REDVET - Revista electrónica de Veterinaria - ISSN 1695-7504
Vol 25, No. 2 (2024)Received date:- Acceptance date:- 3 sept 2024
http://www.veterinaria.org
Article Received: 25/08/2024 Revised: Accepted: 03/09/2024

Immediate Effect Of Chest Mobilization Exercises On Pulmonary Function In Chronic Kidney Disease

Indu[1], R. Deepak[2*], Bhawna[3]

[1]MPT, Department Of Physiotherapy, Santosh Paramedical College, Hospital, Ghaziabad
[2]Professor/Principal, Department Of Physiotherapy, Santosh Paramedical College, Hospital, Ghaziabad
[3]Assistant Professor, Department Of Physiotherapy, Santosh Paramedical College, Hospital, Ghaziabad

***Corresponding Author:** R Deepak
*Professor, Department Of Physiotherapy (Orthopedics), Santosh Medical College, Santosh Deemed To Be University Ghaziabad, Principal/HOD, Department Of Physiotherapy, Santosh Paramedical College, Hospital, Ghaziabad
deepak.raghav@santosh.ac.in

ABSTRACT-
It is estimated that between 700 and 840 million people globally suffer from chronic kidney disease (CKD), a serious and progressive disorder with a frequency of 8–14%.
Interestingly, one study found that a lower FEV1/FVC ratio was linked to a higher chance of incident chronic kidney disease.
This study aims to investigate the effects of chest mobilization on comparing with IMT and breathing exercises on pulmonary function. Method- 100 individuals divided into two groups of 50 each irrespective of gender. Group 1 performing chest mobilization exercises, Group 2 performing IMT and breathing exercises. Both the groups were assessed with 6MWT to ensure further exercise capacity. They were pre and post evaluated for it. Further, groups were divided to evaluate pulmonary function and compare the results .
Results- The comparison shows that there were statistically significance comparison between pre test and post test of SBP, DBP, SPO2, HR, 6MWD, PEFR, FEV1, FVC, FEV1/FVC with P<0.05 except no comparison in FEF 25-75% with P>0.05 in **chest mobilization exercise** group. Post test has greater score than pre test for all pulmonary variables in this group. It shows that there were statistically significance comparison between pre test and post test of SBP, DBP, SPO2, HR, PEFR, FEV1/FVC and FEF 25-75% with P<0.05 except no comparison in FEV1 & FVC with P>0.05 in **IMT with breathing exercises** group. Post test has greater score than pre test for all pulmonary variables in this group.
Conclusion- Chest mobilization exercises and ; IMT and breathing exercises were seen to be effective. Pre and post pulmonary function were seen to be improved in both cases

Keywords: Chest mobilization, pulmonary function, IMT, chronic kidney disease,

Introduction-

Anomalies of kidney structure or function that have affected health and been persistent for at least three months are referred to as chronic kidney disease (CKD). Cause, GFR category (G1–G5), and albuminuria category (A1–A3)—abbreviated CGA—are used to categorize chronic kidney disease. Reduced GFR and an albumin-to-creatinine ratio (ACR) >30 mg/g [>3 mg/mmol] are only two of the many indicators of kidney impairment that are included in the classification of chronic kidney disease (CKD)
Although the cause of chronic kidney disease (CKD) might be difficult to determine, it is typically categorized by the location of anatomic abnormalities and the presence or absence of systemic disease. The kidney is not the only organ impacted by systemic diseases, which include diabetes, autoimmune disorders, chronic infections, cancer, and hereditary disorders. Anatomical sites are separated into vascular, tubulointerstitial, glomerular, and cystic/congenital conditions
The different categories of CKD on the basis of GFR is categorized as- G1: GFR > 90 mL/min/1.73 m^2 with hematuria or proteinuria, G2: GFR 60 - 89 mL/min/1.73 m^2, G3a: GFR 45 - 59 mL/min/1.73 m^2, G3b: GFR 30 - 44 mL/min/1.73 m^2, G4: GFR 15 - 29 mL/min/1.73 m^2, G5: GFR < 15 mL/min/1.73 m^2 or dialysis. The 3 levels of albuminuria are A1: ACR < 30 mg/g (<3.4 mg/mmol), A2: ACR 30 to 299 mg/g (3.4-34 mg/mmol), A3: ACR > 300 mg/g (>34 mg/mmol)[1]
The potential of a pulmonary consequence increases with the severity of kidney disease. Furthermore, a restrictive spirometry pattern associated with chronic fluid overload is frequently observed in CKD patients. Because of fluid retention and changes in metabolism, endocrine function, and cardiovascular health, pulmonary edema and respiratory muscle dysfunction are more likely when the glomerular filtration rate (GFR) falls. Additionally, patients with chronic lower respiratory diseases have been shown to have a higher incidence and prevalence of microalbuminuria (MAB). Even in the early stages of kidney disease, this connection between the kidney and the lung raises the possibility that

