EFFECTIVENESS OF LOW INTENSITY AQUATIC EXERCISE AND FLOOR EXERCISE IN IMPROVING FUNCTIONAL VITAL CAPACITY AND FORCED EXPIRATORTY VOLUME AMONG SUBJECTS WITH COPD

A COMPARATIVE STUDY

A project submitted towards partial fulfillment of the
requirements of for the degree of

MASTER OF PHYSIOTHERAPY

Submitted by
Register number: 271730205

under the guidance of
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Submitted to
THE TAMIL NADU Dr. M.G.R. MEDICAL UNIVERSITY
Chennai – 32

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May - 2019

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INTERNAL EXAMINER :

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MAY 2019

CERTIFICATE - I

This to certify that the project work entitiled **"EFFECTIVENESS OF LOW INTENSITY AQUATIC EXERCISE AND FLOOR EXERCISE IN IMPROVING FUNCTIONAL VITAL CAPACITY AND FORCED EXPIRATORTY VOLUME AMONG SUBJECTS WITH COPD"** was carried out by **Reg.No. 271730205**, **PPG College of physiotherapy,Coimbatore-35,** affiliated to The **Tamilnadu Dr. M.G.R Medical University , Chennai – 32.** This work was done under the supervision and guidance of **Prof. SUBHASINI, M.P.T (Cardio-Resp)., MIAP.**

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CERTIFICATE - II

This is to certify that the project work entitled **“EFFECTIVENESS OF LOW INTENSITY AQUATIC EXERCISE AND FLOOR EXERCISE IN IMPROVING FUNCTIONAL VITAL CAPACITY AND FORCED EXPIRATORTY VOLUME AMONG SUBJECTS WITH COPD"** was carried out by **Reg. No. 271730205 PPG College of physiotherapy, Coimbatore-35,** affiliated to **the Tamilnadu Dr. M. G. R medical university, Chennai-32**, under my guidance and direct supervision

GUIDE

Prof. SUBHASINI
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ACKNOWLEDGEMENT

I give my thanks to **GOD ALMIGHTY** for providing me the wisdom and knowledge to complete my study successfully .

It is my bounded duty to express heartiest gratitude to my parents and family for their support and encouragement that enabled me to turn this idea in to reality.

I express my sincere gratefulness to **Dr. L.P. THANGA VELU** M.S.,F.R.C.S, Chairman and **Mrs. SHANTHI THANGAVELU**, M.A., correspondent, PPG group of institutions, Coimbatore, for their encouragement and providing the source for the successful of the study .

I express my sincere thanks to my principal Dr.**f.C.SIVAKUMAR.MPT (Orthopaedics), Ph.d.,** PRINCIPAL PPG. College of physiotherapy who extend his guidance and encouragement throughout this project.

I express heartful thanks to my Guide **Prof. SUBHASINI, M.P.T (Cardio-Resp)., MIAP** for offering me perceptive inputs and guiding me through the course of my work .

I express my thanks to each and every **PATIENTS** who co-operated to fulfill this dissertation work possible .

Last but not least I thank my **FRIENDS AND FAMILY MEMBERS** who provided support and encouragement throughout this project.

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A COMPARATIVE STUDY

ABSTRACT

INTRODUCTION

Despite the growing number of studies reporting therapeutic success in water environments, research involving aquatic exercise among patients with Chronic Obstructive Pulmonary Disease (COPD) is scarce. This study evaluates the impact of low-intensity aquatic exercise and floor exercises on COPD.

PURPOSE OF THE STUDY

The purpose of the study is to compare the effectiveness of low intensity aquatic exercise in improving functional capacity and forced expiratory volume among subjects with COPD.

METHODOLOGY:

30 subjects were selected based on the inclusion and exclusion criteria and were divided into two groups, Group A (15) and Group B (15). Group A received low intensity Floor exercise and Group B received low intensity Aquatic exercise and the Functional capacity and Forced Expiratory volume were measured using the 6 minute walk test, spirometer.

Results:

Both groups showed significant improvement in vital capacity and forced expiratory volume after treatment program. Aquatic group showed clinically and statistically significant improvement in vital capacity and expiratory forced volume when compared to the floor group.

Conclusion:

The study concluded that the subjects in the Aquatic exercise group showed statistically significant improvement (i.e) the subjects in (Group B) showed increase in functional capacity and forced expiratory volume when compared to the subjects in floor group (Group A).

KEYWORDS

COPD, Low intensity aquatic exercise and floor exercise, Functional capacity, Forced expiratory volume, 6 minute walk test.

CHAPTER I

1.1 INTRODUCTION

Chronic Obstructive Pulmonary Disease is a preventable and treatable disease, where airflow obstruction occurs with bronchial hyper responsiveness. COPD includes the chronic bronchitis and emphysema. Chronic bronchitis is characterized by chronic cough with expectoration for at least 3 months of the two consecutive years and Emphysema is defined as permanent abnormal distention of the air spaces distal to the terminal bronchioles.

Chronic Obstructive Pulmonary Disease (COPD) is currently one of the leading causes of morbidity and mortality worldwide.[1] Sufferers develop progressive incapacity and impaired quality of life associated with healthcare costs, including hospitalization for complications.[2] Intolerance of physical exertion among these patients is one of the main consequences of the disease, primarily due to decreased ventilatory capacity.[3, 4]

The disease has been associated with dyspnea and reduced quality of life,[5] leading to significant functional limitations in COPD patients,[6] compromising performance in activities of daily living.[7] Although this dysfunction has multifactorial causes, chronic decline in fitness is a major factor in the pathogenesis of muscle abnormalities. As such, several treatment strategies have been proposed, including physical exercise,[8] considered the best available form of improving muscle function.[6,7]

World wide,[11] deaths from COPD have reached over 180,000 annually. In the United States, the number of COPD has leapt over 60% since the early 1980s and deaths have doubled to 5000 a year. Mortality due to COPD is not comparable in size to the day to day effects of the disease. Although largely avoidable, COPD tends to occur in epidemics and affects young people. The human and economic burden associated with this condition is severe.

COPD is not just a public health problem for developed countries.[1] In developing countries, however, the incidence of the disease varies greatly. India has an estimated 15-20 million COPD. In the western pacific region of WHO, the incidence varies from over 50%

among children in the Caroline Islands to virtually zero in Papua New Guinea. In Brazil, Costa Rica, Panama, Peru and Uruguay, prevalence of COPD symptoms in children varies from 20% to 30%. In Kenya, it approaches 20% .In India, rough estimates indicate a prevalence of between 10% and 15% in 5-11 year old children.

The global prevalence of COPD[11] is anticipated to be approximately 4.5%. There are about 334 million patients with COPD affecting all age groups across the world. The prevalence of COPD has increased over time and an additional 100 million people world wide are expected to develop COPD by the year 2025. In India analysis using different estimating models (INSEARCH, GINA, WHO) suggest the prevalence of COPD varies between 2.05 to 3.5 (17- 30 million patients).

COPD is a common chronic communicable disease, that affects as many as 334 million people of all ages in all parts of the world. 14% of world's children experience COPD symptoms 8.6% of young adults (aged 18-45) experience COPD symptoms. The burden of COPD is greatest for children aged 10 to 14 years and the aged 75 to 79 years. COPD is the 14th most important disorder of world in terms of extent and duration of disability.

Indian Council of Medical Research the prevalence of COPD[3] is 2.05% (2.28 in rural and 1.64 in urban). There is wide variation among different areas, low in urban Secunderabad (.37%) and rural Mumbai(.74%) and relatively high at Kolkata rural (4.52%), urban(5.52%) and rural Trivandrum. Bangalore had a major prevalence of COPD as compared to other North Indian cities. In Kerala the prevalence of COPD is 10.92% in urban area and 13.18% in rural area. 5.93% of person in urban and 7.88% in rural have severe COPD. Allergic rhinitis and COPD is more prevalent in women; but varies with region.

Morbidity in United states more than half of people had COPD attack in 2008, more than children adults had an attack. 185 children and 362 adults died. It is estimated that number of people with COPD will grow by more than 100 million in 2015. World wide COPD morbidity is 25,100 patients receive general practitioner treatment and 439 emergency admissions in primary care organizations. Globally the economic burden associated with COPD exceeds these of other major diseases. In US 200% increase in hospitalization. In Europe upto 27% of the UK needed health care service.

Mortality WHO (2015); World wide, deaths from COPD have reached over 180,000 annually. In the United States, the number of COPD has leapt over 60% since the early 1980s and deaths have doubled to 5000 a year. Mortality due to COPD is not comparable in size to the day to day effects of the disease. Although largely avoidable, COPD tends to occur in epidemics and affects young people. The human and economic burden associated with this condition is severe.

It is estimated that COPD accounts for about one in every 250 deaths world wide. Many of the deaths are preventable, being due to sub optimal long term medical care and delay in obtaining help during the final attack.

Pulmonary Rehabilitation also called as pulmonary rehab[5] or PR, is a broad program that helps to improve the well being of people to have chronic (on going Breathing Problems). PR also can benefit people how need lung surgery, both before and after the surgery. PR doesn't replace medical therapy. Instead, its used with medical therapy and may include exercise training, nutritional counseling, education on your lung disease or condition and how to manage it, energy-conserving techniques, breathing strategies, psychological counseling and / or group support.

Pulmonary rehabilitation is an effective therapy. It results in improvement in exercise tolerance, improvement in the sensation of dyspnea, improvement in the ability to perform activities of daily living, improvement in health related quality of life, improvement in muscle strength, endurance masses, reductions in number of days spent in hospital. pulmonary rehabilitation is considered to be an important therapeutic intervention.

The exercise component of the program is personalized to the patients capabilities and individual goals. Current guidelines states that the exercise component of pulmonary rehabilitation should consist of aerobic exercises to achieve generalized strengthening of the peripheral muscles.

The benefits of rehabilitation may apply to all patients with dyspnea from respiratory disease, the introduction rehabilitation become appropriate when patients become aware of their disability, some patients with cardiac or locomotors disability may not benefit as much.

LOW INTENSITY EXERCISE

Intensity is the amount of physical power, expressed as a percentage of maximum, the body uses in performing an activity measuring vital capacity and forced expiratory volume is the method most often used to evaluate intensity in everyday life or to set the level of exercise.

