is supported by **Hassan and Amer (2020)** study, which proved that The nasal oxygen source accounted for the biggest percentage of both groups' oxygen sources (84% & 94%, respectively), and their length ranged from 2 to 4 days.

As regard levels of clinical parameters respiratory distress on the admission day before chest percussion, and on the first day from application of chest percussion the current results disclosed that the highest percentage of infants in control and study groups had moderate respiratory distress with no significant difference between the both groups. On the second day and third day, the majority of infants had mild respiratory distress in the intervention compared to the control group. Moreover, on the fourth day, more than of infants in study group had normal respiratory status while sixth of the control group had severe respiratory distress with highly statistically significant differences ( $p < .000$ ). These findings go in line with study findings of **Hassan and Amer (2020)**, who proved that half of infants among two groups presented severe impairment of the respiratory distress at admission day and before application of chest percussion. While At the day 1st and day 2nd post chest percussion, the majority of infants in the intervention group had mild respiratory distress compared to one third of the control group. At 3rd and 4th day post the intervention the highest percent of infants in the intervention group had mild respiratory distress compared to the control group with a highly statistically significant differences ( $p < .0001$ ).

Moreover, The results of the current research was synchronized with **Alexandrino et al (2017)** who realized that the greatest percent of children displayed a moderate respiratory distress mostly due to the existence of secretions and rhinorrhea. Another research made by **Nayani et al (2018)** declared that about one third of children had mild respiratory distress, more than half in moderate distress and nine percent in sever distress. After application of chest percussion the total scores improved with observable decrease in the percent of children having a moderate respiratory distress. Also, in the same line **Monica, (2012)**, documented that majority of children before chest percussion application had moderate respiratory distress and fifth of them had severe distress is while post chest percussion application most of children moved to moderate distress and none had severe distress.

It was clear from current research that the total mean score of clinical parameters related to respiratory condition

increased pre chest percussion on admission day and at 1<sup>st</sup> day from application of chest percussion with no statistically difference between the both groups while decreased at 2<sup>nd</sup>, 3<sup>rd</sup> and 4<sup>th</sup> days post chest percussion with a highly statistically differences between both groups as  $p < .0001$ . This finding are well-matched with study by **Hassan and Amer (2020)**, who proved the mean scores of Respiratory Severity Score in infants admitted with pneumonia was not altered at admission day in both groups but diminished in the experimental group at 1<sup>st</sup>, 2<sup>nd</sup>, 3<sup>rd</sup> and 4<sup>th</sup> day after the chest percussion and was raised in the control group. Likewise, a research executed by **Monica, (2012)**, who found that decrease total mean score of clinical parameter related to respiratory distress from 11.33 to 4.17 after chest percussion with highly statistically significant differences.

As well a research executed by **Lukrafka et al (2012)** who stated that, no differences were noticed between the both two groups at admission day regarding pneumonia severity while respiratory rate and respiratory distress scores reduced after chest percussion application in study group.

Furthermore, the current study results illustrated that the total mean score of RR, HR and O<sub>2</sub>sat among infants was improved at 1<sup>st</sup>, 2<sup>nd</sup>, 3<sup>rd</sup> and 4<sup>th</sup> days after applying of chest percussion at a significance level ( $p < .0001$ ). While no significant difference was proved on admission day before chest percussion application.

The current study agreed with **Hassan and Amer (2020)** stated that the average RR, HR, and O<sub>2</sub> sat of infants with pneumonia had no differences between the two groups at admission day while there were improvement at 1<sup>st</sup>, 2<sup>nd</sup>, 3<sup>rd</sup> and 4<sup>th</sup> day at intervention group following chest percussion, whereas the control group did not. Similarly, the research by **Chaves (2013)** concluded that an improvement in breathing rate and oxygen saturation following chest physical therapy. As in study done by **lestira, (2018)** who indicated that improvement in RR, HR and oxygen saturation after chest percussion in intervention group.

As regard levels of Bio-physiological parameters at the admission day before chest percussion the current findings showed that majority of infants in control and Study had sever altered BMP with no statistically difference while there were improvement in BMP levels after chest percussion in intervention group with highly statistically significant differences between both groups in the 1<sup>st</sup>, 2<sup>nd</sup>, 3<sup>rd</sup> & 4<sup>th</sup> days after chest percussion as  $p < .0001$

This is in congruence with **Monica, (2012)**, who found that in pretest there was no difference between experiment and control group children while in the posttest, the level of score was a significant difference between experiment and control group.

It was remarked from the current findings that there were statistically significant positive correlations between infants' age and heart rate, there was a statistically significant positive correlation between clinical parameter score and infant s' hospital stay and respiratory rate, there was a statistically significant positive correlation between heart rate and oxygen saturation after application of chest percussion post nebulizer on infant. This is consistent with study done by **Hassan and Amer (2020)** who explicated that there was a highly significant relationship ( $p .01$ ) between the pediatric respiratory scale score and the infants' age, hospital stay, respiratory rate, heart rate, and oxygen saturation. This also agrees with a study done by **(lestira, 2018,)** who indicated that age and heart rate had a significant correlation in the bivariate

analysis ( $p > 0.05$ ), whereas other factors had no significant link ( $p > 0.05$ ). Age, respiratory rate, and oxygen saturation all showed a link in the multivariate analysis's findings.

This finding conflicted with the research made by **Corten et al., (2015)** they explicated that infants in intervention group, chest physiotherapy didn't influence on hospital stay. In addition to **Lukrafka et al (2012)** who noticed a significant difference between the both groups with a longer length of hospital stay for intervention group. Another research accomplished by **Lestari et al., (2018)** who observed there were relationship between age and heart rate and the length of illness chest physical therapy had no influence on heart rate, respiration and oxygen saturation.

## Conclusion

As pointed the current research results showed that, the majority of infants with pneumonia in the study group had imperative improvement of respiratory status after receiving chest percussion post inhalation therapy though intervention days compared to the control group with highly statistically significant differences as P-value 0.001 between study and control. In addition to most of the infants in study group had a stable score of clinical parameters and BPM quickly and improvement in respiratory clinical parameters than control infants. This reflects the effectiveness of chest percussion post-nebulizer on respiratory status among infants with pneumonia.

## Recommendations

The subsequent recommendations were offered based on the outcomes of the present research:

- Specialized training program should be applied for pediatric nurses about the appropriate technique of chest percussion for infants with pneumonia should be conducted.
- Application of chest percussion as a part of the protocol for the management of infants suffering from pneumonia in pediatric inpatient wards and PICU.
- Developing and implementing educational sessions for pediatric nurses to maintain better care for infants with pneumonia.
- Spreading awareness about the importance used chest percussion post nebulizer session as a part of care for infants with pneumonia and the advantage of it.
- Future studies should be planned to enrich further evidence based practices about chest percussion effect for infants suffering from pneumonia.

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