REDVET - Revista electrónica de Veterinaria - ISSN 1695-7504
Vol 25, No. 2 (2024)
http://www.veterinaria.org
Article Received:25/08/2024 Revised: Accepted: 03/09/2024

endothelial dysfunction plays a significant part in the onset of lung disease Peak flow, also known as peak expiratory flow measurement, is a straightforward indicator of the highest flow rate possible during strong expiration after complete inspiration. The most popular peak flow meter is a straightforward, portable gadget that patients may keep and use repeatedly. Peak flow measurement can also be helpful in emergency situations to guide disposition. A patient should be admitted to the hospital for continued care and closeobservation for indications of impending respiratory failure if their peak flow is less than orequal to 50% and they have not improved despite vigorous therapy

When screening for decreased pulmonary function in people 40 years of age or older, peak expiratory flow (PEF), which is the instantaneous velocity of expiratory flow during forced spirometry, is a readily available lung function measure. PEF may help diagnose impaired expiratory muscle function, central airflow obstruction, and intrapulmonary airway narrowing caused by premature airway collapse, bronchoconstriction or airway inflammation, wall thickening, or edema, according to the interpretive strategies for lung function described by the American Thoracic Society and the European Respiratory Society. Additionally, PEF is more sensitive than forced expiratory volume in one second (FEV1) and/or forced vital capacity (FVC) for the early detection of central and upper airway obstruction

The standard metric for determining the existence of airflow limitation is the ratio of forced expiratory volume in one second (FEV1) to forced vital capacity (FVC). FVC is sensitive to expiratory time in cases of slow lung emptying, which is common with ageing and particularly in those with airflow obstruction. FVC is dependent to expiratory time: the longer the expiratory time, the higher the FVC and the lower the FEV1/FVC

As part of the pulmonary rehabilitation program, training of the inspiratory muscles, in particular, is advised. The maximum inspiratory pressure (MIP) and maximal expiratory pressure (MEP) values increased.

It is well established that morbidity and death are linked to muscle loss. In dialysis patients, there is a substantial correlation between the number of muscle fibres and their functional ability, muscle strength, and muscle oxygen extraction. Both the diaphragm and the intercostal muscles, which are skeletal muscles and are involved in breathing, can lose strength and endurance. As a result, CKD patients are less physically and functionally capable than the general population, and HD therapy reduces their activity, which makes their functional limitations worse

Numerous factors that affect exercise ability, including anemia, metabolic acidosis, electrolyte imbalance, osteopenia, growth failure, undernutrition, fluid imbalance, muscle wasting, and a sedentary lifestyle, are indicative of the progression of renal disease. Exercise training has gained attention recently as a possible way to increase the physical activity capacity, stamina, and endurance of adults and children with ESRD.

