CHAPTER II

REVIEW OF RELATED LITERATURE

Literature survey has served as guideline to identify the general trends in the area of mode of treatment of obesity. Such a brings about a deep clear perspective of the overall field. Series and scholarly attempts have been made to go through the related literature with the support of e- journals, studies and abstracts of reputed journals and web sources. The salient aspects related to this study are briefly discussed below under suitable headings.

Abdellaoui et al (2011) has Conducted A study on “Skeletal muscle effects of electro stimulation after COPD exacerbation: a pilot study”. Muscle dysfunction is a major problem in chronic obstructive pulmonary disease (COPD), particularly after exacerbations. We thus asked whether neuromuscular electro stimulation (NMES) might be directly useful following an acute exacerbation and if such a therapy decreases muscular oxidative stress and/or alter muscle fiber distribution. A pilot randomized controlled study of NMES during 6 weeks was carried out in 15 inpatients (n=9 NMES; n=6 Sham) following a COPD exacerbation. Stimulation was delivered to the quadriceps and hamstring muscles (35Hz). Primary outcomes were quadriceps force and muscle oxidative stress. At the end of the study, quadriceps force improvement was statistically different between groups (p=0.02), with a significant increase only in the NMES group (median 10 (4.7-11.5) kg, p=0.01). Changes in the 6-minute walking distance were statistically different between groups (p=0.008), with a significant increase in the NMES group (165 (125-203) m, p=0.003). NMES did not lead to higher muscle oxidative stress as indicated by the decrease in total protein carbonization (p=0.02) and Myosin Heavy Chain carbonization (p=0.01) levels. Finally It was further observed a significant increase in type I fibers proportion in the NMES group. Hence the study was conducted that following COPD exacerbation, NMES was effective in counteracting muscle dysfunction and decreases muscle oxidative stress.

Amann et al (2010) has conducted a study on” Impact of pulmonary system limitations on locomotor muscle fatigue in patients with COPD”. It was examined the effects of respiratory muscle work [inspiratory (W(r-insp)); expiratory (W(r-exp))] and
arterial oxygenation (Sp(O(2))) on exercise-induced locomotor muscle fatigue in patients with chronic obstructive pulmonary disease (COPD). Eight patients (FEV₁, 48 +/- 4%) performed constant-load cycling to exhaustion (Ctrl; 9.8 +/- 1.2 min). In subsequent trials, the identical exercise was repeated with 1) proportional assist ventilation + heliox (PAV); 2) heliox (He:21% O(2)); 3) 60% O(2) inspirate (hyperoxia); or 4) hyperoxic heliox mixture (He:40% O(2)). Five age-matched healthy control subjects performed Ctrl exercise at the same relative workload but for 14.7 min (approximately best COPD performance). Exercise-induced quadriceps fatigue was assessed via changes in quadriceps twitch force (Q(tw,pot)) from before to 10 min after exercise in response to supramaximal femoral nerve stimulation. During Ctrl, absolute workload (124 +/- 6 vs. 62 +/- 7 W), W(r-insp) (207 +/- 18 vs. 301 +/- 37 cm H(2)O x s x min(-1)), W(r-exp) (172 +/- 15 vs. 635 +/- 58 cm H(2)O x s x min(-1)), and Sp(O(2)) (96 +/- 1% vs. 87 +/- 3%) differed between control subjects and patients. Various interventions altered W(r-insp), W(r-exp), and Sp(O(2)) from Ctrl (PAV: -55 +/- 5%, -21 +/- 7%, +6 +/- 2%; He:21% O(2): -16 +/- 2%, -25 +/- 5%, +4 +/- 1%; hyperoxia: -11 +/- 2%, -17 +/- 4%, +16 +/- 4%; He:40% O(2): -22 +/- 2%, -27 +/- 6%, +15 +/- 4%). Ten minutes after Ctrl exercise, Q(tw,pot) was reduced by 25 +/- 2% (P < 0.01) in all COPD and 2 +/- 1% (P = 0.07) in healthy control subjects. In COPD, DeltaQ(tw,pot) was attenuated by one-third after each interventional trial; however, most of the exercise-induced reductions in Q(tw,pot) remained. The findings also suggested that the high susceptibility to locomotor muscle fatigue in patients with COPD was in part attributable to insufficient O(2) transport as a consequence of exaggerated arterial hypoxemia and/or excessive respiratory muscle work but also support a critical role for the well-known altered intrinsic muscle characteristics in these patients.

Andrea Rossi et al (2011) has Conducted A study on “Effects of Body Composition and Adipose Tissue Distribution on Respiratory Function in Elderly Men and Women: The Health, Aging, and Body Composition Study”. Previous cross-sectional studies demonstrate positive associations of fat-free mass and negative associations of centrally distributed fat deposits with respiratory function in older adults. Few studies have evaluated whether greater losses of muscle and increases in fat are associated with more rapid decline in respiratory function in aging. Methods. Nine hundred and
fifty-seven men and 1,024 women aged, respectively, 73.6 ± 2.8 years and 73.2 ± 2.8 years at baseline were followed for 5 years. Body weight, waist circumference, bone mineral density, fat-free mass, fat mass and fat mass percentage as measured by DXA, abdominal subcutaneous and visceral adipose tissue, thigh muscle area, thigh intermuscular fat by CT and forced expiratory volume in 1 second (FEV1) and forced vital capacity (FVC) were evaluated at baseline and after 5-years follow-up. Results. Cross-sectional analyses showed that height and thigh muscle area were positively and visceral adipose tissue negatively related to FEV1 and FVC. Increase in fat mass over five years was associated with concurrent FEV1 and FVC decline. In analyses stratified by weight-change categories, men and women who gained weight (vs. stable/lost weight) had more rapid declines in FEV1 and FVC. Conclusion. In this well-functioning cohort, less muscle and greater abdominal fat were each associated with poorer lung spirometry cross-sectionally, whereas increase in fat mass over 5 years was associated with concurrent FEV1 and FVC decline. Weight gain and accompanying fat deposition may accelerate age-related declines in respiratory function.

Camillo et al (2011) has Conducted A study on “Improvement of heart rate variability after exercise training and its predictors in COPD”. OBJECTIVES: TO investigate changes in HRV after two exercise training programs in patients with COPD and to investigate the determinants of these eventual changes. METHODS: Forty patients with COPD (FEV1 39 ± 13%pred) were randomized into high (n = 20) or low (n = 20) intensity exercise training (3-month duration), and had their HRV assessed by the head-up tilt test before and after either protocols. Baseline spirometry, level of daily physical activity, exercise capacity, body composition, functional status, health-related quality of life and muscle force were also assessed to investigate the determinants of improvement in HRV after the training program. RESULTS: There was a significant improvement in HRV only after the high-intensity protocol (pre versus post; SDNN 29 ± 15 ms versus 36 ± 19 ms; rMSSD 22 ± 14 ms versus 28 ± 22 ms; p < 0.05 for both). Higher values of biceps brachialis strength, time spent walking in daily life and SDNN at baseline were determinants of improvement in HRV after the training program. CONCLUSIONS:
High-intensity exercise training improved HRV at rest and during orthostatic stimulus in patients with COPD. Better baseline total HRV, muscle force and daily physical activity level were predictors of HRV improvements after the training program.

