JHSS
Journal of Health and Sport Sciences

DERLEME MAKALESİ
E-ISSN: 2791-6847
JHSS 2024; 7(3): 237-247

THE ROLE OF COGNITIVE REHABILITATION AND MOTOR IMAGERY IN COPD: LITERATURE REVIEW

Amine ATAÇ[1]

Gönderilme Tarihi: 17.08.2024 - Kabul Tarihi: 19.10.2024

Abstract

Chronic Obstructive Pulmonary Disease (COPD) is a common lung disease worldwide, progressively characterized by permanent airflow limitation. Exercise limitation, skeletal muscle dysfunction, cognitive dysfunctions can be seen in COPD. Motor imagery (MI) and action observation (AO) are cognitive rehabilitation methods. These methods are not limited to addressing cognitive impairments; they also have measurable effects on physical outcomes, such as increased muscle strength and improvements in the autonomic nervous system. From this point of view, exercise limitation in COPD patients is a type of rehabilitation that may have an effect on skeletal muscle dysfunction. This study aims to review the place of cognitive rehabilitation in COPD patients. A literature search was conducted in PUBMED, EBSCO, PEDro, Cochrane, Web of Science (WOS) databases and relevant articles were reviewed. In the literature review, when "motor imagery" AND "pulmonary" is searched in PUBMED, only 4 studies are found between the years 1991-2024, 15 results are found in the search for "motor imagery" AND "respiratory" between the years 1991-2024. Searching for "motor imagery" AND "pulmonary disease" or "motor imagery" AND "respiratory disease" yields zero results. There is 1 congress paper publication in which "motor imagery" AND "pulmonary rehabilitation" and motor imagery in pulmonary rehabilitation are examined. There were 2905 results related to motor imagery in EBSCO, 47 in WOS, 197 in PEDro, and 3 in Cochrane. As a result of our study, it was understood that there is a need for studies investigating the effects of motor imagery and action observation methods, which are cognitive rehabilitation methods and have the potential to affect not only cognitive functions but also physical functions, in COPD patients.

Keywords: Cognitive rehabilitation, COPD, COPD motor imagery, motor imagery, action observation

KOAH'TA KOGNİTİF REHABİLİTASYON VE MOTOR İMGELEMENİN ROLÜ: LİTERATÜR İNCELEMESİ

Öz

Kronik Obstrüktif Akciğer Hastalığı (KOAH) dünya çapında yaygın bir akciğer hastalığıdır ve ilerleyici olarak kalıcı hava akımı kısıtlılığı ile karakterizedir. KOAH'ta egzersiz kısıtlılığı, iskelet kası disfonksiyonu, bilişsel işlev bozuklukları görülebilir. Motor imgeleme (MI) ve eylem gözlemi (EG) bir bilişsel rehabilitasyon yöntemidir. Bu yöntem sadece bilişsel bozukluklar üzerine yapılan çalışmalarla sınırlı değildir. Kas gücü artışı, otonom sinir sistemi,

[1] İstanbul Gedik Üniversitesi Sağlık Bilimleri Fakültesi, amine.atac@gedik.edu.tr, ORCID: 0000-0002-0626-7406

JHSS
Journal of Health and Sport Sciences

DERLEME MAKALESİ
E-ISSN: 2791-6847
JHSS 2024; 7(3): 237-247

etkileri gibi birçok fiziksel sonuçta ölçülebilen etkileri vardır. Bu açıdan bakıldığında KOAH hastalarında egzersiz kısıtlaması iskelet kas disfonksiyonu üzerine etkisi olabilecek bir rehabilitasyon türüdür. Bu çalışmanın amacı KOAH hastalarında kognitif rehabilitasyonun yerini gözden geçirmektir. PUBMED, EBSCO, PEDro, Cochrane, Web of Science (WOS) veri tabanlarında literatür taraması yapıldı ve ilgili makaleler gözden geçirildi. Literatür taramasında PUBMED'de "motor imagery" AND "pulmonary" araması yapıldığında 1991-2024 yılları arasında sadece 4 çalışma, "motor imagery" AND "respiratory" araması yapıldığında 1991-2024 yılları arasında 15 sonuç bulunmuştur. "Motor imagery" AND 'pulmonary disease' veya "motor imagery" AND "respiratory disease" aramalarında ise sıfır sonuç elde edilmiştir. "Motor imagery" AND "pulmonary rehabilitation" ve pulmoner rehabilitasyonda motor imagery konularının incelendiği 1 kongre bildirisi yayını bulunmaktadır. Motor imgeleme ile alakalı EBSCO'da 2905, WOS'ta 47, PEDro'da 197, Cochrane'de 3 sonuç bulundu. Çalışmamız sonucunda bilişsel rehabilitasyon yöntemlerinden olan ve sadece bilişsel fonksiyonları değil fiziksel fonksiyonları da etkileme potansiyeli olan motor imgeleme ve eylem gözlem yöntemlerinin KOAH hastalarında etkilerini araştıran çalışmalara ihtiyaç olduğu anlaşılmıştır.