A self-paced, submaximal exercise test called the 6MWT is used to evaluate children with chronic illnesses' functional exercise capacity. It is currently the test of choice when a functional walk test is needed for clinical or research purposes and it has been used extensively in adults, particularly in patients with cardiac disorders. The evaluation is simple to administer and has good standardization

METHODOLOGY-

This comparative study was carried out at Santosh Hospital, Ghaziabad. The participants were taken from the outpatient department of the hospital. Simple random sampling was used to pick 100 participants in total. All participants were given an explanation of the complete study protocol, and verbal agreement was obtained. The appropriate measures were taken during the procedure. Inclusion criteria includes individuals who had been undergoing haemodialysis for at least three months, regardless of gender, and aged 18 to 70 years were able to participate. Individuals should be mobile. 6MWT was incorporated as a criteria to evaluate individuals' efficiency for the next stage of the study. Exclusion criteria excluded patients with neurological conditions, those on mechanical ventilation, those with recent rib fractures and persistent respiratory difficulties, bedridden, non-ambulatory, and unresponsive, as well as those with diabetes and psychiatric issues. Proper measures were taken to ensure the safety of participants. 6MWT was the criteria to exclude patients who were not able to exercise and felt dizzy after the test.

INTERVENTION-

Participants are divided into two groups. The intervention consists of 6MWT for pre evaluation for both groups. Time duration was 45-60 minutes per individual for the intervention. Group A- The group consists of chest mobilization exercises performed on 50 individuals. The chest mobilization included are- Mobilising upper chest and stretch pectoralis muscle, mobilize paretic side of chest, sternocleido-mastoid muscle mobilization, scalene muscle mobilization, fascia global mobilization. Group B- Inspiratory Muscle Training (IMT) and breathing exercises were given to second group. Deep breathing exercise modified with theraband (low resistance band- yellow) such as reverse flies, dynamic hug and chest flies; and diaphragmatic breathing exercise.

Data were documented using recorded readings during the procedure. Statistical analysis helped in recognizing the effects on pulmonary function.

REDVET - Revista electrónica de Veterinaria - ISSN 1695-7504
Vol 25, No. 2 (2024)
http://www.veterinaria.org
Article Received:25/08/2024 Revised: Accepted: 03/09/2024

DATA ANALYSIS AND RESULTS-

Table 1: Comparison between Pre test and post test pulmonary variables in chronic kidney disease patient in chest mobilization exercise

chest mobilization exercise	Pre-test (Mean ± SD)	Post test (Mean ± SD)	Paired t test value	P-value	Result
SBP	132.24 ± 6.607	141.00 ± 8.337	17.260	0.001	Significant
DBP	94.46 ± 7.260	105.24 ± 7.994	17.90	0.001	Significant
SPO2	94.48 ± 3.005	92.58 ± 3.111	7.119	0.001	Significant
HR	81.20 ± 5.789	90.16 ± 6.453	16.669	0.001	Significant
PEFR	214.80 ± 43.483	230.20 ± 38.597	3.293	0.002	Significant
FEV1	1.304 ± 0.656	1.491 ± 0.640	2.822	0.007	Significant
FVC	1.246 ± 0.671	1.494 ± 0.631	3.052	0.004	Significant
FEV1/FVC	84.438 ± 14.337	88.019 ± 9.505	2.816	0.007	Significant
FEF 25-75%	2.102 ± 1.350	2.023 ± 0.988	0.61	0.551	Insignificant

Above table shows that there were statistically significance comparison between pre test and post test of SBP, DBP, SPO2, HR, 6MWD, PEFR, FEV1, FVC, FEV1/FVC with P<0.05 except no comparison in FEF 25-75% with P>0.05 in chest mobilization exercise group. Post test has greater score than pre test for all pulmonary variables in this group.