Candy Sodhi et al (2009) has Conducted A study on “A Study of the Effect of Yoga Training on Pulmonary functions in Patients with Bronchial Asthma.” The role of yoga breathing exercises, as an adjunct treatment for bronchial asthma is well recognized. One hundred twenty patients of asthma were randomized into two groups i.e Group A (yoga training group) and Group B (control group). Each group included sixty patients. Pulmonary function tests were performed on all the patients at baseline, after 4 weeks and then after 8 weeks. Majority of the subjects in the two groups had moderate disease (34 patients in Group A and 32 in Group B). Group A subjectsshowed a statistically significant increasing trend (P<0.01) in % predicted peak expiratory flow rate (PEFR), forced expiratory volume in the first second (FEV1), forced vital capacity (FVC), forced mid expiratory flow in 0.25–0.75 seconds (FEF25-75) and FEV1/FVC% ratio at 4 weeks and 8 weeks as compared to Group B. Thus, yoga breathing exercises used adjunctively with standard pharmacological treatment significantly improves pulmonary functions in patients with bronchial asthma.

Chen et al (2009) has Conducted A study on “The effect of yoga exercise intervention on health related physical fitness in school-age asthmatic children.” The purpose of this study was to investigate the effect of yoga exercise on the health-related physical fitness of school-age children with asthma. The study employed a quasi-experimental research design in which 31 voluntary children (exercise group 16; control group 15) aged 7 to 12 years were purposively sampled from one public elementary school in Taipei County. The yoga exercise program was practiced by the exercise group three times per week for a consecutive 7 week period. Each 60-minute yoga session included 10 minutes of warm-up and breathing exercises, 40 minutes of yoga postures, and 10 minutes of cool down exercises. Fitness scores were assessed at pre-exercise (baseline) and at the seventh and ninth week after intervention completion. A total of 30 subjects (exercise group 16; control group 14) completed follow-up. Results included: 1. Compared with children in the general population, the study subjects (n = 30) all fell below the 50th percentile in all five physical fitness items of interest. There was no significant difference in scores
between the two groups at baseline (i.e., pre-exercise) for all five fitness items. 2. Research found a positive association between exercise habit after school and muscular strength and endurance among asthmatic children. 3. Compared to the control group, the exercise group showed favorable outcomes in terms of flexibility and muscular endurance. Such favorable outcomes remained evident even after adjusting for age, duration of disease and steroid use, values for which were unequally distributed between the two groups at baseline. 4. There was a tendency for all item-specific fitness scores to increase over time in the exercise group. The GEE analysis showed that yoga exercise indeed improved BMI, flexibility, and muscular endurance. After 2 weeks of self-practice at home, yoga exercise continued to improve BMI, flexibility, muscular strength, and cardiopulmonary fitness.

Cheryl Salome (2011) has conducted a study on” Physiology of obesity and effects on lung function” In obese people, the presence of adipose tissue around the rib cage and abdomen and in the visceral cavity loads the chest wall and reduces functional residual capacity (FRC). The reduction in FRC and in expiratory reserve volume is detectable, even at a modest increase in weight. However, obesity has little direct effect on airway caliber. Spirometric variables decrease in proportion to lung volumes, but are rarely below the normal range, even in the extremely obese, while reductions in expiratory flows and increases in airway resistance are largely normalized by adjusting for lung volumes. Nevertheless, the reduction in FRC has consequences for other aspects of lung function. A low FRC increases the risk of both expiratory flow limitation and airway closure. Marked reductions in expiratory reserve volume may lead to abnormalities in ventilation distribution, with closure of airways in the dependent zones of the lung and ventilation perfusion inequalities. Greater airway closure during tidal breathing is associated with lower arterial oxygen saturation in some subjects, even though lung CO-diffusing capacity is normal or increased in the obese. Bronchoconstriction has the potential to enhance the effects of obesity on airway closure and thus on ventilation distribution. Thus obesity has effects on lung function that can reduce respiratory well-being, even in the absence of specific respiratory disease, and may also exaggerate the effects of existing airway disease.
Christopher et al (2010) has conducted a study on repeated abdominal exercise induces respiratory muscle fatigue" Prolonged bouts of hyperpnea or resisted breathing are known to result in respiratory muscle fatigue, as are primarily non respiratory exercises such as maximal running and cycling. These exercises have a large ventilatory component, though, and can still be argued to be respiratory activities. Sit-up training has been used to increase respiratory muscle strength, but no studies have been done to determine whether this type of non-respiratory activity can lead to respiratory fatigue. The purpose of the study was to test the effect of sit-ups on various respiratory muscle strength and endurance parameters. Eight subjects performed pulmonary function, maximum inspiratory pressure (MIP) and maximum expiratory pressure (MEP) measurements, and an incremental breathing test before and after completing a one-time fatiguing exercise bout of sit-ups. Each subject acted as their own control performing the same measurements 3-5 days following the exercise bout, substituting rest for exercise. Following sit-up induced fatigue, significant decreases were measured in MIP [121.6 ± 26 to 113.8 ± 23 cmH₂O (P <0.025)], and incremental breathing test duration [9.6 ± 1.5 to 8.5 ± 0.7 minutes (P <0.05)]. No significant decreases were observed from control pre-test to control post-test measurements. We conclude that after a one-time fatiguing sit-up exercise bout there is a reduction in respiratory muscle strength (MIP, MEP) and endurance (incremental breathing test duration) but not spirometric pulmonary function.

Danilo Santaella et al (2011) has conducted a study on “Yoga respiratory training improves respiratory function and cardiac sympathovagal balance in elderly subjects: a randomised controlled trial”. Objectives Since ageing is associated with a decline in pulmonary function, heart rate variability and spontaneous baroreflex, and recent studies suggest that yoga respiratory exercises may improve respiratory and cardiovascular function, we hypothesised that yoga respiratory training may improve respiratory function and cardiac autonomic modulation in healthy elderly subjects. Design 76 healthy elderly subjects were enrolled in a randomised control trial in Brazil and 29 completed the study (age 68±6 years, 34% males, body mass index 25±3 kg/m²). Subjects were randomised into a 4-month training program (2 classes/week plus home exercises) of either stretching (control, n=14) or respiratory exercises (yoga, n=15). Yoga respiratory exercises (Bhastrika) consisted of rapid forced expirations followed by inspiration
through the right nostril, inspiratory apnoea with generation of intrathoracic negative pressure, and expiration through the left nostril. Pulmonary function, maximum expiratory and inspiratory pressures (PE\text{max} and PI\text{max}, respectively), heart rate variability and blood pressure variability for spontaneous baroreflex determination were determined at baseline and after 4 months. Results Subjects in both groups had similar demographic parameters. Physiological variables did not change after 4 months in the control group. However, in the yoga group, there were significant increases in PE\text{max} (34%, \(p<0.0001\)) and PI\text{max} (26%, \(p<0.0001\)) and a significant decrease in the low frequency component (a marker of cardiac sympathetic modulation) and low frequency/high frequency ratio (marker of sympathovagal balance) of heart rate variability (40%, \(p<0.001\)). Spontaneous baroreflex did not change, and quality of life only marginally increased in the yoga group. Conclusion Respiratory yoga training may be beneficial for the elderly healthy population by improving respiratory function and sympathovagal balance.