Anahtar Kelimeler: Kognitif rehabilitasyon, KOAH, KOAH motor imgeleme, motor imgeleme, aksiyon gözlemi

Atıf: Ataç, A. (2024). The role of cognitive rehabilitation and motor imagery in copd: literature review. *JHSS 7*(3), 237-247. https://doi.org/10.61150/jhss.2024070306

Introduction

Chronic Obstructive Pulmonary Disease

Global Initiative for Chronic Obstructive Lung Disease (GOLD); Chronic Obstructive Pulmonary Disease (COPD); defines it as a common, preventable disease characterized by airflow limitation and frequent respiratory symptoms (Duffy & Criner, 2019).

COPD affects approximately 400 million people and although the World Health Organization does not predict that COPD will be the 3rd most common cause of death by 2030, it is now ranked 3rd in the world (Labaki & Rosenberg, 2020). Among the factors that cause COPD are smoking, exposure to harmful gas particles, genetics 1-antitrypsin deficiency, a history of frequent infections in childhood, filled the lumen airway macrophages, neutrophils, and T and B lymphocytes, including inflammatory and immune processes can take place (Duffy & Criner, 2019; Labaki & Rosenberg, 2020).

DERLEME MAKALESİ
E-ISSN: 2791-6847
JHSS 2024; 7(3): 237-247

Immunopathogenesis of COPD

It is accepted that the abnormal inflammatory response that develops in the airways and lung parenchyma to harmful particles and gases is the pathology that plays a fundamental role in the pathogenesis of COPD. This abnormal inflammatory response disrupts the normal defense and repair mechanisms of the lung, causing tissue damage. As a result, chronic airflow obstruction and other physiological abnormalities typical of COPD occur (Başyiğit, 2010).

The predominant risk factor for developing COPD is former or current tobacco smoking. However, not all smokers develop COPD, suggesting that other environmental factors are also involved, such as indoor and outdoor air pollution (e.g. exposure to biomass fuel), occupational hazards, infections, and secondhand smoke during pregnancy or early childhood. In addition, genetic predisposition (e.g., α1-antitrypsin deficiency) and epigenetic influences also play a role in the pathogenesis of COPD (Scoditti et al., 2019).

Many factors are involved in the immunopathogenesis of COPD, which leads to physiopathological changes in the course of the disease. Physiopathological changes that occur in COPD (Başyiğit, 2010);

- Airflow restriction and air trapping
- Gas exchange abnormalities
- Ciliary dysfunction and mucus hypersecretion
- Pulmonary hypertension and cor pulmonale
- Systemic manifestations

Causes of Exercise Limitations in COPD

Exercise limitation is one of the main symptoms of COPD. Although airway obstruction is known to be a significant contributor to exercise limitation, skeletal muscle dysfunction also negatively impacts exercise capacity and quality of life. The mechanisms that cause skeletal muscle dysfunction in COPD (Vestbo et al., 2013; Laveneziana et al., 2019);

- Sedentary lifestyle,
- Muscle mass loss,
- Systemic inflammation,
- Tissue hypoxia,
- Oxidative stress
- Nutritional abnormalities

DERLEME MAKALESİ
E-ISSN: 2791-6847
JHSS 2024; 7(3): 237-247

Cognitive Impairment and Pathophysiology in COPD Patients

Cognitive impairment is frequently observed in patients with chronic obstructive pulmonary disease (61%) (Disler et al., 2020) and hinders many aspects of self-management that are essential for disease management and quality of life (Park et al., 2021).

Cognitive impairment in COPD is thought to result from progressive episodes of acute hypoxia and hypercapnia with systemic vascular and inflammatory effects, and the risk of structural changes due to decreased hippocampal volume and increased incidence of microbleeding and white matter lesions (Torres-Sánchez et al., 2015).