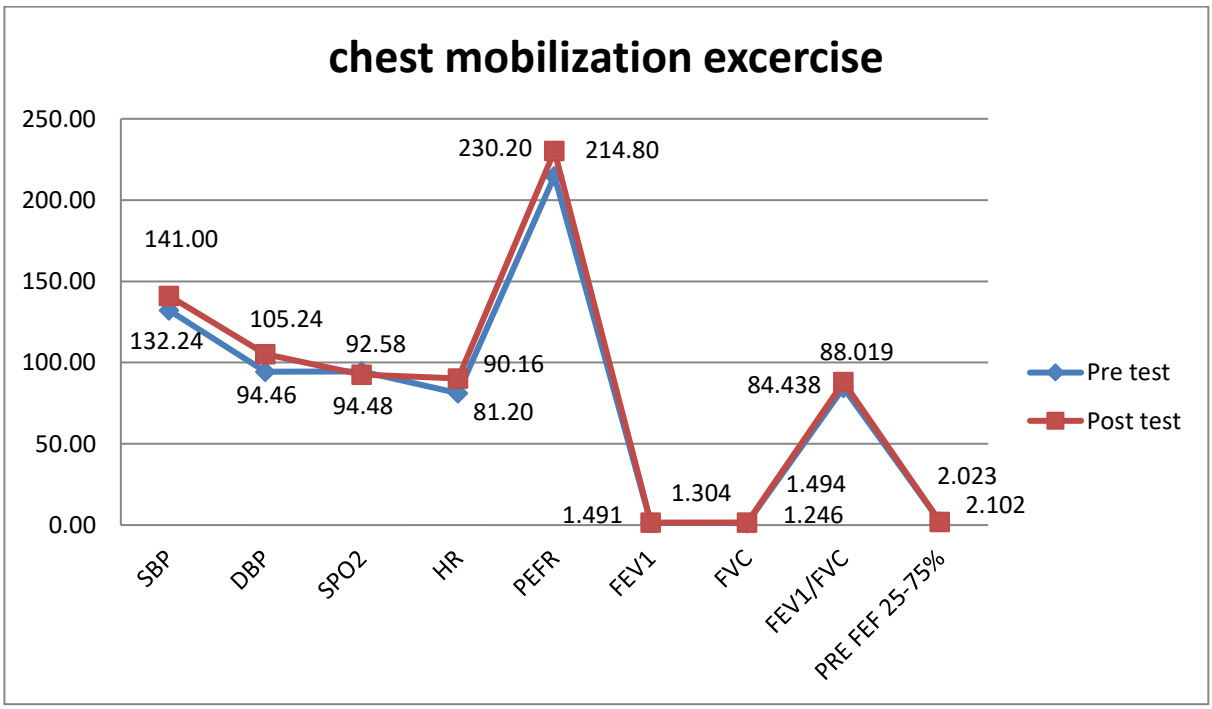
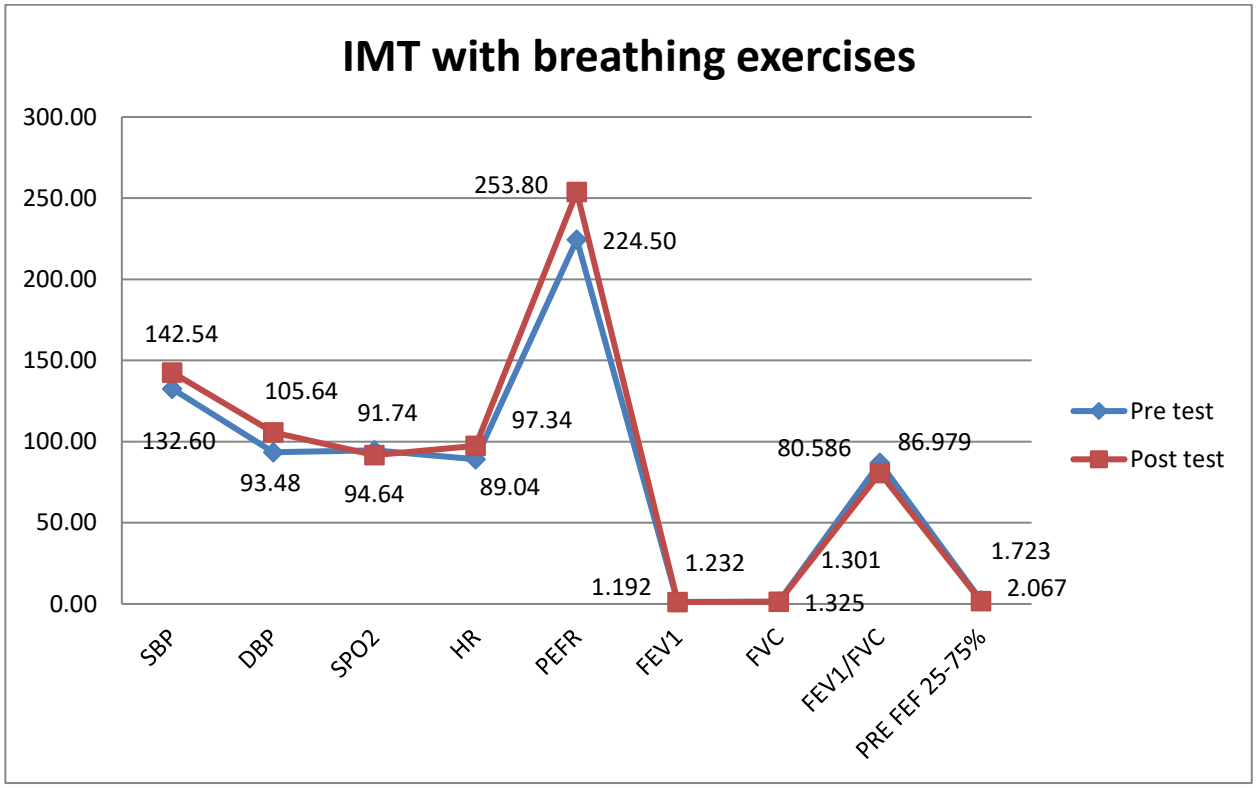