Dionne Peacher et al (2010) has conducted a study on “Effects of hyperoxia on ventilation and pulmonary hemodynamics during immersed prone exercise at 4.7 ATA: possible implications for immersion pulmonary edema” “Immersion pulmonary edema (IPE) can occur in otherwise healthy swimmers and divers, likely because of stress failure of pulmonary capillaries secondary to increased pulmonary vascular pressures. Prior studies have revealed progressive increase in ventilation [minute ventilation (\(V_e\))] during prolonged immersed exercise. We hypothesized that this increase occurs because of development of metabolic acidosis with concomitant rise in mean pulmonary artery pressure (MPAP) and that hyperoxia attenuates this increase. Ten subjects were studied at rest and during 16 min of exercise submersed at 1 atm absolute (ATA) breathing air and at 4.7 ATA in normoxia and hyperoxia [inspired P_{O2} (P_{iO2}) 1.75 ATA]. \(V_e\) increased from early (E, 6th minute) to late (L, 16th minute) exercise at 1 ATA (64.1 ± 8.6 to 71.7 ± 10.9 l/min BTPS; \(P < 0.001\)), with no change in arterial pH or P_{CO2}. MPAP decreased from E to L at 1 ATA (26.7 ± 5.8 to 22.7 ± 5.2 mmHg; \(P = 0.003\)). \(V_e\) and MPAP did not change from E to L at 4.7 ATA. Hyperoxia reduced \(V_e\) (62.6 ± 10.5 to 53.1 ± 6.1 l/min BTPS; \(P < 0.0001\)) and MPAP (29.7 ± 7.4 to 25.1 ± 5.7 mmHg, \(P = 0.002\)). Variability in MPAP among subjects was wide (range 14.1–42.1 mmHg during surface and depth exercise). Alveolar-arterial P_{O2} difference increased from E to L in normoxia, consistent
with increased lung water. We conclude that increased $\dot{V}e$ at 1 ATA is not due to acidosis and is more consistent with respiratory muscle fatigue and that progressive pulmonary vascular hypertension does not occur during prolonged immersed exercise. Wide variation in MPAP among healthy subjects is consistent with variable individual susceptibility to IPE.

Dolmage et al (2011) has conducted a study on “The Effect of Pulmonary Rehabilitation on Critical Walk Speed in Chronic Obstructive Pulmonary Disease: A Comparison with Self-Paced Walks”. Walking is frequently used in the exercise rehabilitation of patients with COPD. Walking ability can be characterized by the two-parameter hyperbolic relationship between endurance and speed. One parameter, critical walk speed, represents the maximum speed that can be endured indefinitely.

OBJECTIVES: The purpose was to: 1) determine the effect of pulmonary rehabilitation on the critical speed; 2) compare the critical speed with the speed chosen during self-paced walking. METHODS: We estimated critical speed in patients with COPD before and after rehabilitation. Patients completed four high intensity constant speed walk tests to intolerance on a 30 m course. The parameters of the hyperbolic relationship were determined from non-linear regression of endurance on speed. Participants also completed self-paced walks: 1) for as long as they could; 2) at their 'usual' and 'fast' speed; 3) a six minute walk test. RESULTS: 12 participants, ($FEV(1) \text{ [SD]} = 41 [16] \%\text{predicted}, FEV(1)/FVC = 41 [12]$) completed the study. At baseline the critical speed ($65 [12] \text{ m·min}^{-1}$) was not significantly different from the self-paced, usual or six minute walk speeds ($65 [12], 67 [14], 63 [15] \text{ m·min}^{-1}$, respectively). There was a significant increase in critical speed ($6 [1 to 10] \text{ m·min}^{-1}$) and six minute speed ($16 [10 to 21] \text{ m·min}^{-1}$) after rehabilitation without changes in the self-paced, usual or fast speeds. CONCLUSIONS: Patients with COPD increase their critical walk speed after pulmonary rehabilitation. The pace chosen during common walk tasks is closely related to critical speed; this relationship was altered after rehabilitation.

DorAnne Donesky-and Cuenco (2010) has conducted a study on “Yoga Therapy Decreases Dyspnea-Related Distress and Improves Functional Performance in People with Chronic Obstructive Pulmonary Disease: A Pilot Study”. There has been limited study of yoga training as a complementary exercise strategy to manage the symptom of dyspnea in patients with chronic obstructive pulmonary disease (COPD). Purpose: The
The purpose of this study was to evaluate a yoga program for its safety, feasibility, and efficacy for decreasing dyspnea intensity (DI) and dyspnea-related distress (DD) in older adults with COPD. Methods: Clinically stable patients with COPD ($n = 29$; age $69.9 \pm 9.5$; forced expiratory volume in 1 second ($FEV_1$) $47.7 \pm 15.6\%$ predicted, female $= 21$) were randomized to a 12-week yoga program specifically designed for people with COPD or usual-care control (UC). The twice-weekly yoga program included asanas (yoga postures) and visama vritti pranayama (timed breathing). Safety measure outcomes included heart rate, oxygen saturation, dyspnea, and pain. Feasibility was measured by patient-reported enjoyment, difficulty, and adherence to yoga sessions. At baseline and at 12 weeks, DI and DD were measured during incremental cycle ergometry and a 6-minute walk (6MW) test. Secondary efficacy outcomes included physical performance, psychologic well-being, and health-related quality of life (HRQoL). Results: Yoga training was safe and feasible for patients with COPD. While yoga training had only small effects on DI after the 6MW test (effect size [ES], $0.20$; $p = 0.60$), there were greater reductions in DD in the yoga group compared to UC (ES, $0.67$; $p = 0.08$). Yoga training also improved 6MW distance ($+71.7 \pm 21.8$ feet versus $-27.6 \pm 36.2$ feet; ES = 0.78, $p = 0.04$) and self-reported functional performance (ES = 0.79, $p = 0.04$) compared to UC. There were small positive changes in muscle strength and HRQoL. Conclusions: Elderly patients with COPD participated safely in a 12-week yoga program especially designed for patients with this chronic illness. After the program, the subjects tolerated more activity with less DD and improved their functional performance.

Dourado et al (2009) has conducted a study on “Effect of three exercise programs on patients with chronic obstructive pulmonary disease”. We compared the effect of three different exercise programs on patients with chronic obstructive pulmonary disease including strength training at 50–80% of one-repetition maximum (1-RM) (ST; N = 11), low-intensity general training (LGT; N = 13), or combined training groups (CT; N = 11). Body composition, muscle strength, treadmill endurance test (TEnd), 6-min walk test (6MWT), Saint George's Respiratory Questionnaire (SGRQ), and baseline dyspnea (BDI) were assessed prior to and after the training programs (12 weeks). The training modalities showed similar improvements ($P > 0.05$) in SGRQ-total (ST = 13 +/- 14%; CT = 12 +/- 14%; LGT = 11 +/- 10%), BDI (ST = 1.8 +/- 4; CT = 1.8 +/- 3; LGT = 1 +/- 2), 6MWT
(ST = 43 +/- 51 m; CT = 48 +/- 50 m; LGT = 31 +/- 75 m), and TEnd (ST = 11 +/- 20 min; CT = 11 +/- 11 min; LGT = 7 +/- 5 min). In the ST and CT groups, an additional improvement in 1-RM values was shown (P < 0.05) compared to the LGT group (ST = 10 +/- 6 to 57 +/- 36 kg; CT = 6 +/- 2 to 38 +/- 16 kg; LGT = 1 +/- 2 to 16 +/- 12 kg).