AQUATIC THERAPY

Aquatic therapy refers to treatment and exercises performed in water for relaxation, fitness, physical rehabilitation, and other therapeutic benefit. Treatments and exercises are performed while floating, partially submerged, or fully submerged in water.

Many aquatic therapy procedures require constant attendance by a trained therapist, and are performed in a specialized temperature-controlled pool. Aquatic exercise is popular for all ages, healthy individuals with a disability, individuals with a diagnosed disease, individuals with special needs, and individuals in physical therapy.

A huge variety of aerobic and strength exercises can be performed in water.[26] The purpose of the study is to compare the effectiveness of high intensity aerobic exercise in ground level versus water level to improve the functional capacity among subjects after COPD.

Research on aquatic exercise for COPD patients is scarce. As a result, the present study sought to find the impact of a water environment on the effectiveness of training by comparing the effect of aquatic and floor exercises on the treatment of these patients.

1.2 NEED OF THE STUDY

According to other researches, COPD patients were cautioned for decades to avoid aquatic exercise, to avoid physiological cardio respiratory changes. These cautions are responsibly safe and ethical considering there was very little research evidence of aquatic exercise for various respiratory health concerns. More research is needed even though it has increased in recent decades.

The Research on aquatic exercises is scarce for subjects with COPD so this present study sought to determine the impact of a water environment on the effectiveness of training by comparing the effect of floor exercise versus aquatic exercise on the treatment.

So the need of the study is to compare the effectiveness of low intensity aquatic exercise versus floor exercise to improve the functional capacity and forced expiratory volume among subjects with COPD.

1.3 AIM OF THE STUDY

The aim of the study is to compare the effectiveness of low intensity aquatic exercise and floor exercise to improve the functional capacity and forced expiratory volume among subjects with COPD.

1.4 OBJECTIVE OF THE STUDY

- To evaluate the effectiveness of low intensity aquatic exercise to improve the functional capacity and forced expiratory volume among subjects with COPD.
- To evaluate the effectiveness of low intensity floor exercise to improve the functional capacity and forced expiratory volume among subjects with COPD.
- To compare the effectiveness of low intensity aquatic exercise versus floor exercise to improve the To evaluate the effectiveness of low intensity aquatic exercise to improve the functional capacity and forced expiratory volume among subjects with COPD.

1.5 HYPOTHESIS

NULL HYPOTHESIS

There would not have been any significant improvement in the functional capacity after the application of low intensity floor exercise versus aquatic exercise among subjects with COPD.

ALTERNATIVE HYPOTHESIS

There would have been any significant improvement in the functional capacity after the application of low intensity floor exercise versus aquatic exercise among subjects with COPD.

1.6 OPERATIONAL DEFINITIONS

COPD

Obstructive lung disease is general term that refers to a number of chronic pulmonary conditions, all of which obstruct the flow of air in the respiratory tract and affect ventilation and gas exchange. Each disease has its unique features and is distinguished by the cause of the obstruction of airflow, the onset of the disease, the location of the obstruction, and the reversibility of the obstruction.

CAROLYN

DYSPNEA

Dyspnea means difficulty in breathing. It is otherwise called the air hunger. Normally, the breathing goes on without consciousness. When breathing enters the consciousness and produces discomfort, it is called dyspnea. Dyspnea is defined ‘ as a consciousness of necessity for increased respiratory effort’.

VENGATESHWARA

HYDROTHERAPY

Aquatic exercise refers to the use of multi depth immersion pools or tanks that facilitate the application of various established therapeutic interventions, including stretching, strengthening, joint mobilization, balance and gait training and endurance training.

LYNN ALLEN COLBY

FUNCTIONAL CAPACITY

The extent to which a person can increase exercise intensity and maintain increased levels, dependent largely on cardio respiratory fitness.

FARLEX

CHAPTER II

REVIEW OF LITERATURE

2.1 Review of literature related to Chronic Obstructive Pulmonary Disease.

James K.Stooler et al., (2016) was conducted the study to find out the increasing prevalence, mortality, and disease burden. Recent estimates suggest that there are approximately 23.6 million men and women with COPD in the U.S. and more than 52 million sufferers around the world. The worldwide prevalence is likely to be underestimated for several reasons, including delays in establishing the diagnosis, the variability in defining COPD, and the lack of age-adjusted estimates. A recent multinational population-based study, placed the worldwide overall prevalence of stage-II or higher COPD at 10.1% with a higher prevalence rate for men (11.8%) than for women (8.5 %). The rates and severity of Spiro metrically confirmed COPD were higher than those previously reported. Age adjustment is important because the prevalence of COPD in people aged 65 years. In 1995, 553,000 patients were treated for COPD in the U.S., two-thirds of them were aged >65 years. The prevalence of COPD in those aged >65 years was 4 times that among those aged 45-64 years.

Massimo Gorini, Gianni Misuri et al., (2014) conducted a study to assess the the factors leading to chronic hypercapnia and rapid shallow breathing in patients with severe chronic obstructive pulmonary disease (COPD) are not completely understood. In this study the interrelations between chronic carbon di-oxide retention, breathing pattern, dyspnea, and the pressure required for breathing relative to inspiratory muscle strength in stable COPD patients with severe airflow obstruction were studied. Thirty patients with COPD in a clinically stable condition with forced expiratory volume in one second (FEV1) of <1 fliter were studied. In each patient the following parameters were assessed: (1) dyspnea scale rating, (2) inspiratory muscle strength by measuring minimal pleural pressure (PPLmin), and (3) tidal volume (VT), flow, pleural pressure swing (PPLSW), total lung resistance (RiL), dynamic lung elastance (ELdyn), and positive end expiratory alveolar pressure (PEEPi) during resting breathing. Results - Arterial carbon dioxide tension (Paco2) related directly to RLiPPLmin, and ELdynIPPLmin, and inversely to VT and PPLmin. There was no relationship between Paco2 and functional residual capacity (FRC), total lung capacity (TLC), or minute ventilation. PEEPi was similar in eucapnic and hypercapnic patients. Expressing Paco2 as a combined function of VT and PPLmin (stepwise multiple regression analysis) explained 71% of the variance in Paco2. Tidal volume was directly related to inspiratory time (TI), and TI was inversely related to the pressure required for breathing relative to inspiratory muscle strength (PPLSW, %PPLmin). There was an association between the severity of dyspnoea and both the increase in PPLSW (%PPLmin) and the shortening in TI The results indicate that, in stable patients with COPD with severe airflow obstruction, hypercapnia is associated with shallow breathing and inspiratory muscle weakness, and rapid and shallow breathing appears to be linked to both a marked increase in the pressure required for breathing relative to inspiratory muscle strength and to the severity of the breathlessness.

K. Hill et al., (2013) was conducted a study at School of Physiotherapy and Exercise Science Western Australia .Comprehensive pulmonary rehabilitation is an important component in the clinical management of people with chronic obstructive pulmonary disease (COPD). Although supervised exercise training is considered the cornerstone of effective pulmonary rehabilitation, there are many other components that should be considered to manage the impairments and symptom burden, as well as the psychosocial and lifestyle changes imposed by COPD. These include approaches designed to: 1) facilitate smoking cessation; 2) optimise pharmacotherapy; 3) assist with early identification and treatment of acute exacerbations; 4) manage acute dyspnoea; 5) increase physical activity; 6) improve body composition; 7) promote mental health; 8) facilitate advance care planning; and 9) establish social support networks. This article will describe these approaches, which may be incorporated within pulmonary rehabilitation, to optimise effective chronic disease self management.

Catherine E Rycroft, Anne Heyes, Lee Lanza, Karin Becker et al., (2012) conducted a study to quantify the burden of chronic obstructive pulmonary disease (COPD) – incidence, prevalence, and mortality and identify trends in Australia, Canada, France, Germany, Italy, Japan, The Netherlands, Spain, Sweden, the United Kingdom, and the United States of America. A structured literature search was performed (January 2000 to September 2010) of PubMed and EMBASE, identifying English-language articles reporting COPD prevalence, incidence, or mortality. Of 2838 articles identified, 299 full-text articles were reviewed, and data were extracted from 133 publications. Prevalence data were extracted from 80 articles, incidence data from 15 articles, and mortality data from 58 articles. Prevalence ranged from 0.2%–37%, but varied widely across countries and populations, and by COPD diagnosis and classification methods. Prevalence and incidence were greatest in men and those aged 75 years and older. Mortality ranged from 3–111 deaths per 100,000 populations. Mortality increased in the last 30–40 years; more recently, mortality decreased in men in several countries, while increasing or stabilizing in women. Although COPD mortality increased over time, rates declined more recently, likely indicating improvements in COPD management. In many countries, COPD mortality has increased in women but decreased in men.

Facchiano L, Hoffman Snyder C, Nunez DE et al., (2011) was conducted a study in missourito investigate the breathing retraining as a self-management strategy for individuals with chronic obstructive pulmonary disease (COPD) guided by Rosswurm and Larrabee's evidence-based practice model. Scientific literature review, grey literature review, and hand searching.An exhaustive review of the literature revealed evidence that regularly practiced pursed lip breathing is an effective self-management strategy for individuals with COPD to improve their dyspnea.They concluded that implementation of this non-pharmacological self-management intervention will improve perception of dyspnoea, functional performance, and self-efficacy in individuals with COPD.

DD Marciniuk, D Good ridge, P Hernandez, et al., (2011) was conducted a study in Canada to investigate the dyspnea and its severity and magnitude increases as the disease progresses, leading to significant disability and a negative effect on quality of life. Refractory dyspnea is a common and difficult symptom to treat in patients with advanced COPD. There are many questions concerning optimal management and, specifically, whether various therapies are effective in this set- ting. The present document was compiled to address these important clinical issues using an evidence-based systematic review process led by a representative inter professional panel of experts. The evidence supports the benefits of oral opioids, neuromuscular electrical stimulation, chest wall vibration, walking aids and pursed-lip breathing in the management of dyspnea in the individual patient with advanced COPD. Oxygen is recommended for COPD patients with resting hypoxemia, but its use for the targeted management of dyspnoea in this setting should be reserved for patients who receive symptomatic benefit. There is insufficient evidence to support the routine use of anxiolytic medications, nebulised opioids, acupuncture, acupressure, distractive auditory stimuli (music), relaxation, hand- held fans, counselling programs or psychotherapy. There is also no evidence to support the use of supplemental oxygen to reduce dyspnoea in non hypoxemic patients with advanced COPD. Recognizing the current unfamiliarity with prescribing and dosing of opioid therapy in this setting, a potential approach for their use is illustrated. They concluded the role of opioid and other effective therapies in the comprehensive management of refractory dyspnoea in patients with advanced Chronic Obstructive Pulmonary Disease.