Table 2: Comparison between Pre test and post test pulmonary variables in chronic kidney disease patient in MT with breathing exercises N=50

IMT with breathing exercises	Pre-test (Mean ± SD)	Post test (Mean ± SD)	Paire t test value	P-value	Result
SBP	132.60 ± 7.051	142.54 ± 8.683	13.250	0.001	Significant
DBP	93.48 ± 8.462	105.64 ± 9.012	13.337	0.001	Significant
SPO2	94.64 ± 3.109	91.74 ± 3.784	9.295	0.001	Significant
HR	89.04 ± 5.151	97.34 ± 5.506	13.425	0.001	Significant
PEFR	224.50 ± 61.464	253.80 ± 58.515	6.572	0.001	Significant
FEV1	1.232 ± 0.656	1.192 ± 0.572	0.476	0.636	Insignificant
FVC	1.325 ± 0.748	1.301 ± 0.574	0.308	0.759	Insignificant
FEV1/FVC	86.979 ± 12.415	80.586 ± 18.070	2.780	0.008	Significant
FEF 25-75%	2.067 ± 1.067	1.723 ± 1.007	3.194	0.002	Significant

REDVET - Revista electrónica de Veterinaria - ISSN 1695-7504
Vol 25, No. 2 (2024)
http://www.veterinaria.org
Article Received:25/08/2024 Revised: Accepted: 03/09/2024

Above table shows that there were statistically significance comparison between pre test and post test of SBP, DBP, SPO2, HR, PEFR, FEV1/FVC and FEF 25-75% with P<0.05 except no comparison in FEV1 & FVC with P>0.05 in IMT with breathing exercises group. Post test has greater score than pre test for all pulmonary variables in this group.



DISCUSSION-

CME is a type of technique used to increase chest mobility and ventilation improvement. In chronic kidney disease patients, inspiratory muscles get weak due to reduce strength. Due to which it is essential to strengthen inspiratory muscles.

A specific method of strengthening the inspiratory muscles by applying resistance during inspiration is called inspiratory muscle training. The primary distinction between threshold and resistive loading is that the former relies on the patient's flow, which makes training intensity effort-dependent. On the other hand, threshold loading requires patients to produce a certain pressure in order to permit airflow for every breath; once this threshold is reached, inspiratory flow is independent of patient pressure

In both health and illness, the kidneys and the lungs are intimately related. In actuality, the kidney-lung relationship is intimately related to the control of blood pressure, fluid homeostasis, and acid-base balance. In CKD, the lungs may be pathologically seriously damaged.

Breathing against an external inspiratory load supplied by various devices is how IMT is carried out. It is regarded as pertinent in the context of rehabilitation, is simple to use, and is an inexpensive intervention. This training appears to be a potential strategy for improving general health since it has been implemented in populations with various disorders, besides strengthening the inspiratory muscles. Thoracic mobility, respiratory muscle flexibility, and respiratory function are all enhanced by chest mobilization. Stretching the Intercoastal muscle was used to mobilize the chest. The sixth intercostal muscle on the right side, which is located between the anterior axillary line and a vertical line that passes through the nipple and is where the shear modulus is measured, was the only site of the stretching since the effect of stretching on the shear modulus decreases in a time-dependent manner

CONCLUSION- Chest mobilization exercises and ; IMT and breathing exercises were seen to be effective. Pre and post pulmonary function were seen to be improved in both cases.