The addition of strength training to our current training program increased muscle strength; however, it produced no additional improvement in walking endurance, dyspnea or quality of life. A simple combined training program provides benefits without increasing the duration of the training sessions.

Fabiane et al (2011) has conducted a study on “Aerobic capacity and skeletal muscle function in children with asthma”. Peripheral muscle strength and endurance are decreased in patients with chronic pulmonary diseases and seem to contribute to patients' exercise intolerance. However, the authors are not aware of any studies evaluating peripheral muscle function in children with asthma. It seems to be implied that children with asthma have lower aerobic fitness, but there are limited studies comparing the aerobic capacity of children with and without asthma. The present study aimed to evaluate muscle strength and endurance in children with persistent asthma and their association with aerobic capacity and inhaled corticosteroid consumption. Methods Forty children with moderate persistent asthma (MPA) or severe persistent asthma (SPA) (N=20 each) and 20 children without asthma (control group) were evaluated. Upper (pectoralis and latissimus dorsi) and lower (quadriceps) muscle strength and endurance were assessed, and cardiopulmonary exercise testing was performed. Inhaled corticosteroid consumption during the last 6 and 24 months was also quantified. Results Children with SPA presented a reduction in peak oxygen consumption (VO\textsubscript{2}) (28.2±8.1 vs 34.7±6.9 ml/kg/min; p<0.01) and quadriceps endurance (43.1±6.7 vs 80.9±11.9 repetitions; p<0.05) compared with the control group, but not the MPA group (31.5±6.1 ml/kg/min and 56.7±47.7 repetitions respectively; p>0.05). Maximal upper and lower muscle strength was preserved in children with both moderate and severe asthma (p>0.05). Finally, the authors observed that lower muscle endurance weakness was not associated with reductions in either peak VO\textsubscript{2} (r=0.22, p>0.05) or corticosteroid
consumption ($r = -0.31$, $p > 0.05$) in children with asthma. Conclusion The findings suggested that cardiopulmonary exercise and lower limb muscle endurance should be a priority during physical training programs for children with severe asthma.

Felipe et al (2010) has conducted a study on “Effects of Aerobic Training on Psychosocial Morbidity and Symptoms in Patients with Asthma” Asthma symptoms reduce patients’ daily activities, impair their health-related quality of life (HRQoL), and increase their reports of anxiety and depression, all of which seem to be related to a decrease in asthma control. Aerobic exercise training is known to improve aerobic fitness and reduce dyspnea in asthmatics; however, its effect in reducing psychologic distress and symptoms remains poorly understood. We evaluated the role of an aerobic training program in improving HRQoL (primary aim) and reducing psychologic distress and asthma symptoms (secondary aims) for patients with moderate or severe persistent asthma. Methods: A total of 101 patients were randomly assigned to either a control group or an aerobic training group and studied during the period between medical consultations. Control group patients (educational program plus breathing exercises) ($n = 51$) and training group patients (educational program plus breathing exercises plus aerobic training) ($n = 50$) were followed twice a week during a 3-month period. HRQoL and levels of anxiety and depression were quantified before and after treatment. Asthma symptoms were evaluated monthly. Results: At 3 months, the domains (physical limitations, frequency of symptoms, and psychosocial) and total scores of HRQoL significantly improved only in the training group patients ($P < .001$); the number of asthma-symptom-free days and anxiety and depression levels also significantly improved in this group ($P < .001$). In addition, a linear relationship between improvement in aerobic capacity and the days without asthma symptoms was observed ($r = 0.47$; $P < .01$). Conclusions: The results suggested that aerobic training can play an important role in the clinical management of patients with persistent asthma. Further, they may be especially useful for patients with higher degrees of psychosocial distress.

Ganesan Kathiresan and Asokan Paul Raj (2010) has conducted a study on “Effect of aerobic training on airflow obstruction, $vo_2$ max, EIB in stable asthmatic children” Children with bronchial asthma, primarily those with a clinically more severe disease, tend to have a sedentary lifestyle and therefore be inclined to have lower aerobic...
fitness than their healthy non-asthmatic peers. Aerobic training has a number of well known beneficial effects in both normal and asthmatic children. However, the impact of training on the clinical management of the underlying bronchial asthma remains controversial, particularly in the most severe patients. Clinical evaluation, spirometric tests, symptom limited maximum exercise testing, and exercise challenge tests were performed in a group of children with stable moderate to severe asthma. Forty two patients (24 boys) aged 8-16 were evaluated twice: before and after supervised aerobic training (group 1, n = 26) and two months apart (untrained group 2, n = 16). In results, Spirometric and maximal exercise variables in the initial evaluation were significantly reduced in group 1 (p < 0.05) but medication and clinical scores and the occurrence of exercise induced bronchospasm (EIB) did not differ between the two groups. Aerobic improvement with training (maximal oxygen uptake and/or anaerobic threshold increment > 10% and 100 ml) was inversely related to the baseline level of fitness and was independent of disease severity. Although the clinical score and the occurrence of EIB did not change after training, aerobic improvement was associated with a significant reduction in the medication score and the daily use of both inhaled and oral steroids (p < 0.05). In conclusion, results show that the less fit asthmatic children were able to normalize their aerobic fitness with a supervised training program without clinical complications. It was finally conducted that there was significant association between aerobic improvement and reduction in use.

_Gosselink et al (2011)_ has conducted a study on “Impact of inspiratory muscle training in patients with COPD: what is the evidence?” A meta-analysis including 32 randomised controlled trials on the effects of inspiratory muscle training (IMT) in chronic obstructive pulmonary disease (COPD) patients was performed. Overall and subgroup analyses with respect to training modality (strength or endurance training, added to general exercise training) and patient characteristics were performed. Significant improvements were found in maximal inspiratory muscle strength (P(I,max); +13 cmH₂O), endurance time (+261 s), 6- or 12-min walking distance (+32 and +85 m respectively) and quality of life (+3.8 units). Dyspnoea was significantly reduced (Borg score -0.9 point; Transitional Dyspnoea Index +2.8 units). Endurance exercise capacity tended to improve, while no effects on maximal exercise capacity were found. Respiratory muscle
endurance training revealed no significant effect on P(I,max), functional exercise
capacity and dyspnoea. IMT added to a general exercise programme improved P(I,max)
significantly, while functional exercise capacity tended to increase in patients with
inspiratory muscle weakness (P(I,max) <60 cmH₂O). IMT improves inspiratory muscle
strength and endurance, functional exercise capacity, dyspnoea and quality of life.
Inspiratory muscle endurance training was shown to be less effective than respiratory
muscle strength training. In patients with inspiratory muscle weakness, the addition of
IMT to a general exercise training program improved P(I,max) and tended to improve
exercise performance.