Cognitive Rehabilitation

The concept of action simulation refers to an internal representation of motor programs that does not include explicit movement. The motor imagery (MI) method or the action observation (AO) method are considered two separate action simulation methods that activate the motor regions in the brain (Hardwick et al., 2017; Losana-Ferrer et al., 2018). Both methods remain a popular and effective tool for enhancing motor learning.

Studies have shown that these methods are recommended for use by clinicians in rehabilitation settings, as well as by patients, athletes, and others seeking to improve their motor skills (Scott et al., 2018).

Motor Imagery and Action Observation

Motor imagery training is a dynamic mental process in which a movement is mentally visualized without any visible movement, any voluntary motor muscle activation (Figure 1) (Stenekes et al., 2009)(Cuenca-Martínez et al., 2018).

Action observation training is a method that includes internal, real-time motor simulation of movements in which the observer visually perceives movements performed by another person (Fig. 1) (Losana-Ferrer et al., 2018; Cuenca-Martínez et al., 2018).

Motor Imgarey and Action Observation Mechanism and Effects

Both mental processes trigger the activation of neurocognitive mechanisms in a way similar to the activation of brain regions involved in the planning and execution of volitional movement (Losana-Ferrer et al., 2018; Cuenca-Martínez et al., 2018).

The application of resistance training programs together with mental practice, which includes action simulation, is gaining increasing attention. Porro et al. (2007), reported that daily training sessions with AO planned for two consecutive weeks increased the index finger abductor muscle strength by 30% and the strength gain was specific to the observed movement during training. The authors noted increased excitability of the corticospinal pathways associated with the corresponding cortical representation map of the dorsal interosseous muscles after

DERLEME MAKALESİ
E-ISSN: 2791-6847
JHSS 2024; 7(3): 237-247

completion of training. Although it is reported in the literature that the addition of mental practice in addition to the resistance training program triggers this muscle strength increase more, physically weak individuals experience difficulties when training with heavy weights. For such individuals, MI combined with AO is a promising approach to maintain or increase muscle strength (Shimada et al., 2019).

Frenkel et al. (2014) showed that when the patient applied MI and AO methods after an immobilization period, the patient's functionality loss decreased, and the normal joint movement of the extremity, strength and muscle mass loss decreased (Frenkel-Toledo et al., 2020). There is evidence in the literature that MI and AO also trigger sympathetic nervous system activation. There may be changes in breathing, heart rate and skin temperature, as well as an increase in electrodermal activity. Neural activation for these peripheral autonomic responses is associated with the motivational and emotional states that occur during MI (Losana-Ferrer et al., 2018; Díaz-Sáez et al., 2021).

Although the neurophysiological mechanisms remain unclear and still based on hypotheses, both MI and AO have been shown to induce changes in autonomic nervous system that induce sympathetic responses (Losana-Ferrer et al., 2018).

Cognitive Rehabilitation and Motor Imagery in Respiratory Patients

When a search is made in the PUBMED database as "cognitive rehabilitation" AND "pulmonary", 10 literature results come out between 2007 and 2024. When the literature is searched as "cognitive rehabilitation" AND "pulmonary disease", it is seen that 4 results appear.

When the "cognitive rehabilitation" AND "respiratory" search, which resulted from 15 studies between 2006-2021, is changed to "cognitive rehabilitation" AND "respiratory disease", it is seen that only 1 article not related to the search term is encountered in 2020.

When a search is made in PUBMED as "cognitive rehabilitation" AND "pulmonary rehabilitation" to see if cognitive rehabilitation has been studied related to pulmonary rehabilitation, 1 result is obtained. This study was conducted in 2020 and is about COPD patients (Disler et al., 2020). In this study, cognitive impairment of COPD patients was evaluated in the form of a questionnaire and interview, and was not related to motor imagery or action observation.

When "motor imagery" AND "pulmonary" is searched in PUBMED, only 4 studies are found between the years 1991-2024, and 15 results are found in the search for "motor imagery" AND "respiratory" between the years 1991-2024. Searching for "motor imagery" AND "pulmonary disease" and "motor imagery" AND "respiratory disease" yields zero results. When a research is done such as "motor imagery" AND "pulmonary rehabilitation" and is there a study in which motor imagery is performed in pulmonary rehabilitation, the result is 1 congress paper publication.