Anna sap this and Sara booth et al., (2008) conducted a study in to evaluate the increasing evidence that the end of life needs of those with advanced COPD is not being met by existing services. Many barriers hinder the provision of good end of life care in COPD, including the inherent difficulties in determining prognosis. This review provides an evidence-based approach to overcoming these barriers, summarizing current evidence and highlighting areas for future research. They conclude end of life needs, symptom control, advance care planning, and service development to improve the quality of end of life care.

P.samarakoon et al., (2008) Conducted a study to investigate the increasing reports describing invasive pulmonary aspergillosis (IPA) in patients with chronic obstructive pulmonary disease (COPD) without the classic risk factors for this severe infection. The available literature on this association is based on case reports or small case series. The aim of this review is to systematically review these cases and describe the clinical features, diagnostic studies and outcome. They identified all the cases of IPA and COPD reported in the literature and had enough clinical information. They also included five cases of IPA in patients with COPD identified by the authors. These cases were systematically reviewed for clinical features, diagnostic studies and outcome.

R. Nielsen, M. Klemmetsby and A. Gulsvik et al., (2008) conducted a study in Nordic population. The burden of diseases should be described in terms of costs. The available literature gives imprecise estimates of costs of chronic obstructive pulmonary disease (COPD) in the Nordic populations. Previous studies have methodological weaknesses related to choice of disease criteria, the use of highly selected populations and insufficient specification of the cost process. There are no robust estimates concerning the economics of COPD in Norway. They were conducted a 1 year follow-up cost of illness study in a general Population, recruiting ever smoking Global Initiative for Chronic Obstructive Lung Disease (GOLD) stage 2+ COPD patients and ever smokers without COPD. They were used diaries to recollect data, and comprehensive questionnaires to cover all costs of COPD. The main challenges were the participants' unwillingness to complete diaries, the large amount of information and the logistics related to following up 476 individuals on four occasions during one year.

2.2 Review related to aquatic exercise

YAZIGI F, et al.,(2018) In his study, the cadence and water temperature effect on physiological responses during water cycling ten young men were included and performed the protocols in separate days. Blood lactate concentration, heart rate, oxygen uptake, ventilation and thermal comfort were collected during the exercise. The maximal HR and VO2 showed no significant differences between the protocols: HRmax:189 ± 7 (land), 188 ±14(wc27),185 ± 9 bpm(WC31) and VO2max: 4.2 ± 0.4 (land), 4.1 ± 0.5 (WC27) and 4.3 ± 0.51 min (-1) (WC31). However, the maximal BL demonstrated significant lower value during the water protocols compared to the land protocol (p=0.018). All the sub maximal physiological responses showed significant differences between the cadences (60, 70, 80 and 90 rpm). The effect of warm temperature was significant for TC response (p=0.001) showing higher values at **31**°C than 27°C (TCW27:7 ± 1 and TCW1:9**± 1),** finally concluded that higher physiological responses were showed by increasing the cadence by 10 rpm and the subjects were more comfortable when cycling in the lower water temperature.

Wang Z et al., (2018 May) Participants were randomly allocated to one of three groups: the water-based Liuzijue exercise group (WG), the land-based Liuzijue exercise group (LG), and the control group (CG). CG participants accepted no exercise intervention, while training groups performed Liuzijue exercise according to Health Qigong Liuzijue (People's Republic of China) in different environments for 60-min sessions twice a week for 3 months Of the 50 patients enrolled, 45 (90%) completed the 3-month intervention. The CG showed decreased expiratory muscle strength, extensor and flexor endurance ratio (ER) of the elbow joints and flexor peak torque (PT), total work (TW), and ER of the knee joints (p<0.05). Both training groups showed improved respiratory muscle strength, which differed from the CG (p<0.001). In addition, extensor and flexor TW of the elbow joints in the training groups were increased ($p<0.01$), and the WG differed from the CG in extensor TW and ER and flexor TW ($p<0.01$), while the LG differed from the CG in flexor TW and extensor ER ($p<0.05$). PT, PT/body weight (BW), and TW in the knee joint extensor in the training groups were increased as well (PT and PT/BW: $p<0.05$, TW: $p<0.01$), and the WG differed from the CG in terms of knee joints outcomes, while the LG differed from the CG in flexor TW only ($p<0.05$).Water-based Liuzijue exercise has beneficial effects on COPD patients' respiratory muscle strength and peripheral skeletal muscle function, and additional benefits may exist in endurance of upper limbs and strength and endurance of lower limbs when compared with land-based Liuzijue exercise.

CIDER ASA., et al., (2017)

In this study, Aquatic exercise is effective in improving exercise performance in patients with heart failure and type 2 diabetes mellitus, Twenty patients (Four women) with both CHF and 2dm (age 67.4 ± 7.1, NYHA II-III) were randomly assigned to either aquatic exercise or a control group. The patients exercised for 45 minutes 3 times /week in 33-34oc , swimming pool, concluded that aquatic exercise could be used to improve exercise capacity and muscle function in patients with the combination of CHF and 2DM[32].

White P et al, (2015) 101 patients with mild or moderate COPD registered with a South London general practice were invited to a swimming pool-based PR programme. Participants completed spirometry, the Chronic Respiratory Questionnaire (CRQ-SR), and the Incremental Shuttle Walk Test (ISWT) before and after the programme. A qualitative interview was used to assess participants' views.24 patients (24%) expressed interest; 18 were recruited and 16 (16%) completed the PR programme. Their mean age was 69 years, seven were female, and mean % predicted FEV1 was 59%. The mean number of sessions attended was 10.6 out of 12. Significant improvements in dyspnoea score (difference 4.9; 95% CI -8.27 to -1.48) and walking distance (difference 32 metres; 95% CI -52.63 to -11.36) were observed, and all other findings were in the direction of improvement. Most patients enjoyed being in the water, were happy to expose themselves in swimsuits, overcame their fears, valued learning about COPD and socializing with fellow sufferers, and were positive about their physical improvement. The swimming pool is a feasible and positive alternative venue for PR for COPD patients in primary care.

Rune Lundgren, et al (2011)

The effect of high intensity physical group training in water and on land for patients with COPD with regard to physical capacity and health related quality of life (HRQoL). A controlled, semi-randomised study was conducted where 30 patients were randomised to training either in water or on land. Thirteen patients constituted a control group. Forty-three outpatients, with moderate to severe COPD (27w/16m), from two local hospitals in northern Sweden, were included in the study. High intensity physical group training in water (water group) or on land (land group) was performed for 12 weeks, three times per week, 45min per session. The control group received no intervention. Pre- and post-intervention, all patients performed incremental and endurance shuttle walking tests (ISWT and ESWT), cycle ergometer tests and responded questionnaires about HRQoL (St. Georges Respiratory Questionnaire—SGRQ and SF-36). The patients trained with a mean heart rate of 80–90% of peak heart rate. Both training groups increased the distance walked, i.e. land group in ISWT (25m) and water group in ESWT (179m). The water group increased the distance in ESWT significantly more that both the land and the control groups. Both training groups increased the time cycled (40–85s) and work load (10–20W) in the cycle ergometer test. The control group deteriorated in HRQoL according to total score in SGRQ while the training groups remained constant. The water group improved their activity score in SGRQ and their physical health score in SF-36 and those improvements were significant as compared to the land and the control groups. In conclusion, high intensity physical group training in water is of benefit for patients with COPD. It was in some areas found to be even more effective regarding improvements in physical capacity and experienced physical health compared to the same kind of training on land.

2.3 Review of literature related to floor exercise program

Antonino Bianco et al, May 2017 Calisthenics was a term used to define a generic set of body weight exercises. Such term is now used to define a world wide spread discipline based on body weight and gymnastics exercises. The aim of this study was to administer a calisthenics training protocol and evaluate its effects on posture, strength and body composition in untrained individuals. Twenty-eight male participants (24.2 ± 4.2 years; 67.0 ± 8.3 Kg; 173.3 ± 5.2 cm) were divided into two groups, a Calisthenics based intervention group (SG) and a control group (CG). The SG exercised for 8 weeks. Each participant underwent a body composition analysis, a postural assessment, a handgrip test, a push-up and a pull-up test. Each participant was tested at baseline and post intervention. RESULTS: The SG improved their posture (with open eyes $p < 0.001$ and with closed eyes $p < 0.05$), their strength (push-up test $p < 0.01$ with a 16.4% increase and pull up test $p < 0.0001$ with a 39.2% increase) and their body composition (Fat mass 14.8 ± 5.1 vs. 11.4 ± 5.9, $p < 0.01$). No difference was shown for the handgrip test. No significant differences were displayed in any variable of the CG between pre and post measures. Calisthenics training is a feasible and effective training solution to improve posture, strength and body composition without the use any major training equipment.

O'Brien JJ et al, 2015 Participants were 43 Navy men (mean age = 32.1 year) assigned to one of three exercise training protocols: aerobic/circuit weight training performed at either 40 or 60% of determined one-repetition maximum strength or aerobic/calisthenic training. During the 10-week study, each exercise group participated in three training sessions per week performed on alternate days. The results of this study indicate that dynamic strength (both upper and lower) increased for the aerobic/circuit weight training groups but not for the aerobic/calisthenic group. With the exception of bench press endurance for the aerobic/calisthenic group, all groups showed significant increases in muscular endurance and stamina. No significant changes were seen in static strength or flexibility in any of the groups. Study II. Subjects were 87 male Navy personnel (mean age = 19.8 year) receiving basic training at the Recruit Training Command, San Diego, CA. One company of recruits (N = 41) participated in an experimental aerobic/circuit weight training program at 70% of determined one-repetition maximum. A second company (N = 46) received the standard Navy recruit physical training program (aerobic/calisthenic training). During the 8-week study, both groups participated in an identical running program performed three times per week on alternate days. Additionally, aerobic/circuit weight training participants completed two circuits (1 circuit = 15 exercises) three times per week on alternate days to running. Study findings show the experimental aerobic/circuit weight training program produced significantly greater dynamic muscular strength and muscular endurance changes than the standard aerobic/calisthenic program.