Hopkinson et al (2010) has conducted a study on “Abdominal muscle fatigue
following exercise in chronic obstructive pulmonary disease”. In patients with chronic
obstructive pulmonary disease, a restriction on maximum ventilatory capacity contributes
to exercise limitation. It has been demonstrated that the diaphragm in COPD is relatively
protected from fatigue during exercise. Because of expiratory flow limitation the
abdominal muscles are activated early during exercise in COPD. This adds significantly
to the work of breathing and may therefore contribute to exercise limitation. In healthy
subjects, prior expiratory muscle fatigue has been shown itself to contribute to the
development of quadriceps fatigue. It is not known whether fatigue of the abdominal
muscles occurs during exercise in COPD.

METHODS: Twitch gastric pressure (TwT10Pga), elicited by magnetic stimulation over the 10th thoracic vertebra and twitch
transdiaphragmatic pressure (TwPdi), elicited by bilateral anterolateral magnetic phrenic
nerve stimulation were measured before and after symptom-limited, incremental cycle
ergometry in patients with COPD. RESULTS: Twenty-three COPD patients, with a mean
(SD) FEV1 40.8(23.1)% predicted, achieved a mean peak workload of 53.5(15.9) W.
Following exercise, TwT10Pga fell from 51.3(27.1) cmH₂O to 47.4(25.2) cmH₂O
(p = 0.011). TwPdi did not change significantly; pre 17.0(6.4) cmH₂O post 17.5(5.9) cmH₂O
(p = 0.7). Fatiguers, defined as having a fall TwT10Pga > or = 10% had significantly
worse lung gas transfer, but did not differ in other exercise parameters. CONCLUSIONS:
In patients with COPD, abdominal muscle but not diaphragm fatigue develops following
symptom limited incremental cycle ergometry. Further work is needed to establish whether abdominal muscle fatigue is relevant to exercise limitation in COPD, perhaps indirectly through an effect on quadriceps fatigability.

Huang et al (2011) has conducted a study on “Comparison of inspiratory muscle strength training effects between older subjects with and without chronic obstructive pulmonary disease”. Inspiratory muscle strength training (IMST) has been traditionally recommended for patients with chronic obstructive pulmonary disease (COPD) to improve respiratory strength. Respiratory strength is reduced as age increases. However, few studies have focused on the effects of IMST on older adults without COPD. METHODS: Subjects were divided into training non-COPD (TNC, n = 24) and training COPD (TC, n = 12) according to their forced expiratory volume in 1 second (% predicted). Both groups received 6 weeks of IMST, with training at 75-80% of maximal inspiratory pressure using pressure threshold trainers. A second group of COPD subjects served as controls (CC, n = 24), which received no training. Dyspnea was measured using the basic dyspnea index. Health-related quality of life was measured using the SF-36. The SF-36 subcategories, physical component summary and mental component summary were compared. A 6-minute walk test was performed to determine functional status. Two-way repeated measures analysis of variance was used to compare group effects and training effects of IMST. RESULTS: Maximal inspiratory pressure was increased in both training groups (TNC: 59.1 cmH(2)O pre-IMST to 82.5 cmH(2)O post-IMST; TC: 53.2 to 72.6), but not in the CC group. Therefore, the basic dyspnea index was improved in both training groups (TNC: 9.6 to 10.8; TC: 6.2 to 7.3). Functional status was improved in the TNC group (TNC: 392.1 m to 436.3 m), but not in the TC or CC groups. Quality of life was improved in the physical component summary in both training groups. CONCLUSION: IMST increases maximal inspiratory pressure, relieves dyspnea and improves health-related quality of life in older adults. IMST especially improves functional status in subjects without COPD. IMST benefits subjects with COPD and those without COPD. Therefore, IMST as a treatment tool was not confined to patients with COPD.

Janaudis-Ferreira et al (2011) has conducted a study on “Resistance arm training in patients with COPD: A Randomized Controlled Trial”. The study aimed to evaluate
the effect of upper extremity resistance training for patients with COPD on dyspnea during activity of daily living (ADL), arm function, arm exercise capacity, muscle strength, and health-related quality of life (HRQL).

METHODS: Patients were randomly assigned to an intervention or control group. The intervention group underwent arm resistance training. The control group performed a sham. Both groups exercised three times a week for 6 weeks. Dyspnea during ADL and HRQL were measured using the Chronic Respiratory Disease Questionnaire (CRDQ). Arm function and exercise capacity were measured using the 6-min pegboard and ring test (6PBRT) and the unsupported upper limb exercise test (UULEX), respectively. Muscle strength for the biceps, triceps, and anterior and middle deltoids was obtained using an isometric dynamometer.

RESULTS: Thirty-six patients with COPD (66 ± 9 years) participated in the study. Compared with the control group, the magnitude of change in the intervention group was greater for the 6PBRT (P = .03), UULEX (P = .01), elbow flexion force (P = .01), elbow extension force (P = .02), shoulder flexion force (P = .029), and shoulder abduction force (P = .01). There was no between-group difference in dyspnea during ADL, HRQL, or symptoms during the 6PBRT or UULEX (all P values > .08).

CONCLUSIONS: Resistance-based arm training improved arm function, arm exercise capacity, and muscle strength in patients with COPD. No improvement in dyspnea during ADL, HRQL, or symptoms was demonstrated.

Jordan et al (2011) has conducted a study on “induced diaphragmatic fatigue in endurance-trained athletes.” There is evidence that female athletes may be more susceptible to exercise-induced arterial hypoxemia and expiratory flow limitation and have greater increases in operational lung volumes during exercise relative to men. These pulmonary limitations may ultimately lead to greater levels of diaphragmatic fatigue in women. Accordingly, the purpose of this study was to determine whether there are sex differences in the prevalence and severity of exercise-induced diaphragmatic fatigue in 38 healthy endurance-trained men (n = 19; maximal aerobic capacity = 64.0 ± 1.9 ml·kg⁻¹·min⁻¹) and women (n = 19; maximal aerobic capacity = 57.1 ± 1.5 ml·kg⁻¹·min⁻¹). Transdiaphragmatic pressure (Pdi) was calculated as the difference between gastric and esophageal pressures. Inspiratory pressure-time products of the diaphragm and esophagus were calculated as the product of breathing frequency and the
Pdi and esophageal pressure time integrals, respectively. Cervical magnetic stimulation was used to measure potentiated Pdi twitches (Pdi,tw) before and 10, 30, and 60 min after a constant-load cycling test performed at 90% of peak work rate until exhaustion. Diaphragm fatigue was considered present if there was a ≥15% reduction in Pdi,tw after exercise. Diaphragm fatigue occurred in 11 of 19 men (58%) and 8 of 19 women (42%). The percent drop in Pdi,tw at 10, 30, and 60 min after exercise in men (n = 11) was 30.6 ± 2.3, 20.7 ± 3.2, and 13.3 ± 4.5%, respectively, whereas results in women (n = 8) were 21.0 ± 2.1, 11.6 ± 2.9, and 9.7 ± 4.2%, respectively, with sex differences occurring at 10 and 30 min (P < 0.05). Men continued to have a reduced contribution of the diaphragm to total inspiratory force output (pressure-time product of the diaphragm/ pressure-time product of the esophagus) during exercise, whereas diaphragmatic contribution in women changed very little over time. The findings from this study pointed to a female diaphragm that was more resistant to fatigue relative to their male counterparts.