DERLEME MAKALESİ
E-ISSN: 2791-6847
JHSS 2024; 7(3): 237-247

When we do a general search such as "motor imagery" AND "action observation", 288 results are encountered. Interestingly, among these results, articles related to pulmonary diseases or pulmonary rehabilitation are almost never encountered. It draws our attention that 7 articles are related to autonomic nervous system related respiratory area and 1 article is about immobilization.

In summary, in other detailed scans of motor imagery and cognitive rehabilitation related to pulmonary rehabilitation, 4 unrelated case studies, 1 brain stimulation, 1 change of cognitive characteristics in COPD patients in 2020 (Disler et al., 2020)(screening with self-created questionnaire and other questionnaires), 2 studies with COPD patients in 2021 related article on the effect of cognitive rehabilitation on cognitive function, self-management, and quality of life (one of these studies is the cognitive rehabilitation program; a program of six 30-minute sessions over a 2-week period and six domains: attention, memory, language, visuospatial perception, executive function, and problem solving (Park et al., 2021). The other study consisted of the intervention, which assessed cognitive function, self-management, and quality of life three times (pre-intervention and immediately and 4 weeks post-intervention). There is 1 article about cognitive changes and impairments in the intensive care unit (Jackson et al., 2012), 2 prospective and concluded articles of a randomized controlled trial related to intensive care patients (Brummel et al., 2012)(Jackson et al., 2012). It is seen that there are 6 articles (Porro et al., 2007)(Díaz-Sáez et al., 2021)(Decety et al., 1991)(Grosprêtre et al., 2021)(Szameitat et al., 2011)(Oishi & Maeshima, 2004) investigating the effects of motor imagery and cognitive rehabilitation on heart rate and respiration, and 1 article on single leg cycling ergometer exercise in the literature (Asahara et al., 2016).

The Role of Cognitive Rehabilitation and Motor Imagery in the Literature in COPD Patients

It is seen that classical cognitive rehabilitation applications, which have mostly been studied on the main cognitive areas associated with COPD, have been studied in the literature in COPD patients. These major cognitive impairments are also essential for task and exercise performance; memory, information processing, language, attention, visuospatial abilities, judgment and executive functions (Park et al., 2021).

When searching the PUBMED database by typing "cognitive rehabilitation" AND "COPD", 3 results appear. In one of these studies, in the study of Disler et al. in 2020, cognitive impairments of COPD patients were evaluated in the form of a questionnaire and interview, and it is not related to motor imagery or action observation. In another study, Park et al.'s effects of cognitive rehabilitation on cognitive function, self-management and quality of life in patients with COPD in 2021; It was researched through a program of six 30-minute sessions and six domains (attention, memory, language, visuospatial perception, executive function, and problem

DERLEME MAKALESİ
E-ISSN: 2791-6847
JHSS 2024; 7(3): 237-247

solving) administered over a 2-week period. The last study (Scoyni et al., 2007) examined the cognitive effects of drug use in COPD patients and was not related to motor imagery.

Motor imagery (MI) and action observation (AO) is also a cognitive rehabilitation method and is not limited to the study of cognitive impairments. It has effects that can be measured in many physical results such as muscle strength increase, autonomic nervous system, and effects. From this point of view, exercise limitation in COPD patients is a type of rehabilitation that may have an effect on skeletal muscle dysfunction. Interestingly, when imagery training in COPD errors is investigated in the literature, it is seen that the focus is on classical imagination and relaxation training with a limited number of studies. Whereas (MI) occurs as a result of rehearsal of a particular motor movement in working memory without any overt movement of the involved muscle. It is divided into two categories, visual imagery (VI) and kinesthetic imagery (KI). VI consists of the visualization of the subject moving a limb, which does not require any special training or perception of muscles, while KI is the sensation of muscle movement that can usually be achieved by athletes or specially trained persons (Chholak et al., 2019).

Motor Imagery and Respiratory-Review of Studies in COPD Patients in Other Databases Review

Although many studies were found when COPD and motor imagery were searched separately in EBSCO, PEDro, Cochrane, and Web of Science databases, there is little to no research on the study of motor imagery in COPD patients or respiratory patients. In particular, there are studies in the literature on the reduction of stress levels by guided imagery training rather than motor imagery training. There are almost no studies on motor imagery in respiratory patients (Louie, 2004)(Moody et al., 1993).