Berube c, et al (2015) The effect of different exercise training modalities in patients with chronic obstructive pulmonary disease, including strength training (n = 17), endurance training (n = 16), and combined strength and endurance (n = 14) (half of the endurance and half of the strengthening exercises). Data were compared at baseline, the end of the 12-week exercise-training program, and 12 weeks later. Improvement in the walking distance was only significant in the strength group. Increases in submaximal exercise capacity for the endurance group were significantly higher than those observed in the strength group but were of similar magnitude than those in the combined training modality, which in turn were significantly higher than for the strength group. Increases in the strength of the muscle groups measured in five weight lifting exercises were significantly higher in the strength group than in the endurance group but were of similar magnitude than in the combined training group, which again showed significantly higher increases than subjects in the endurance group. Any training modality showed significant improvements of the breathlessness score and the dyspnea dimension of the chronic respiratory questionnaire. In conclusion, the combination of strength and endurance training seems an adequate training strategy for chronic obstructive pulmonary disease patients.

Hendriks EJ, Asijee GM, Beekman E, Gosselink R, van Schayck OC et al, 2014 Aug Chronic obstructive pulmonary disease (COPD) is recognized as a systemic illness with significant extra-pulmonary features, such as exercise intolerance and muscle weakness. Pulmonary rehabilitation has been shown to be very effective in counteracting these consequences in patients with more advanced COPD. However, limited data is available on the efficacy of a physical exercise training programme in patients with mild to moderate COPD in primary care. Furthermore, it is unknown if improved exercise capacity translates into enhanced daily physical activities. The aim of this paper is to describe the design of a randomized controlled trial to assess the efficacy of a physical exercise training programme in patients with mild to moderate COPD.

In this randomized controlled trial situated in the primary care setting, 102 patients with mild to moderate airflow obstruction (FEV1 ≥ 50% of predicted), dyspnoea and a physically inactive lifestyle will be randomized to an intervention or control group. The intervention group receives a 4-month physical exercise training programme at a local physiotherapy practice, which includes exercise training, resistance training, breathing exercises and advises on how to increase the level of physical activity. The control group receives usual care, i.e. advises on how to increase the level of physical activity and a sham treatment at a local physiotherapy practice of which no physiological training stimulus can be expected. Primary outcome is functional exercise capacity at 4-months measured on the six-minute walk distance. Secondary outcomes include peripheral muscle strength, physical activity in daily life, health related quality of life, dyspnoea score and patients' perceived effectiveness. Follow-up measurement will take place at 6 months after baseline.

Naciye Vardar Yagli et al, 2013 The effects of different exercise in COPD remain to be investigated. The aim of study was to determine effects of calisthenic exercises on exercise capasity, physical fitness, quality of life, dispne, fatigue in COPD. 27 patients in GOLD level II-III randomised in study. 14 patients (mean age:61,28±5,10, FEV_1:57,28±10,54%pred) received calisthenic exercise for 6 weeks, 3 sessions per week. Control group, 13 patients (mean age:63,84±5,78, FEV_1:63,69±10,81%pred)received routine medical therapy. Pulmonary function using spirometry, exercise capacity using incremental cycle ergometer, physical fitness using Senior Fitness Test, quality of life using Saint George Respiratory Questionnaire, activities of daily living using London Chest Activities of Daily Living Scale(LCADL), dyspneae using Modified Medical Research Council dyspnea scale, fatigue using Fatigue Severity and Impact Scale were evaluated. FEV1, MVV, VO_2, VCO_2, VE, O_2 pulse, exercise time, work load increased in calisthenic group ($p<0.05$). Quality of life and Senior Fitness Test, except back scratch test subgroup, improved in calisthenic group and LCADL scores, except indoor activities subgroup, improved in exercise group ($p<0.05$). Dyspnea, fatique symptoms decreased in exercise group ($p<0.05$) while no significant improvements were seen in control group in all outcomes ($p>0.05$). Calisthenics improved exercise capacity, physical fitness, quality of life, activities of daily living while it reduced dyspnea, fatigue. It is necessary to integrate calisthenic exercise to the comprehensive pulmonary rehabilitation.

2.4 Literature regarding outcome measures

Spirometry

Antonius Schneider et al., (2018) They evaluated the sensitivity, specificity and predictive values of spirometry for the diagnosis of COPD in patients suspected of suffering from an airway disease in primary care and they estimated high diagnostic accuracy using spirometry in COPD.

Thomas L petty., (2017) John Hutchinson introduced spirometry in 1846. Joseph milic emili coined the term vital capacity. Tiffneau of paris added the term timed vital capacity that is FEV1 to spirometry.

Walker et al., (2014) Spirometry is an important tool for general practice and should have a central role in diagnosis and management of chronic respiratory diseases. There are various ways in which high quality spirometry can be made available to primary care office. spirometry can help to identify the presence of COPD. Spirometry plays a key role in patients presenting symptoms suggestive of chronic respiratory disease and the use of these symptoms to guide its application.

Modified borg scale

2.4.1 Modified Borg Scale

Alfredo Chetta et al., (2017); This study also gives evidence that the score of bronchoconstriction associated breathlessness evaluated on a modifies borg scale is a tool to successfully use to measure the perception of symptoms in patients with chronic respiratory failure.

Borg et al., (2015); Modified Brog scale is a category scale that consists of numerical ratings of sensation intensity that are anchored by verbal descriptions of sensation intensity. This scale was originally developed by Borg to allow ratings of perceived exertion during exercise. Borg scale is relatively easy for the patients to learn to use and it appears to produce valid and reproducible measurement.

Burdon et al (2011); The usual means of assessing the subjective elements of breathlessness are the modified Borg scale of perceived breathlessness and visual analogue scores. The original Borg scale of perceived exertion has been modified for the measurement of breathlessness. It has 12 points, 1 of which have accompanying verbal descriptors.

2.4.2 Six Minute Walk Test

A M. Li, J. Yin et al., (2015); The aim of this study was to assess the reliability and validity of the six minute walk test (6 MWT) in healthy children. Concurrent validity was demonstrated by good correlation between the six minute walking distance and maximum oxygen uptake determined on the exercise treadmill. Test-rest reliability was undertaken in 52 subjects, and the intra class correlation coefficient (95% confidence interval) was calculated as 0.94 (0.89-0.96). In addition, Bland and Altman plots demonstrated a high degree of repeatability. In healthy children, the 6-min walk test is a reliable and valid functional test for assessing exercise tolerance and endurance.

Hamilton Dm.HaennelRg et al., (2012); Conducted a study on validity and reliability of the six minute walk test in a cardiac rehabilitation population. They concluded that the six minute walk test is a valid and reliable method of assessing functional ability in a phase II/III cardiac rehabilitation population.

Roberta E Rikili, C Jessie et al(2011); Conducted a study to assess the reliability and validity of six minute walk test as a measure of physical endurance in order adults. The six minute walk test had good test retest reliability (.88<r<.94). In this it was concluded that the six minute walk test can be used to obtain reasonably reliable and valid measure of physical endurance in adults and that it moderately reflects overall physical and functional performance.

CHAPTER III

MATERIALS AND METHODOLOGY

3.1 STUDY DESIGN

The study design is a comparative study design with pre and post test evaluation.

3.2 STUDY POPULATION

Subjects with COPD were selected for this study.

3.3 SAMPLING SIZE

30 subjects with COPD were enrolled for this study.

3.4 SAMPLING TECHNIQUE

The subjects were selected based on convenient sampling technique and they were divided into two groups.

3.5 STUDY SETTING

The study was conducted at outpatient Department

Floor exercise : Sane fitness center, Coimbatore.

Aquatic exercise: Life fitness center, Coimbatore.

3.6 STUDY DURATION

The study duration was 3 Months.

3.7 SELECTION CRITERIA

INCLUSION CRITERIA

- Age : 40 years.
- Both genders will be included.
- Non smokers or Ex – Smokers for at least three months.
- Free of lung infection and had medical supervision and authorization for inclusion in the study.

EXCLUSION CRITERIA

- Terminal illness (Life expectancy of > 6 Months)
- Diagnosed psychiatric condition or any other condition that modifies pursed health status.
- Inability to understand spoken or written.
- Modification of COPD treatment within the last month.
- Likely to be admitted to hospital or an institution at enrolment because of their COPD.
- Patients with Neuro muscular, Renal and cardiac disease.
- Patients with uncontrolled hypertension and diabetes mellitus and those who did not perform functional tests or did not complete the 24 sessions.

3.8 MATERIALS

- Floater
- Stop watch
- spirometer

3.9 PARAMETER

RESPIRATORY MUSCLE STRENGTH ASSESSMENT

Maximal Inspiratory (MIP) and Expiratory (MEP) Pressures were measured according to standards proposed by Black and Hyatt.[15] Three reproducible maneuvers were performed,with values between them differing by no more than 10% of the highest value.

PULMONARY FUNCTION EVALUATION

Forced Vital Capacity (FVC), Forced Expiratory Volume in one second (FEV1), and the Tiffenau index (FEV1/FVC) were measured according to recommendations of the American Thoracic Society (ATS).[12,13] Relative values were calculated using Knudson et al. reference equations.[14]

FUNCTIONAL CAPACITY EVALUATION

Functional capacity was assessed by maximum distance traveled in the 6-Minute Walk Test (6MWT), in accordance with ATS recommendations.[16] The test was conducted in a straight, covered corridor 30 m long. Pulse Oxygen Saturation (SaO2%), Cardiac Frequency (CF), Arterial Pressure (AP), perceived respiratory exertion scale (Borg dyspnea) and lower limb fatigue (Borg lower limbs) using the Borg CR10 scale,[17] were measured at the beginning and end of the testing. Two tests were conducted on alternate daysand the best values were used. The 6MWT was performed by the same investigator, without assistance, using standard phrases of encouragement at the end of each minute.

BODE MORTALITY PREDICTOR INDEX.

The BODE index was calculated for each patient using the variables FEV1, distance traveled in the 6MWT, MRC and BMI. Points for each variable were added to determine the BODE score.