Judith Balk (2011) has conducted a study on “Yoga and Peak Flow Rates in Pregnant Asthmatics” Asthma is a relatively common disorder in pregnancy (4 percent) with the potential to increase maternal and fetal morbidity. As with all medical disorders in pregnancy, the usual pharmacologic management is a source of concern for mothers and health care providers. Yoga therapy has been shown to improve asthma as measured by pulmonary function tests, symptom scores, and frequency of asthma attacks in nonpregnant women and men. The study proposed, which is ancillary to the ongoing observational study of asthma in pregnancy, is a pilot study to investigate the efficacy of yoga to improve the pulmonary function in asthmatic women during pregnancy. The design is prospective, single blinded, randomized, and placebo-controlled. Moderate to severe asthmatics who are candidates for the observational asthma study will be randomized to either a yoga program, a non-yoga program of relaxing for the same amount of time, or a non-intervention arm. Pulmonary function tests, frequency of asthma exacerbations, and medication usage will be measured at each office visit. The primary outcome will be a 20 percent improvement of peak flow rate as determined by analysis of variance in subjects who perform yoga as compared to control subjects. The study is designed as an intent to treat trial, however compliance will be assessed by a prospectively gathered diary which will be blinded until the end of the study.
Kapella et al (2011) has conducted a study on “Functional performance in chronic obstructive pulmonary disease declines with time”. PURPOSE: it is well known that people with chronic obstructive pulmonary disease experience declines in functional performance, but little is known about the rate of decline. The purposes of this research were to describe the rate of decline in functional performance and to examine the contribution of disease severity, body composition, symptoms, and functional capacity. Functional performance was defined as the activities that people choose to engage in on a day-to-day basis. METHODS: people (n = 108) with chronic obstructive pulmonary disease were enrolled and followed yearly for 3 yr with self-reported functional performance (Functional Performance Inventory), spirometry, lung volumes, diffusion capacity, body composition (dual-energy x-ray absorptiometry), dyspnea and fatigue (Chronic Respiratory Disease Questionnaire), and functional capacity (6-min walk distance (6MWD), isokinetic strength of knee flexors and extensors, handgrip strength, and maximal inspiratory pressure). A total of 88 subjects completed a (mean ± SD) of 2.7 ± 0.9 yr of follow-up. RESULTS: significant negative slopes were observed for functional performance (P = 0.001), spirometry (the ratio of forced expiratory volume in 1 s to forced vital capacity (FEV1/FVC), P < 0.0001), diffusion capacity (P < 0.0001), and muscle strength (P < 0.0001)). The slopes for dyspnea, fatigue, and functional capacity were not significantly different from zero, but there was a wide individual variation. Hierarchical regression demonstrated that 31% of the variance in the slope of functional performance was accounted for by the hierarchical model, and the primary predictors were the slopes of the FEV1/FVC, 6MWD, and muscle strength (knee flexors/extensor and handgrip). CONCLUSIONS: subjects experienced a slow decline in functional performance, associated with declines in functional capacity and increases in body fat. Symptoms were relatively stable and not associated with declines in functional performance.

Kovelis et al (2011) has conducted a study on “Responsiveness of Three Instruments to Assess Self-Reported Functional Status in Patients with COPD”. The study aimed to compare the responsiveness of three instruments to assess self-reported changes in functional status after exercise training in patients with COPD: Pulmonary Functional Status and Dyspnea Questionnaire -modified version (PFSDQ-M), London
Chest Activity of Daily Living (LCADL) and Medical Research Council scale (MRC). Twenty-two patients (11 female, 66[62-71] years, FEV(1) 42[33-61]%predicted) participated in a 3-month high-intensity exercise program. The three instruments were applied pre- and post-program, as well as assessment of lung function, muscle strength, exercise capacity (6-minute walking test, 6MWT) and quality of life (St. George's Respiratory Questionnaire, SGRQ). SGRQ, 6MWT and quadriceps femoris, biceps and triceps brachialis strength improved significantly after the program (p < 0.05 for all). Training also yielded significant improvement in the LCADL total score and self-care, domestic and leisure domains and in the PFSDQ-M 'change in activities' domain, with no improvement in the MRC (p = 0.11). Calculation of effects sizes also indicated higher responsiveness in the LCADL than the other instruments. There were no significant correlations between changes in the three instruments and changes in lung function, SGRQ or 6MWT. In conclusion, PFSDQ-M's 'change in activity' domain and specially the LCADL (to a higher extent) showed responsiveness to detect changes in functional status after three months of high-intensity exercise training in patients with COPD, whereas the MRC scale did not. In this population, the improvement in functional status was not related with improvement in exercise capacity, lung function or quality of life.

Lan et al (2011) has conducted a study on “Pulmonary rehabilitation improves exercise capacity and quality of life in underweight patients with chronic obstructive pulmonary disease”. An estimated 20-40% of COPD patients are underweight. We sought to confirm the physiological and psychosocial benefits of pulmonary rehabilitation programmes (PRP) in underweight compared with non-underweight patients with COPD. METHODS: Twenty-two underweight COPD patients with BMI <20 kg/m(2), and 22 non-underweight COPD patients, who were matched for FEV(1) and age, were studied. All patients had moderate-to-very severe COPD. All patients participated in 12-week, hospital-based outpatient PRP consisting of two sessions per week. Baseline and post-PRP status were evaluated by spirometry, cardiopulmonary exercise testing, ventilatory muscle strength and the St. George's Respiratory Questionnaire (SGRQ). RESULTS: At baseline, the age distribution and airflow obstruction were similar in underweight and non-underweight patients with COPD. Baseline exercise capacity, inspiratory muscle strength and SGRQ total and symptoms scores were significantly
lower in the underweight patients (all P < 0.05). After the PRP, there was significant weight gain in the underweight COPD patients (mean increase 0.8 kg, P = 0.01). There were also significant improvements in peak oxygen uptake, peak workload and the SGRQ total, symptoms, activity and impact scores in both underweight and non-underweight patients with COPD (all P < 0.05). CONCLUSIONS: Underweight patients with COPD have impaired exercise capacity and health-related quality of life (HRQL). Exercise training with supplemental oxygen may result in significant weight gains and improvements in exercise capacity and HRQL. Exercise training is indicated for underweight patients with COPD.