In a study conducted in 2024, Nirmala et al. investigated the effect of guided imagery training on the stress level of COPD patients (Nirmala et al., 2024). Guided imagery training is different from motor imagery training and has an activating effect on the parasympathetic nervous system (Tusek & CwynarRE, 2000) . At the end of the study, they found a significant decrease in the stress level of COPD patients. Moody et al. examined the effects of guided imagery training combined with respiratory muscle training in chronic bronchitis and emphysema (Moody et al., 1993). The results showed that the psychological intervention of guided imagery significantly improved the subjects' perceived quality of life. The physiological intervention of respiratory muscle training was not tolerated by the subjects, preventing testing of the effects on the dependent variables. The application of the study findings to clinical practice and the need for further research are discussed. Louie et al. assigned half of the 26 participants to a treatment group, where they received six guided imagery practice sessions, while the control group was instructed to rest quietly for six sessions (Louie, 2004). In the seventh session, physiological changes: fractional percent oxygen saturation; heart rate; upper thoracic surface electromyography; skin conductance; and peripheral skin temperature were recorded during a

DERLEME MAKALESİ
E-ISSN: 2791-6847
JHSS 2024; 7(3): 237-247

30-minute session with a one-minute sampling frequency. The results showed a statistically significant increase in fractional percent oxygen saturation in the treatment group, but no significant effect on other physiological parameters. The authors recommend further studies investigating the psychological effects of guided imagery.

Conclusion

Cognitive impairment in COPD has been shown to be strongly associated with hypoxemia and hypercapnia caused by pulmonary dysfunction. Exercise limitation is one of the main symptoms of COPD. Although it is known that airway obstruction causes exercise limitation to a large extent, skeletal muscle dysfunction also negatively affects exercise capacity and quality of life. Motor imagery (MI) and action observation (AO) is also a cognitive rehabilitation method and is not limited to the study of cognitive impairments. It has effects that can be measured in many physical results such as muscle strength increase, autonomic nervous system, and effects. From this point of view, exercise limitation in COPD patients is a type of rehabilitation that may have an effect on skeletal muscle dysfunction. Interestingly, when imagery training in COPD errors is investigated in the literature, it is seen that the focus is on classical imagination and relaxation training with a limited number of studies. There is a need for studies investigating the effects of motor imagery and action observation in COPD patients.

Conflict of Interest

The author reported no conflict of interest related to this article.

References

Asahara, R., Matsukawa, K., Ishii, K., Liang, N., & Endo, K. (2016). The prefrontal oxygenation and ventilatory responses at start of one-legged cycling exercise have relation to central command. *Journal of Applied Physiology*, *121*(5), 1115–1126. https://doi.org/10.1152/japplphysiol.00401.2016

Başyiğit, İ. (2010). KOAH Patogenezi ve Fizyopatalojisi. *TTD Toraks Cerrahisi Bülteni*, *1*(2), 114–118.

Brummel, N. E., Jackson, J. C., Girard, T. D., Pandharipande, P. P., Schiro, E., Work, B., Pun, B. T., Boehm, L., Gill, T. M., & Ely Wesley, E. (2012). A combined early cognitive and physical rehabilitation program for people who are critically ill: The activity and cognitive therapy in the intensive care unit (ACT-ICU) trial. *Physical Therapy*, *92*(12), 1580–1592. https://doi.org/10.2522/ptj.20110414

Chholak, P., Niso, G., Maksimenko, V. A., Kurkin, S. A., Frolov, N. S., Pitsik, E. N., Hramov, A. E., & Pisarchik, A. N. (2019). Visual and kinesthetic modes affect motor imagery classification in untrained subjects. *Scientific Reports 2019 9:1*, *9*(1), 1–12. https://doi.org/10.1038/s41598-019-46310-9

Cuenca-Martínez, F., Suso-Martí, L., Grande-Alonso, M., Paris-Alemany, A., & Touche, R. La. (2018). Combining motor imagery with action observation training does not lead to a greater autonomic nervous

DERLEME MAKALESİ
E-ISSN: 2791-6847
JHSS 2024; 7(3): 237-247

system response than motor imagery alone during simple and functional movements: A randomized controlled trial. *PeerJ*, *2018*(7). https://doi.org/10.7717/peerj.5142

Decety, J., Jeannerod, M., Germain, M., & Pastene, J. (1991). Vegetative response during imagined movement is proportional to mental effort. *Behavioural Brain Research*, *42*(1), 1–5. https://doi.org/10.1016/S0166-4328(05)80033-6