3.9 PROCEDURE

The purpose and objectives of the study was clearly explained to the ethical committee of PPG college of physiotherapy and permission was obtained. After that the study was planned to conduct at sane fitness center and life fitness center, Coimbatore. 45 subjects were showed their interest to participate in this study on that 30 subjects who came under the selection criteria were enrolled for this study. They were received clear explanation in detail about the treatment procedure, merits and demerits and effect and uses before stating the study. After that they were asked to submit written informed consent form.

30 subjects were randomly allocated into two groups by lot method. Group A consisting of 15 subjects and they were received low intensity floor exercise. Group B consisting of 15 subjects and they were received low intensity aquatic exercise.

Both the group members received intervention for one session per day three times in a week for 8 weeks. The total treatment session was 24 sessions. The primary outcome of the study was functional capacity and it was measured by using six minute walk distance test. The pre and post score values of functional capacity and forced expiratory volume were measured and data were recorded.

LOW INTENSITY FLOOR EXERCISE

- 1st stage: continuous exercises for upper and lower limbs, for 15 min, without weights according to the ability of each patient, consisting of callisthenic activities associated with the respiratory cycle.
- 2nd stage: unsupported upper limb exercises using weights (halters) and diagonal movements for 2 min, with equal rest periods. Weekly loads were increased according to the individual ability of each participant. Ideal weight used was previously established by the incremental test, training with an initial weight of 50% of the maximum load supported by the subject.
- 3rd stage: lower limb training performed on an exercise bicycle for 30 min. Exercise intensity was determined individually by a Borg dyspnea and perceived effort score of 5.[20]
- 4th stage: 15 min of cooling-down exercises for muscle groups used during the session.

LOW INTENSITY AQUATIC EXERCISE

The physical training session was divided into four phases [19], in a pool heated to 32 ± 2 °C:

- 1st phase: continuous warm-up exercises for the upper and lower limbs for 15 min, without weights, consisting of callisthenic activities related to the respiratory cycle.
- 2nd phase: unsupported upper limb exercises, using two diagonal movements and weights (halters) for 2 min, with an equal rest period. Loads were increased weekly in accordance with the ability of each subject. Ideal weight was previously established for each individual using the incremental test and training with an initial weight of 50%

of the maximum load supported by the patient.

- 3rd phase: training for lower limbs using floats positioned between the legs and subjects performing bicycle movements in the water for 30 min. Exercise intensity was individually determined by applying the BORG dyspnea and perceived effort score of 5.
- 4th phase: approximately 15 min of cooling down exercises for muscle groups used during the session.

3.10 TREATMENT TECHNIQUE

Subjects in each group were received common form of warm up and cool down session.

WARM UP SESSION:

Continuous exercises for upper and lower limbs, for 15 min, with and with out weights according to the ability of each patient, consisting of callisthenic activities.

TECHNIQUES:

- **LOW INTENSITY FLOOR EXERCISE**

  Subjects in Group A were received low intensity floor exercise. The exercise was given in the form of 6MWT and with or without Weight lifting.

- **LOW INTENSITY AQUATIC EXERCISE**

  Subjects in Group B were received low intensity aquatic exercise. The exercise was given in the form of 6MWT.

COOL DOWN SESSION: 15 min of cooling down exercises for muscle groups used during the session.

MEASUREMENT PROCEDURE OF FUNCTIONAL CAPACITY:

The functional capacity was measured by using six minutes walking distance test. The test was conducted in a straight, covered corridor of 30 meters long. The subjects were seated in the starting point. About 10 minutes of rest period was given to all the subjects for general relaxation.

The subjects were instructed to walk in straight for six minutes without any diversion and also there were asked to inform any discomfort during the test.

Before stating the test the subject were checked for vital and the readings were documented. The subjects were received instruction and timings during the test. The lap which is completed during the test was documented in a worksheet. After six minutes the subject was asked to stop walking and the total distance was measured.

CHAPTER IV

DATA ANALYSIS AND RESULT

The study consisting of two group to find out the effectiveness of low intensity aquatic exercise and floor exercise training on functional capacity among subjects with COPD.

4.1 STATISTICAL TOOLS

Within group analysis was done by using paired t- test and between group analysis was done by using unpaired t-test.

PAIRED 't' TEST

The paired t-test was used to find out the statistical significance between pre and post t-test values of low intensity floor exercise and aquatic exercise before and after treatment for Group A and Group B.

$$S = \sqrt{\frac{\sum(x-\bar{x})^2}{n-1}}$$

$$t = \frac{\bar{d}\sqrt{n}}{s}$$

d= difference between the pre test Vs post test

d-= mean difference

n= total number of subjects

s= standard deviation

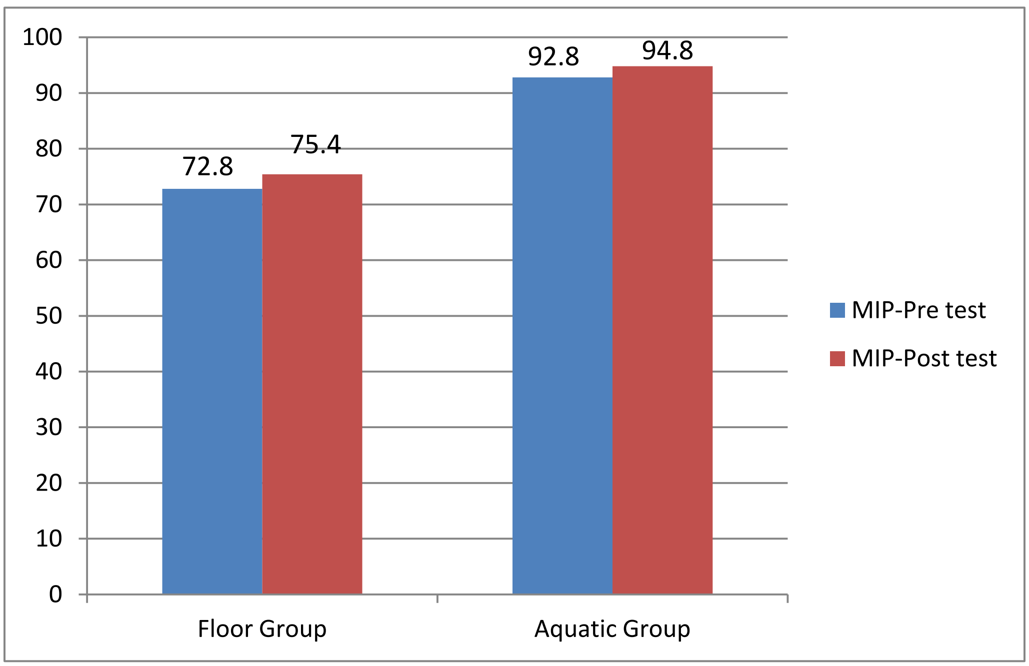
4.2 DEMOGRAPHIC DATA

Variable	**Group A**	**Group B**
AGE	47.2	48.5
DURATION(weeks)	12	12

Table No: 01 : Demographical data

4.3 ANALYSIS OF THE PRE AND POST MAXIMUM INSPIRATORY PRESSURE FOR FLOOR GROUP AND AQUATIC GROUP

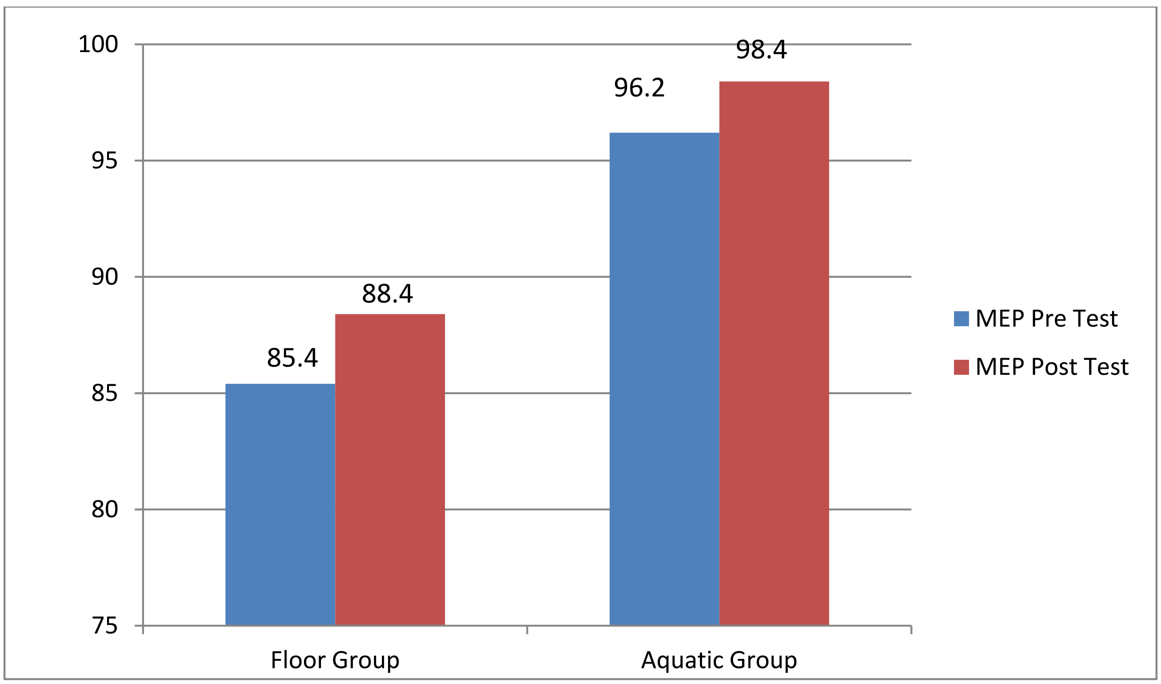
When evaluating respiratory muscle strength, a statistical difference was observed in maximal respiratory pressures in the training groups after the physical exercise program; MIP in the FG pre test was 72.8 and post test was 75.4, AG pre test was 92.8 and 94.8. However, intergroup comparison showed a significant difference in the MIP between the FG and AG training groups



Graph No :1: Graphical representation shows most inspiratory pressure comparison of two groups.

4.4 ANALYSIS OF THE PRE AND POST MAXIMUM EXPIRATORY PRESSURE FOR FLOOR GROUP AND AQUATIC GROUP

When evaluating respiratory muscle strength, a statistical difference was observed in maximal expiratory pressures in the training groups after the physical exercise program; MEP in the FG pre test was 85.4 and post test was 88.4, AG pre test was 96.2 and 98.4. However, intergroup comparison showed a significant difference in the MEP between the FG and AG training groups.