LIMITATIONS AND FUTURE SCOPE- This research was carried to determine the immediate effects. For future perspective, the study can be carried out for longer duration with sessions included for better effect. The individuals selected performed the intervention post haemodialysis, in contrast for future study pre dialysis patients could be taken. The long term effect could hold more efficiency for the improvement of pulmonary function in chronic kidney disease patients.

REFERENCES-

1. Kidney Disease: Improving Global Outcomes (KDIGO) CKD Work Group (2024). KDIGO 2024 Clinical Practice Guideline for the Evaluation and Management of Chronic Kidney Disease. Kidney international, 105(4S), S117–S314. https://doi.org/10.1016/j.kint.2023.10.018
2. Chen, T. K., Knicely, D. H., & Grams, M. E. (2019). Chronic Kidney Disease Diagnosis and Management: A Review. JAMA, 322(13), 1294–1304. https://doi.org/10.1001/jama.2019.14745
3. Vaidya, S. R., & Aeddula, N. R. (2024). Chronic Kidney Disease. In StatPearls. StatPearls Publishing.
4. Gembillo, G., Calimeri, S., Tranchida, V., Silipigni, S., Vella, D., Ferrara, D., Spinella, C., Santoro, D., & Visconti, L. (2023). Lung Dysfunction and Chronic Kidney Disease: A Complex Network of Multiple Interactions. *Journal of personalized medicine*, *13*(2), 286. https://doi.org/10.3390/jpm13020286
5. DeVrieze BW, Modi P, Giwa AO. Peak Flow Rate Measurement. [Updated 2023 Jul 31]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2023 Jan-. Available from: https://www.ncbi.nlm.nih.gov/books/NBK459325/
6. Han, S., Xu, Y., & Wang, Y. (2024). Association between pulmonary function and rapid kidney function decline: a longitudinal cohort study from CHARLS. BMJ open respiratory research, 11(1), e002107. https://doi.org/10.1136/bmjresp-2023-002107
7. Perez-Padilla, R., Wehrmeister, F. C., Celli, B. R., Lopez-Varela, M. V., Montes de Oca, M., Muiño, A., Talamo, C., Jardim, J. R., Valdivia, G., Lisboa, C., Menezes, A. M., & PLATINO Team (2013). Reliability of FEV1/FEV6 to diagnose airflow obstruction compared with FEV1/FVC: the PLATINO longitudinal study. *PloS one*, *8*(8), e67960. https://doi.org/10.1371/journal.pone.0067960
8. Neto, J. R., Figueiredo E Castro, L. M., Santos de Oliveira, F., Silva, A. M., Maria Dos Reis, L., Quirino, A. P., Dragosavac, D., & Kosour, C. (2016). Comparison between two physiotherapy protocols for patients with chronic kidney disease on 17 dialysis. Journal of physical therapy science, 28(5), 1644–1650. https://doi.org/10.1589/jpts.28.1644
9. Takken, T., Engelbert, R., van Bergen, M., Groothoff, J., Nauta, J., van Hoeck, K., Lilien, M., & Helders, P. (2009). Six-minute walking test in children with ESRD: discrimination validity and construct validity. *Pediatric nephrology (Berlin, Germany)*, *24*(11), 2217–2223. https://doi.org/10.1007/s00467-009-1259-x
10. Nadiya Garnis Sallyfan, Endro Yulianto, & Torib Hamzah. (2020). Peak Flow Meter Equipped with Inspection Results Indicator. Journal of Electronics, Electromedical Engineering, and Medical Informatics, 2(1), 7-12. https://doi.org/10.35882/jeeemi.v2i1.2
11. Neto, J. R., Figueiredo E Castro, L. M., Santos de Oliveira, F., Silva, A. M., Maria Dos Reis, L., Quirino, A. P., Dragosavac, D., & Kosour, C. (2016). Comparison between two physiotherapy protocols for patients with chronic kidney disease on dialysis. Journal of physical therapy science, 28(5), 1644–1650. https://doi.org/10.1589/jpts.28.1644