Díaz-Sáez, M. C., La Touche, R., & Cuenca-Martínez, F. (2021). Comparative analysis of the autonomic nervous system response during movement representation in healthy individuals and patients with chronic low back pain: a prospective cohort study. *Somatosensory & Motor Research*, *38*(1), 68–76. https://doi.org/10.1080/08990220.2020.1845137

Disler, R. T., Spiliopoulos, N., Inglis, S. C., Currow, D. C., & Davidson, P. M. (2020). Cognitive screening in chronic obstructive pulmonary disease: patient's perspectives. *Disability and Rehabilitation*, *42*(9), 1233–1239. https://doi.org/10.1080/09638288.2018.1519046

Duffy, S. P., & Criner, G. J. (2019). Chronic Obstructive Pulmonary Disease: Evaluation and Management. *Medical Clinics of North America*, *103*(3), 453–461. https://doi.org/10.1016/j.mcna.2018.12.005

Frenkel-Toledo, S., Einat, M., & Kozol, Z. (2020). The Effects of Instruction Manipulation on Motor Performance Following Action Observation. *Frontiers in Human Neuroscience*, *14*(March), 1–13. https://doi.org/10.3389/fnhum.2020.00033

Grosprêtre, S., Marusic, U., Gimenez, P., Ennequin, G., Mourot, L., & Isacco, L. (2021). Stand Up to Excite the Spine: Neuromuscular, Autonomic, and Cardiometabolic Responses During Motor Imagery in Standing vs. Sitting Posture. *Frontiers in Physiology*, *12*(November), 1–19. https://doi.org/10.3389/fphys.2021.762452

Hardwick, R. M., Caspers, S., Eickhoff, S. B., & Swinnen, S. P. (2017). Neural Correlates of Motor Imagery, Action Observation, and Movement Execution: A Comparison Across Quantitative Meta-Analyses. *BioRxiv*, 1–50. https://doi.org/10.1101/198432

Jackson, J. C., Ely, E. W., Morey, M. C., Anderson, V. M., Denne, L. B., Clune, J., Siebert, C. S., Archer, K. R., Torres, R., Janz, D., Schiro, E., Jones, J., Shintani, A. K., Levine, B., Pun, B. T., Thompson, J., Brummel, N. E., & Hoenig, H. (2012). Cognitive and physical rehabilitation of intensive care unit survivors: Results of the RETURN randomized controlled pilot investigation. *Critical Care Medicine*, *40*(4), 1088–1097. https://doi.org/10.1097/CCM.0b013e3182373115

Labaki, W. W., & Rosenberg, S. R. (2020). Chronic Obstructive Pulmonary Disease. *Annals of Internal Medicine*, *173*(3), ITC17–ITC32. https://doi.org/10.7326/AITC202008040

Laveneziana, P., Albuquerque, A., Aliverti, A., Babb, T., Barreiro, E., Dres, M., Dubé, B. P., Fauroux, B., Gea, J., Guenette, J. A., Hudson, A. L., Kabitz, H. J., Laghi, F., Langer, D., Luo, Y. M., Neder, J. A., O'Donnell, D., Polkey, M. I., Rabinovich, R. A., … Verges, S. (2019). ERS statement on respiratory muscle testing at rest and during exercise. *European Respiratory Journal*, *53*(6). https://doi.org/10.1183/13993003.01214-2018

DERLEME MAKALESİ
E-ISSN: 2791-6847
JHSS 2024; 7(3): 237-247

Losana-Ferrer, A., Manzanas-López, S., Cuenca-Martínez, F., Paris-Alemany, A., & La Touche, R. (2018). Effects of motor imagery and action observation on hand grip strength, electromyographic activity and intramuscular oxygenation in the hand gripping gesture: A randomized controlled trial. *Human Movement Science*, *58*(10), 119–131. https://doi.org/10.1016/j.humov.2018.01.011

Louie, S. W. S. (2004). The effects of guided imagery relaxation in people with COPD. *Occupational Therapy International*, *11*(3), 145–159. https://doi.org/10.1002/oti.203

Moody, L., Fraser, M., & Yarandi, H. (1993). Effects of guided imagery in patients with chronic bronchitis and emphysema. *Clin Nurs Res.*, *2*(4), 478–486. https://doi.org/10.1177/105477389300200409