Graph No :2: Graphical representation shows most expiratory pressure comparison of two groups.

4.5 Analysis of Pre and post test FVC values of the Floor Exercise Group and Aquatic Exercise Group

GROUP	N	PRE TEST		t	SIGNIFICANCE VALUE
		MEAN	SD		
Floor Group	15	2.1713	.35924	.343	.734
Aquatic Group	15	2.1153	.51950		
Group	N	Post test		t	Significance Value
		Mean	SD		
Floor Group	15	2.2540	.35910	2.590	.015
Aquatic Group	15	2.6580	.48587		

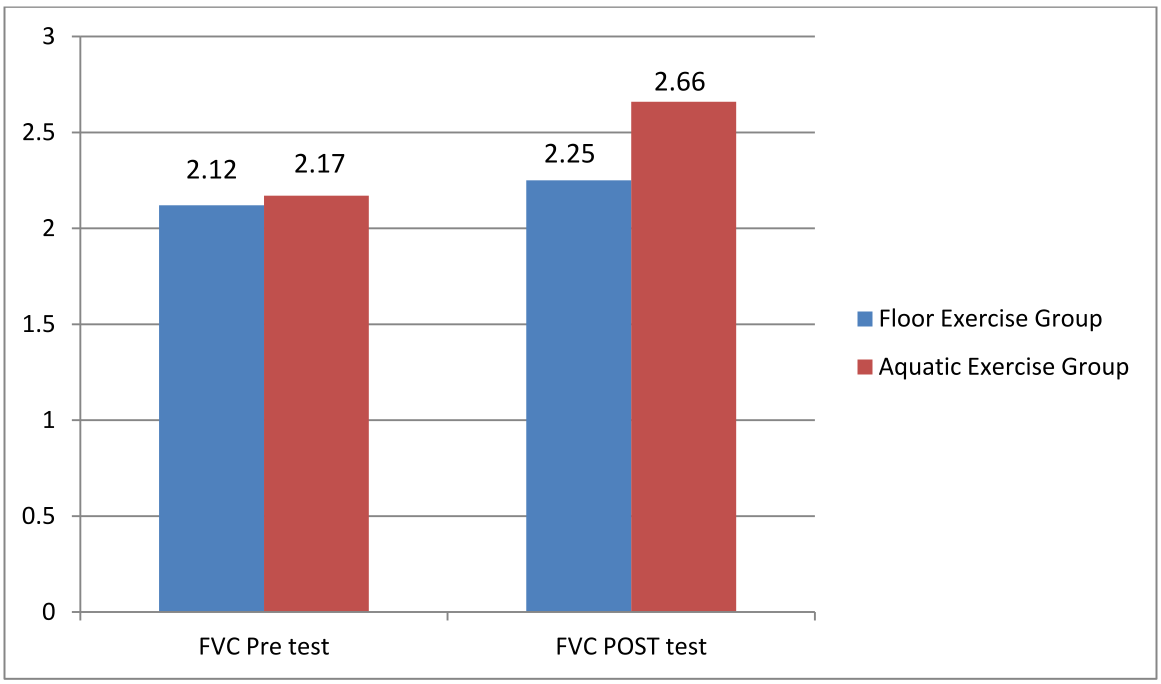
Table No: 02 : For pre test floor group mean value is 2.1713 and standard deviation is.35924. For the pre test aquatic exercise group mean value is 2.1153 and standard deviation is.51950. The 't' value is .343 which is significant at 5% level. That there is significant difference between the FVC scores of the two groups at 5 % level of significance.

For post test floor group mean value 2.2540 and standard deviation is.35910. For the post test aquatic exercise group mean value is 2.6580 and standard deviation is.48587. The 't' value is 2.590 which is significant at 5% level. That there is significant difference between the post FVC scores of the two groups at 5 % level of significance.

COMPARISON OF PRE TEST AND POST TEST OF FVC VALUES FOR THE FLOOR EXERCISE GROUP AND AQUATIC EXERCISE GROUP

Group	N	improvement		t	Significance Value
		Mean	SD		
Floor Group	15	2.1713	.35924	14.224	.000
Aquatic Group	15	2.2540	.35910		

Table No: 03 The 't' value is 14.224 which is significant at 5% level. The post FVC values are significantly greater than the pre FVC value. Data analysis shows improvement in vital capacity.



Graph No :3: Graphical representation shows FVC for two groups.

4.6 Analysis of the FEV1 scores of pre and post floor exercise and aquatic exercise group

Group	N	Pre test		t	Significance Value
		Mean	SD		
Floor Group	15	1.5407	.26133	.334	.741
Aquatic Group	15	1.5033	.34533		
Group	N	Post test		t	Significance Value
		Mean	SD		
Floor Group	15	1.6273	.27727	2.882	.007
Aquatic Group	15	1.9507	.33448		

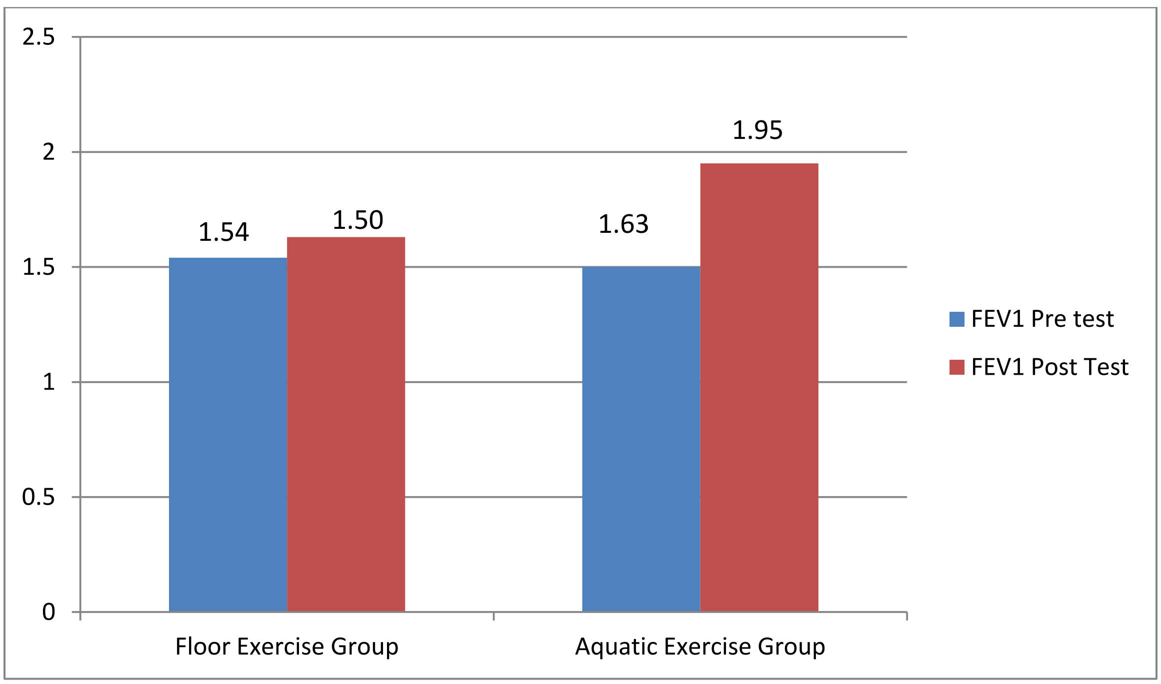
Table No: 04 For pre test floor group mean value is 1.5407 and standard deviation is .26133. For pre test aquatic group mean value is 1.5033 and standard deviation is .34533. The ‘t’ value is .334 which is not significant at 5% level. That is there is no significant difference between the pre fev1 scores of the two groups at 5% level.

For post test floor group mean value is 1.6273 and standard deviation is .27727. For the post test aquatic group mean value is 1.9507 and standard deviation is .33448. The ‘t’ value is 2.882 which is not significant at 5% level. That is there is significant difference between the post FEV1 measurement scores of the two groups at 5% level of significance. This might be due to cumulative effect of aquatic exercise along with conventional physiotherapy.

COMPARISON OF FEV1 SCORES OF FLOOR EXERCISE AND AQUATIC EXERCISE GROUP

Group	N	Improvement		t	Significance Value
		pretest	Posttest		
Floor Group	15	1.5407	1.50	3.514	.003
Aquatic Group	15	1.6273	1.95		

Table No: 05 The 't' value for both group is 3.514 which is significant at 5% level. Data analysis shows significant improvement in forced expiratory volume.



Graph No :4: Graphical representation shows FEV1 of two groups.

4.7 Analysis of pre and post test values for six minute walk test for Floor exercise group and Aquatic exercise group

Group	N	Pre test		t	Significance Value
		Mean	SD		
Floor Group	15	216.00	28.50063	0.067	.947
Aquatic Group	15	216.67	25.96059		
Group	N	Post test		t	Significance Value
		Mean	SD		
Floor Group	15	250.00	27.07397	2.331	.027
Aquatic Group	15	274.87	31.19951		