Lee Romer and Michael Polkey (2011) has conducted a study on “Exercise-induced respiratory muscle fatigue: implications for performance” It is commonly held that the respiratory system has ample capacity relative to the demand for maximal O\textsubscript{2} and CO\textsubscript{2} transport in healthy humans exercising near sea level. However, this situation may not apply during heavy-intensity, sustained exercise where exercise may encroach on the capacity of the respiratory system. Nerve stimulation techniques have provided objective evidence that the diaphragm and abdominal muscles are susceptible to fatigue with heavy, sustained exercise. The fatigue appears to be due to elevated levels of respiratory muscle work combined with an increased competition for blood flow with limb locomotor muscles. When respiratory muscles are prefatigued using voluntary respiratory maneuvers, time to exhaustion during subsequent exercise is decreased. Partially unloading the respiratory muscles during heavy exercise using low-density gas mixtures or mechanical ventilation can prevent exercise-induced diaphragm fatigue and increase exercise time to exhaustion. Collectively, these findings suggest that respiratory muscle fatigue may be involved in limiting exercise tolerance or those other factors, including alterations in the sensation of dyspnea or mechanical load, may be important. The major consequence of respiratory muscle fatigue is an increased sympathetic vasoconstrictor outflow to working skeletal muscle through a respiratory muscle metaboreflex, thereby reducing limb blood flow and increasing the severity of exercise-induced locomotor muscle fatigue. An increase in limb locomotor muscle fatigue may play a pivotal role in determining exercise tolerance through a direct effect on muscle force output and a feedback effect on effort perception, causing reduced motor output to the working limb muscles.
Luo et al (2011) has conducted a study on “Neural Respiratory Drive in Patients with COPD during Exercise Tests”  

**Background:** It is unknown whether neural drive is comparable in constant rate and incremental exercise tests. Few data have previously been available to address this question because of the lack of reliable methods to assess neural respiratory drive in patients with chronic obstructive pulmonary disease (COPD).  

**Objectives:** The aims of this study are to determine whether neural respiratory drive during constant rate exercise differs from that during incremental exercise and to determine whether neural respiratory drive was maximal at the end of exhaustive exercise tests.  

**Methods:** We studied sixteen patients with moderate-severe COPD (mean ± SD FEV$_1$ 29 ± 10%). Both diaphragmatic electro-myogram (EMG) and transdiaphragmatic pressure were recorded with a combined multipair electrode balloon catheter during incremental and constant (80% of maximal oxygen consumption derived from a prior incremental exercise test) treadmill exercise. Minute ventilation and oxygen uptake were also measured.  

**Results:** Root mean square (RMS) of the diaphragmatic EMG increased gradually without a plateau during incremental exercise, whereas the RMS increased initially and reached a plateau during constant work rate exercise. The RMS of the diaphragmatic EMG at the end of exercise was similar for both incremental and constant work rate exercise (176 ± 42 µV vs. 184 ± 39 µV); these values were 70 and 73% of maximal values recorded over the study.  

**Conclusions:** The pattern of increase in neural respiratory drive during incremental exercise is different to that observed during constant work rate exercise, but both exercise protocols were terminated when the patients achieve a similar but submaximal drive.

Marc-André Caron et al (2011) has conducted a study on “Comparative assessment of the quadriceps and the diaphragm in patients with COPD”. Chronic obstructive pulmonary disease (COPD) and other chronic diseases such as heart failure are accompanied by skeletal muscle alterations that further enhance morbidity and mortality in affected individuals. Several studies have highlighted important structural and biochemical modifications in limb and respiratory muscles in COPD. Reviewing the similarities and differences between the two most studied muscles in COPD, the quadriceps and the diaphragm, may be helpful in providing important clues about the mechanisms underlying muscle changes associated with this disease. Although oxidative
stress is present in both muscles, other muscle alterations are clearly distinct between the quadriceps and the diaphragm. For example, the oxidative metabolism varies in opposite directions, the diaphragm exhibiting increased resistance to fatigue while the quadriceps in COPD is characterized by premature fatigability. Differences in muscle phenotypic expression between the diaphragm and the quadriceps indicate that, in addition to systemic factors, the local microenvironment must participate in the reorganization seen in these two skeletal muscles in COPD.

Mekonnen and Andualem (2010) has Conducted A study on “Clinical Effects of Asthmatic Patients: A Preliminary Clinical Trial. Jimma, Southwest Ethiopia” is one of the commonest respiratory diseases in Jimma area as well as a significant disease burden worldwide costing billions of dollars. Anti-asthmatic drugs that are available in the market are expensive have adverse effects. Thus, it is wise to look for an adjunct therapy to alleviate these problems. Therefore, the main aim of this study is to see the effect of patterns of clinical features, peak expiratory flow rates use of drugs in asthmatic patients. METHODS: A preliminary controlled clinical trial study was conducted 24 volunteer asthmatic patients who were getting support at the missionary of charity. They were grouped in control groups. An Indian expert through a translator conducted the training yogic practice, yogic posture, breath slowing technique discussion at the end. Then, the groups were supervised for four weeks taking exercise daily for 50 minutes. Peak expiratory flow rate was taken using the mini Wright peak flow meter vital signs were measured in both groups. Data were analyzed using web based Graph pad quick calcs statistical software. RESULTS: The male to female ratio was 1:1 in both cases control groups, 8(66.7%) were Christian 9 (75.0%) were farmers. The group showed 66.7% reduction in the use of salbutamole puff 58.3% salbutamole tablets. There was a 10% increment in the PEFR in the group while only 2% in the control group. There was statistically significant reduction in day night attacks in the group. Consolation exercise among asthmatic patients resulted in a decreased number of day night attacks use of drugs. It also shows significant improvement in the peak expiratory flow rate. Further large scale study is recommended.

Nicholas et al (2010) has conducted a study on “Abdominal muscle fatigue following exercise in chronic obstructive pulmonary disease” In patients with chronic
obstructive pulmonary disease, a restriction on maximum ventilatory capacity contributes to exercise limitation. It has been demonstrated that the diaphragm in COPD is relatively protected from fatigue during exercise. Because of expiratory flow limitation the abdominal muscles are activated early during exercise in COPD. This adds significantly to the work of breathing and may therefore contribute to exercise limitation. In healthy subjects, prior expiratory muscle fatigue has been shown itself to contribute to the development of quadriceps fatigue. It is not known whether fatigue of the abdominal muscles occurs during exercise in COPD.

Methods

Twitch gastric pressure (TwT10Pga), elicited by magnetic stimulation over the 10th thoracic vertebra and twitch transdiaphragmatic pressure (TwPdi), elicited by bilateral anterolateral magnetic phrenic nerve stimulation were measured before and after symptom-limited, incremental cycle ergometry in patients with COPD. Results

Twenty-three COPD patients, with a mean (SD) FEV1 40.8(23.1) % predicted, achieved a mean peak workload of 53.5(15.9) W. Following exercise, TwT10Pga fell from 51.3(27.1) cmH2O to 47.4(25.2) cmH2O (p = 0.011). TwPdi did not change significantly; pre 17.0(6.4) cmH2O post 17.5(5.9) cmH2O (p = 0.7). Fatigued, defined as having a fall TwT10Pga ≥ 10% had significantly worse lung gas transfer, but did not differ in other exercise parameters. Conclusions:

In patients with COPD, abdominal muscle but not diaphragm fatigue develops following symptom limited incremental cycle ergometry. Further work is needed to establish whether abdominal muscle fatigue is relevant to exercise limitation in COPD, perhaps indirectly through an effect on quadriceps fatigability.