Nirmala, S. R., Nugroho, I. I., & Kusuma, W. (2024). Effectiveness of guided imagery lowers stress levels in Chronic Obstructive Pulmonary Disease patients at Universitas Sebelas Maret Hospital. *Jurnal Kedokteran Syiah Kuala*, *24*(1), 1–6. https://doi.org/10.24815/jks.v24i1.34418

Oishi, K., & Maeshima, T. (2004). Autonomic nervous system activities during motor imagery in elite athletes. *Journal of Clinical Neurophysiology*, *21*(3), 170–179. https://doi.org/10.1097/00004691-200405000-00005

Park, M. O., Oh, H. S., & Seo, W. S. (2021). Effects of a cognitive rehabilitation programme on cognitive function, self-management and quality of life in patients with chronic obstructive pulmonary disease. *International Journal of Nursing Practice*, *27*(4), 1–11. https://doi.org/10.1111/ijn.12932

Porro, C. A., Facchin, P., Fusi, S., Dri, G., & Fadiga, L. (2007). Enhancement of force after action observation. Behavioural and neurophysiological studies. *Neuropsychologia*, *45*(13), 3114–3121. https://doi.org/10.1016/j.neuropsychologia.2007.06.016

Scoditti, E., Massaro, M., Garbarino, S., & Toraldo, D. M. (2019). Role of Diet in Chronic Obstructive Pulmonary Disease Prevention and Treatment. *Nutrients*, *11*(6), 1–9.

Scott, M., Taylor, S., Chesterton, P., Vogt, S., & Eaves, D. L. (2018). Motor imagery during action observation increases eccentric hamstring force: an acute non-physical intervention. *Disability and Rehabilitation*, *40*(12), 1443–1451. https://doi.org/10.1080/09638288.2017.1300333

Scoyni, R., Aiello, L., Trani, I., Felli, B., Masin, A., Camponi, V., Dignazio, L., Cortese, M., Pacitti, M., Caratelli, D., & Morocutti, C. (2007). Drug Adverse Events and Drop-out Risk: A clinical case. *Arch. Gerontol. Geriatr. Suppl.*, *3*(7), 119–122.

Shimada, K., Onishi, T., Ogawa, Y., Yamauchi, J., & Kawada, S. (2019). Effects of motor imagery combined with action observation training on the lateral specificity of muscle strength in healthy subjects. *Biomedical Research (Japan)*, *40*(3), 115–123. https://doi.org/10.2220/biomedres.40.115

Stenekes, M. W., Geertzen, J. H., Nicolai, J. P. A., De Jong, B. M., & Mulder, T. (2009). Effects of Motor Imagery on Hand Function During Immobilization After Flexor Tendon Repair. *Archives of Physical Medicine and Rehabilitation*, *90*(4), 553–559. https://doi.org/10.1016/j.apmr.2008.10.029

JHSS
Journal of Health and Sport Sciences

DERLEME MAKALESİ
E-ISSN: 2791-6847
JHSS 2024; 7(3): 237-247

Szameitat, A. J., Raabe, M., Müller, H. J., & Greenlee, M. W. (2011). Motor imagery of voluntary coughing: An fMRI study using a support vector machine. *NeuroReport, 21*(15), 980–984. https://doi.org/10.1097/WNR.0b013e32833e926f.Motor

Torres-Sánchez, I., Rodríguez-Alzueta, E., Cabrera-Martos, I., López-Torres, I., Moreno-Ramírez, M. P., & Valenza, M. C. (2015). Cognitive impairment in COPD: a systematic review. *Jornal Brasileiro de Pneumologia*, *41*(2), 182–190. https://doi.org/10.1590/s1806-37132015000004424

Tusek, D., & CwynarRE. (2000). Strategies for implementing a guided imagery program to enhance patient experience. *AACN Clin Issues*, *11*(1), 68–76. https://doi.org/10.1097/00044067-200002000-00009.

Vestbo, J., Hurd, S. S., Agustí, A. G., Jones, P. W., Vogelmeier, C., Anzueto, A., Barnes, P. J., Fabbri, L. M., Martinez, F. J., Nishimura, M., Stockley, R. A., Sin, D. D., … Rodriguez-Roisin, R. (2013). Global strategy for the diagnosis, management, and prevention of chronic obstructive pulmonary disease GOLD executive summary. *American Journal of Respiratory and Critical Care Medicine*, *187*(4), 347–365. https://doi.org/10.1164/rccm.201204-0596PP

Figures

Figure 1. Motor Imagery (A) and Action Observation (B) (Cuenca-Martínez et al., 2018)