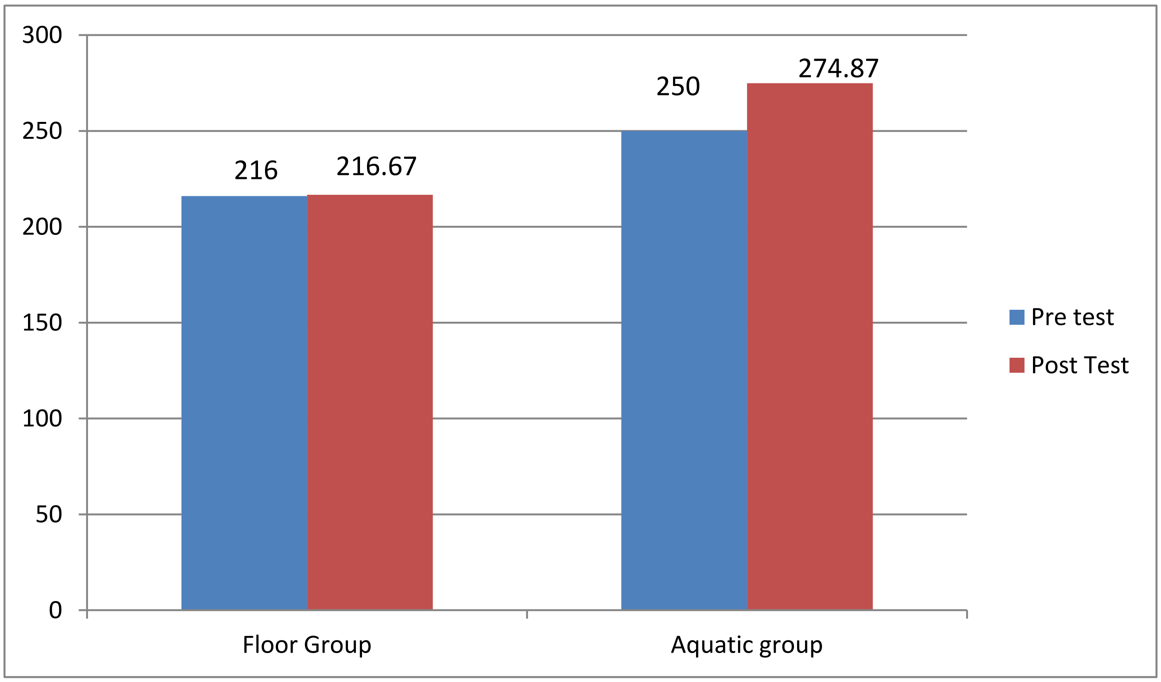
Table No: 06 For pre test floor group mean value is 216. 00 and standard deviation is 28.50063. For the aquatic exercise group mean value is 216.67 and standard deviation is 25.96059. The 't' value is 0.067 which is not significant at 5% level. That there is no significant difference between the pre 6MWT scores of the two groups at 5 % level

For post test floor group mean value is 250.00 and standard deviation is 27.07397. For the aquatic exercise group mean value is 274.87and standard deviation is 31.19951. The 't' value is 2.331 which is significant at 5% level. That there is significant difference between the post 6MWT scores of the two groups at 5 % level of significance. This might be due to cumulative effect of aquatic exercise along with conventional physiotherapy.

Comparison of Floor exercise and Aquatic exercise group six minute walk test

Group	N	Improvement		t	Significance Value
		Mean	SD		
Floor Group	15	216.67	25.96059	26.692	.000
Aquatic Group	15	274.87	31.19951		

. **Table No: 07** The 't' value is 26.692 which is significant at 5% level. That there is significant difference between the pre and post 6MWT values at 5% level of significance. The post 6MWT values are greater than the pre 6MWT values. This might be due to the effect of aquatic exercise



Graph No :5: Graphical representation shows 6MWT for two groups.

CHAPTER V
DISCUSSION

The present study assessed the impact of two low-intensity physical training protocols (floor and aquatic exercise) on COPD, by analyzing several outcomes. The data suggest that both modalities of low-intensity physical exercise were beneficial to patients with moderate to very severe COPD. An interesting finding is that, with the same exercise intensity, the group submitted to training in water exhibited additional benefits for physical capacity in relation to the floor exercise group.

COPD occurs among adults, primarily from their forties onwards. This may explain the difference between the FG and AG in regard to age, despite the randomized nature of the study. However, for the lungs in particular, it is difficult to distinguish between impacts resulting solely from Physiological aging and those attributed to the cumulative effect of environmental action.

Thus, cellular changes caused by aging and those provoked by smoking may involve interrelated pathogenic mechanisms. Aging can lower the injury threshold or increase mechanisms involved in lung damage through smoking. Tobacco smoke can also act as an environmental factor, disrupting organ repair and maintenance, contributing to the aging process.[21] According to our results, FEV1 increased significantly in the training groups. This finding corroborates several literature studies[1,5] confirming that the rehabilitation program results in improved spirometry, despite previous research indicating pulmonary rehabilitation[22] does not alter pulmonary function. Nevertheless, the long-term behavior of pulmonary function after completing a physical exercise program is unknown. Patients who presented exacerbation and therefore changed the medication were excluded. The individuals used the same drug and dose during the entire study. Thus, the changes in FEV1 in the training groups were induced by exercise.

This outcome in pulmonary function among trained individuals is due to improved oxidative capacity, resulting in efficient skeletal muscles that reduce alveolar ventilation for a given work rate, thereby decreasing the dynamic hyperinflation found in COPD patients. Several studies[23, 24] have shown that physical training or respiratory reeducation may increase respiratory muscle strength, although the effectiveness of specific muscle training is widely debated[9] aquatic exercises is greater when compared with floor exercises, capable of achieving double the value required to produce an aerobic training effect in this environment.

The assessment of HRQOL is an important issue to take into account when developing therapeutic strategies andb Redelmeier et al.,[27] studied 112 patients with COPD, suggesting that an alteration of 54 m in the 6MWT can be considered clinically relevant. Puhan et al[28], reported that 6MWT must change by approximately 35 m in subjects with moderate to severe COPD in order to represent a significant effect. This was not observed in the floor exercise group, which exhibited a slight increase of only 22 m after training. Furthermore, a reduction in the 6MWT was recorded in the CG, corroborating a similar study.[20] This demonstrates the high physical and functional limitations of physically inactive COPD patients.

Thus, these results indicate that energy spent performing evaluating the results thereof. At the beginning of the present study, the SGRQ was not able to differentiate the two groups, but for all domains analyzed the worst quality of live. Perhaps this can be explained by the GC have more elderly patients than the other groups examined, and probably have a reduced ability to perform activities with age.

It is well documented that individuals with COPD have impaired HRQOL[9,20]. When assessing quality of life levels among patients in the present study, a difference was found in all domains of the COPD-specific questionnaire, the SGRQ, before and after physical training. Research on the effects of pulmonary rehabilitation in COPD patients found better scores for all domains of the SGRQ after rehabilitation.[22,30]

This study recorded an important clinical difference in the aquatic training group for all SGRQ domains. This alteration, evidenced by the increase greater or equal to 4% in any domain or the sum of all points, after intervention, represents a significant change in quality of life for subjects with COPD.[18] The CG displayed a significant post-intervention increase in the impact domain and total score, as well as a clinical rise in symptom and activity scores. These findings reveal an important clinical reduction in HRQOL for physical training groups. A significant difference was found between the CG and FG for all domains. Studies of the aquatic environment in COPD patients are scarce. We found only two investigations[31,32] in the existing literature comparing aquatic and floor exercise environments in this population. The first carried out reports that all subjects performed exercises better in water, with no clinically relevant desaturation, arrhythmia or discomfort and suggest that cardiorespiratory adaptation during physical training in water fully compensates the restricted lung volume evidenced by hydrostatic pressure[32]

The second study, using high-intensity exercise[20], concluded that the water training group showed additional benefits in physical capacity and physical health in relation to the floor exercise group. Thus, the selection of highly motivated participants is especially important in the case of programs in an outpatient regimen.

CHAPTER- VI
SUMMARY AND CONCLUSION

6.1 SUMMARY

In the present study, which used low-intensity physical exercise without specific respiratory muscle training, MIP and MEP increased significantly with the intervention proposed and was better in training groups when compared to the control. However, there as no difference in regard to the environment used and maximal respiratory pressures. A possible explanation for the respiratory muscle strength gain achieved through physical exercise is structural changes in the size and proportion of type I and II muscle fibers of the internal and external intercostals muscles, as well as accessory respiratory muscles.

In clinical practice, the 6MWT is frequently used to evaluate changes in functional capacity among COPD patients after pulmonary rehabilitation. Contrary to expectations, physical training groups in this study did not significantly increase 6MWT distance following intervention

A number of clinical investigations have analyzed the benefits of pulmonary rehabilitation through exercise capacity, severity of dyspnea and HRQOL. These findings are based on controlled, randomized clinical trials. Results obtained for these variables show that benefits to COPD are generally greater than in any other treatment. A significant increase was also observed in the 6MWT following intervention for the AG, in accordance with the relevant literature. This important outcome is directly reflected in the improved functional capacity recorded in the group submitted to water training, since aerobic metabolism is the energy source used to sustain physical activity in water.

Results show that physical exercise lessened the severity and frequency of COPD symptoms, increasing physical performance for a certain level of activity, in addition to optimizing social and psychological function among these individuals.

6.2 CONCLUSION

In conclusion both programs water and floor exercises produced positive results, with water environments having the added advantage of being low impact, in addition to representing a new therapeutic modality for COPD sufferers.

CHAPTER VII

LIMITATION AND SUGGESTION

LIMITATIONS:

- The study was conducted on smaller samples.
- The study included males and females, if one gender was considered homogenicity can be maintained.
- Only one outcome measures was included.
- Study did not include follow up programme to know whether the effect was maintained.
- Only one type of training was given to the subjects.

SUGGESTIONS:

- Long term follow up is needed to evaluate whether there is any sustained effect after treatment.
- Studies including large sample size are recommended to make the results more valid.
- It is suggested that number of treatment sessions should be increased and the effect analyzed.

CHAPTER-VIII

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CHAPTER-IX

ANNEXURE-I

INFORMED CONSENT FORM

TITLE: A COMPARATIVE STUDY ON EFFECTIVENESS OF LOW INTENSITY FLOOR EXERCISES AND AQUATIC EXERCISES IN IMPROVING FUNCTIONAL CAPACITY AND FORCED EXPIRATORY VOLUME AMONG SUBJECTS WITH COPD.

INVESTIGATOR:

CO-INVESTIGATOR:

PURPOSE OF THE STUDY:

I -------------- have been informed that is study will help clinicians and therapists to find out the effectiveness of floor and aquatic exercise on improving functional capacity and forced expiratory volume.

PROCEDURE:

I ---------- understand that I will undergo experiments with ---------- Under the direct supervision of coach. I am aware that I have to follow therapist's instruction as has been told to me.

RISK AND DISCOMFORT:

I --------------------- understand that there are no potential risks associated with this procedure, and understand that ------ will accompany me during this procedure.

CONFIDENTIALITY :

I ------------------ understand that the medical information produced by this study will be confidential. If the data are used for publication in the medical literature or for teaching purpose, no name will be used and photographs will be used without identify for publication and presentation.

REQUEST FOR MORE INFORMATION:

I ----------------------- understand that I may ask any question about the study at any times……… are available to answer my question. Copy of this concern form will be given to me keep for my careful reading.

REFUSAL OR WITHDRAWAL OF PARTICIPATION:

I ……………………understand that my participation is voluntary and I may withdraw consent and discontinue participation at any time after he has explained the reasons for doing so.