12. Park, S. J., Lee, J. H., & Min, K. O. (2017). Comparison of the effects of core stabilization and chest mobilization exercises on lung function and chest wall expansion in stroke patients. Journal of physical therapy science, 29(7), 1144–1147. https://doi.org/10.1589/jpts.29.1144
13. Sharma, A., Sharma, A., Gahlot, S., & Prasher, P. K. (2017). A study of pulmonary function in end-stage renal disease patients on hemodialysis: a cross-sectional study. Sao Paulo medical journal = Revista paulista de medicina, 135(6), 568–572. https://doi.org/10.1590/1516-3180.2017.0179150817
14. Mukai, H., Ming, P., Lindholm, B., Heimbürger, O., Barany, P., Stenvinkel, P., & Qureshi, A. R. (2018). Lung Dysfunction and Mortality in Patients with Chronic Kidney Disease. Kidney & blood pressure research, 43(2), 522–535. https://doi.org/10.1159/000488699
15. Lima, I. S., Florêncio de Moura Filho, O., Cunha, F. V., Ribeiro, J. L., Valenti, V. E., & Carlos de Abreu, L. (2011). Chest and neck mobilization effects on spirometric responses in healthy subjects. Journal of manipulative and physiological therapeutics, 34(9), 622–626. https://doi.org/10.1016/j.jmpt.2011.08.004
16. Zhang, F., Wang, H., Bai, Y., Huang, L., & Zhang, H. (2023). Effect of respiratory muscle training in patients with chronic kidney disease: A systematic review andmeta-analysis of randomized controlled trials. Clinical rehabilitation, 37(3), 348–361. https://doi.org/10.1177/02692155221135729
17. de Medeiros, A. I. C., Fuzari, H. K. B., Rattesa, C., Brandão, D. C., & de Melo Marinho, P. É. (2017). Inspiratory muscle training improves respiratory muscle strength, functional capacity and quality of life in patients with chronic kidney disease: a systematic review. Journal of physiotherapy, 63(2), 76–83. https://doi.org/10.1016/j.jphys.2017.02.016 Bostanci, Ö., Mayda, H., Yılmaz, C., Kabadayı, M., Yılmaz, A. K., & Özdal, M. (2019). Inspiratory muscle training improves pulmonary functions and respiratory muscle strength in healthy male smokers. Respiratory physiology & neurobiology, 264, 28–32. https://doi.org/10.1016/j.resp.2019.04.001
18. Arazi, T., Aliasgharpour, M., Mohammadi, S., Mohammadi, N., & Kazemnejad, A. (2021). Effect of a Breathing Exercise on Respiratory Function and 6-Minute Walking Distance in Patients Under Hemodialysis: A

Randomized Controlled Trial. The journal of nursing research : JNR, 29(2), e146. https://doi.org/10.1097/JNR.0000000000000423

19. de Medeiros, A. I. C., Fuzari, H. K. B., Rattesa, C., Brandão, D. C., & de Melo Marinho, P. É. (2017). Inspiratory muscle training improves respiratory muscle strength, functional capacity and quality of life in patients with chronic kidney disease: a systematic review. *Journal of physiotherapy*, *63*(2), 76–83. https://doi.org/10.1016/j.jphys.2017.02.016
20. Bush, A., & Gabriel, R. (1985). The lungs in uraemia: a review. *Journal of the Royal Society of Medicine*, *78*(10), 849–855. https://doi.org/10.1177/014107688507801012
21. Reshia, F. A. A., Salameh, B., Alsadaan, N., Alqahtani, M., Ayed, A., Kassabry, M. F., & Abo Seada, A. I. (2023). Enhancing pulmonary function and arterial blood gas readings through immediate chest physiotherapy among extubated patients in ICU. The Journal of international medical research, 51(11), 3000605231208600. https://doi.org/10.1177/03000605231208600