INJURY STATEMENT:

I ……………..Understand that the diagnosis/ treatment procedure, under the guidance of my therapist, is likely to cause any/ no injury. In such case medical attention will be provide, but in compensation will be provide.

I understand my agreement to participation in this study and I am not waiving any of my legal rights. I ………… confirm that ……………… have explained me the purpose of the study procedure and possible risk that it may experience. I have read and I have understood this concern to participate as a subject in this study……………

………………………………….   ……………………………………

SUBJECT   **DATE**

………………………………….   …………………………………….

WITNESS TO SIGNATURE   **DATE**

I have explained……………. The purpose of the research, the procedure required and the possible risks and benefits, to the best of my ability.

Investigator's Signature

Investigator's Name

ANNEXURE –II

RESPIRATORY ASSESSMENT FORM

SUBJECTIVE EVALUATION

NAME	
AGE GENDER HEIGHT WEIGHT BMI	
OCCUPATION	
CHIEF COMPLAINTS	
DURATION OF CONDITION	
PAST MEDICAL HISTORY	
PRESENT MEDICAL HISTORY	
FAMILY HISTORY	
DRUG INTAKE	

OBJECTIVE ASSESSMENT

A. DYSPNOEA

ON STERNOUS ACTIVITY	
ON ORDINARY ACTIVITY	
ON MILD EXERTION	
AT REST	

B.WHEEZE

DIURNAL VARIATIONS	
AGGERVATING FACTORS	
POSTURAL VARIATIONS	

C.COUGH

DRY/PRODUCTIVE	

D.SPUTUM

COLOUR	
CONSISTANCY	

ON OBSERVATION	
BODY BUILT	
BREATHING PATTERN	
USE OF ACCESSORY MUSCLE	
CYANOSIS	

VITAL SIGNS

TEMPERATURE	
RESPIRATORY RATE	
BLOOD PRESSURE	
PULSE RATE	

ON EXAMINATION

A.BREATHING PATTERN

RATE	
DEPTH	
RHYTHUM	
CHEST WALL EXPANSION	

B.CHEST WALL CONFIGURATION

PECTUS EXCAVATUM	
PECTUS CARINATUM	
FLIAL CHEST	

C. ON PALPATION

SYMMETRY OF CHEST MOVEMENT	
MUSCLE SPASM	
TACTILE FREMITUS	
TRACHEALDEVIATION	

D.ON PERCUSSION

RESONANT	
HYPER RESONANT	
DULL	
FLAT	

E.ON AUSCULTATION

A. BREATH SOUNDS	
NORMAL	
ABNORMAL	
ADVENTITOUS	
B. HEART SOUNDS	

INVESTIGATION

PULMONARY FUNCTION TEST	FVC
	FEV 1
	FEV 1 / FVC
	PEFR
ARTERIAL BLOOD GAS ANALYSIS	
CHEST X RAY	

DIAGNOSIS				
AIM OF TREATMENT				
MEANS OF TREATMENT				
WHEATHER THE PATIENT IS SELECTED	YES		NO	
FOR STUDY				
IF YES	GROUP A		GROUP B	

ANNEXURE – III

DATA COLLECTION SHEET

Name…………………………………………………………………….Patient

ID…………………………………………..

Date……………………….Gender………………Age……...EXPERIMENTAL

GROUP / CONTROL GROUP

GROUP	**FLOOR EXERCISE GROUP**		**AQUATIC EXERCISE GROUP**	
	PRE TEST SCORE	POST TEST SCORE	PRE TEST SCORE	POST TEST SCORE
FVC				
FEV1				
6MWT				

SPIROMETER

- Spirometer is a device for measuring timed expired and inspired volumes, and hence how quickly and effectively the lungs can be emptied and filled.
- Spirometer should be used to diagnose airflow obstruction in patients with respiratory symptoms spirometry can also be used to monitor disease progression and also rehabilitation and treatment gains. It is the gold standard for the diagnosis, assessment and monitoring of chronic obstructive pulmonary disease and is now the preferred method over PEFR measurement for confirmation of obstruction of airways in the diagnosis of asthma in adults and children (Children under 5 years are unsuitable for this form of testing and there is great variation in the 5-12 year range). It is felt to offer clearer identification of airway obstruction and to be less effort-dependent.

Instructions for spirometry

- Prior to testing, the patient's condition should be stable
- Standing is not mandatory but may provide better results. Sitting is safer for the elderly and infirm; if sitting, then the patient should sit straight up, with their head slightly extended.
- Breathe in maximally.
- Hold the mouthpiece between the teeth, and then apply the lips for an airtight seal.
- Breathe out as hard and as fast as possible. The patient should aim for maximal flow at the moment expiration start rotating while the spirometer is brought to the lips, thus avoiding artefacts.
- Keep breathing out until the lungs are 'EMPTY'.
- Some get the users to practise just emptying their lungs, ie to do a slow vital capacity (SVC - The amount of air that can be breathed out during the largest possible breath when breathing gently) before getting to repeat the same as quickly as possible. This allows comparison of the SVC with the forced vital capacity (FVC - the maximum amount of air a person can expel from the lungs after a maximum inspiration) and allows the user to discard poor attempts where the FVC is below the expiration volume.
- Limit the total number of attempts (practice and recordings) to eight.

- Three satisfactory blows should be performed and best values taken for interpretation criteria for satisfactory blows are :
- The blow should continue until a volume plateau is reached - This may take more than 12 seconds in severe COPD.
- FVC and FEV1 readings should be within 5% or 100ml.
- The expiratory volume-time graph be smooth and free from irregularities.

MEASUREMENTS

Measurement	Definition	Interpretation
Vital capacity (VC)	**Slow vital capacity (SVC) -** maximal amount of air exhaled steadily from full inspiration to maximal expiration. Not time dependent. **Forced Vital capacity (FVC)-** Volume of lungs from full inspiration to forced maximal expiration. Expressed as a percentage of the predicted normal for a person.	SVC should >80% predicted, reduce in restrictive disease.FVC is reduced in restrictive disease and also in obstructive disease if air-trapping occurs.
Forced expiratory volume in one second (FEVI)	Volume of air expelled in the first second of a forced expiration.	Reduce in both obstructive and restrictive disease.
Forced expiratory ratio (FER)%	(FEVI / FVC) x 100 Percentage of FVC expelled in the first second of a forced expiration.	Remains normal (or even elevate) in restrictive disease, reduced obstructive disease.

INTERPRETATION

For a full assessment you need to consider the spirometry derived values: FEVI , FVC. Calculate the FEVI / FVC ration. Compare these with the individual's predicted values .(Based on age, Sex, race and height)

FEV1

FEV1 is likely to show up the lesser degrees of airflow obstruction occurring later in the expiratory effort.

FVC

Patients with COPD may have a reduction in FVC

FEV1/FVC RATIO

A ratio of 70% implies obstructive disease.

Obstructive ventilatory pattern: due to conditions in which airways are obstructed due to diffuse airways narrowing of any cause- eg, COPD, extensive bronchiectasis, cystic fibrosis, lung tumours. The FVC and FEV1 are reduced disproportionately:

FVC normal or reduced

FEV1 reduced 80%

FEV1/ FVC reduced.

SIX MINUTE WALK TEST

6MWT is performed to assess the exercise capacity location. The 6MWT should be performed indoors, along a long, flat, straight, enclosed with a hard surface that is seldom travelled. If the weather is comfortable, the test may be performed outdoors. The walking course must be 30 m in length. A 100-ft hallway is, therefore required. The length of the corridor should be marked every 3 m. The turnaround points should be marked with a cone. A starting line, which marks the beginning and end of each 60-m lap, should be marked on the floor using brightly colored tape.

REQUIRED EQUIPMENT 1. Countdown timer (or stopwatch) 2. Mechanical lap counter 3. Two small cones to mark the turnaround points 4. A chair that can be easily moved along the walking course 5.Worksheets on a clipboard 6.A source of oxygen 7.Sphygmomanometer 8. Telephone 9.Automated electronic defibrillator.

PATIENT PREPARATION 1.Comfortable clothing should be worn. 2.Appropriate shoes for walking should be worn. 3.Patients should use their usual walking aids during the test (Cane, Walker, etc.). 4. The patient's usual medical regimen should be continued. 5. A light meal is acceptable before early morning or early afternoon tests. 6.Patients should not have exercised vigorously within 2 hours of beginning the test.

MEASUREMENTS 1. Repeat testing should be performed about the same time of day to minimize intraday variability. 2. A "Warm-up" period before the test should not be performed. 3. The patient should sit at rest in a chair, located near the starting position, for at least 10 minutes before the test starts. During this time, check for contraindications, measure pulse and blood pressure, and make sure that clothing and shoes are appropriate. 4. Pulse oximetry is optional. 5. Have the patient stand and rate their baseline dyspnea and overall fatigue using the Borg scale 6.Set the lap counter to zero and the timer to 6 minutes. Assemble all necessary equipment (lap counter, timer, clipboard, Borg Scale worksheet) and move to the starting point. 7. Instruct the patient as follows: "The object of this test is to walk as far as possible for 6 minutes. You will walk back and forth in this hallway. Six minutes is a long time to walk, so you will be exerting yourself. You will probably get out of breath or become exhausted. You are permitted to slow down, to stop, and to rest as necessary. You may lean against the wall while resting, but resume walking as soon as you are able. You will be walking back and forth around the cones. You should pivot briskly around the cones and continue back the other without hesitation. Now I'm going to show you. Please watch the way I turn without hesitation. "Demonstrate by walking one lap yourself. Walk and pivot around a cone briskly. " Are you ready to do that? I am going to use this counter to keep track of the number of laps you complete. I will click it each time you turnaround at this starting line. Remember that the object is to walk AS FAR AS POSSIBLE for 6 minutes, but don't run or jog. Start now, or whenever you are ready 8. Position the patient at the starting line. As soon as the patient starts to walk, start the timer. 9. Do not talk to anyone during walk. Watch the patient. 10. Post-test: Record the post walk Borg dyspnea and fatigue levels 11. If using the pulse oximeter, measure SpO2 and pulse rate from the oximeter and then remove the sensor. 12. Record the number of laps from the counter 13. Record the additional distance covered 14. Congratulate the patient on good effort.