Pomidori Luca et al (2009) has conducted a study on “Efficacy and Tolerability of Yoga Breathing in Patients With Chronic Obstructive Pulmonary Disease.” Purpose: Yoga-derived breathing has been reported to improve gas exchange in patients with chronic heart failure and in participants exposed to high-altitude hypoxia. We investigated the tolerability and effect of yoga breathing on ventilatory pattern and oxygenation in patients with chronic obstructive pulmonary disease (COPD). Methods: Patients with COPD (N = 11, 3 women) without previous yoga practice and taking only short-acting β2-adrenergic blocking drugs were enrolled. Ventilatory pattern and oxygen saturation were monitored by means of inductive plethysmography during 30-minute spontaneous breathing at rest (sb) and during a 30-minute yoga lesson (y). During the
yoga lesson, the patients were requested to mobilize in sequence the diaphragm, lower
chest, and upper chest adopting a slower and deeper breathing. We evaluated oxygen
saturation (SaO₂%), tidal volume (VT), minute ventilation (E), respiratory rate (i>f),
inspiratory time, total breath time, fractional inspiratory time, an index of thoracoabdominal coordination, and an index of rapid shallow breathing. Changes in
dyspnea during the yoga lesson were assessed with the Borg scale.

RESULTS: During the
yoga lesson, data showed the adoption of a deeper and slower breathing pattern (VTsb L
0.54[0.04], VTy L 0.74[0.08], P = .01; i>fšb 20.8[1.3], i>fšy 13.8[0.2], P = .001) and a
significant improvement in SaO₂% with no change in E (SaO₂%sb 91.5%[1.13], SaO₂%y
93.5%[0.99], P = .02; Esb L/min 11.2[1.1], Ey L/min 10.2[0.9]). All the participants
reported to be comfortable during the yoga lesson, with no increase in dyspnea
index.

CONCLUSION: We conclude that short-term training in yoga is well tolerated and
induces favorable respiratory changes in patients with COPD.

Posadzki and Ernst (2011) has conducted a study on “Yoga for asthma?
A systematic review of randomized clinical trials”.

OBJECTIVE: The objective of this
systematic review was to assess the effectiveness of yoga as a treatment option
for asthma.

METHOD: Seven databases were searched from their inception to October
2010. Randomized clinical trials (RCTs) and non-
randomized clinical trials (NRCTs) were considered, if they investigated any type of yoga in patients with asthma. The
selection of studies, data extraction, and validation were performed independently by two
reviewers.

RESULTS: Six RCTs and one NRCT met the inclusion criteria. Their
methodological quality was mostly poor. Three RCTs and one NRCT suggested that yoga
leads to a significantly greater reduction in spirometric measures, airway hyperresponsivity,
dose of histamine needed to provoke a 20% reduction in forced expiratory volume in the
first second, weekly number of asthma attacks, and need for drug treatment. Three RCTs
showed no positive effects compared to various control interventions.

CONCLUSIONS: The belief that yoga alleviates asthma is not supported by sound evidence. Further, more
rigorous trials are warranted.

Ramaprabhu Vempati et al (2009) has conducted a study on “The efficacy of a
comprehensive lifestyle modification programme based on yoga in the management of
bronchial asthma: a randomized controlled trial”.

There is a substantial body of evidence
on the efficacy of yoga in the management of bronchial asthma. Many studies have reported, as the effects of yoga on bronchial asthma, significant improvements in pulmonary functions, quality of life and reduction in airway hyper-reactivity, frequency of attacks and medication use. In addition, a few studies have attempted to understand the effects of yoga on exercise-induced bronchoconstriction (EIB) or exercise tolerance capacity. However, none of these studies has investigated any immunological mechanisms by which yoga improves these variables in bronchial asthma. Methods The present randomized controlled trial (RCT) was conducted on 57 adult subjects with moderate or moderate bronchial asthma who were allocated randomly to either the yoga (intervention) group (n = 29) or the wait-listed control group (n = 28). The control group received only conventional care and the yoga group received an intervention based on yoga, in addition to the conventional care. The intervention consisted of 2-wk supervised training in lifestyle modification and stress management based on yoga followed by closely monitored continuation of the practices at home for 6-wk. The outcome measures were assessed in both the groups at 0 wk (baseline), 2, 4 and 8 wk by using Generalized Linear Model (GLM) repeated measures followed by post-hoc analysis. Results In the yoga group, there was a steady and progressive improvement in pulmonary function, the change being statistically significant in case of the first second of forced expiratory volume (FEV$_1$) at 8 wk, and peak expiratory flow rate (PEFR) at 2, 4 and 8 wk as compared to the corresponding baseline values. There was a significant reduction in EIB in the yoga group. However, there was no corresponding reduction in the urinary prostaglandin D$_2$ metabolite (11β prostaglandin F2α) levels in response to the exercise challenge. There was also no significant change in serum eosinophilic cationic protein levels during the 8-wk study period in either group. There was a significant improvement in Asthma Quality of Life (AQOL) scores in both groups over the 8-wk study period. But the improvement was achieved earlier and was more complete in the yoga group. The number-needed-to-treat worked out to be 1.82 for the total AQOL score. An improvement in total AQOL score was greater than the minimal important difference and the same outcome was achieved for the sub-domains of the AQOL. The frequency of rescue medication use showed a significant decrease over the study period in both the groups. However, the decrease was achieved relatively earlier and was more marked in
the yoga group than in the control group. Conclusion The present RCT has demonstrated that adding the mind-body approach of yoga to the predominantly physical approach of conventional care results in measurable improvement in subjective as well as objective outcomes in bronchial asthma. The trial supports the efficacy of yoga in the management of bronchial asthma. However, the preliminary efforts made towards working out the mechanism of action of the intervention have not thrown much light on how yoga works in bronchial asthma.

Seymour et al (2010) has conducted a study on “The prevalence of quadriceps weakness in COPD and the relationship with disease severity” Quadriceps strength relates to exercise capacity and prognosis in chronic obstructive pulmonary disease (COPD). We wanted to quantify the prevalence of quadriceps weakness in COPD and hypothesised that it would not be restricted to patients with severe airflow obstruction or dyspnoea. Predicted quadriceps strength was calculated using a regression equation (incorporating age, sex, height and fat-free mass), based on measurements from 212 healthy subjects. The prevalence of weakness (defined as observed values 1.645 standardised residuals below predicted) was related to Global Initiative for Chronic Obstructive Lung Disease (GOLD) stage and Medical Research Council (MRC) dyspnoea score in two cohorts of stable COPD outpatients recruited from the UK (n = 240) and the Netherlands (n = 351). 32% and 33% of UK and Dutch COPD patients had quadriceps weakness. A significant proportion of patients in GOLD stages 1 and 2, or with an MRC dyspnoea score of 1 or 2, had quadriceps weakness (28% and 26%, respectively). These values rose to 38% in GOLD stage 4, and 43% in patients with an MRC Score of 4 or 5. Quadriceps weakness was demonstrable in one-third of COPD patients attending hospital respiratory outpatient services. Quadriceps weakness exists in the absence of severe airflow obstruction or breathlessness. Support Statement J.M. Seymour was funded by the British Lung Foundation, and an unrestricted educational grant from GlaxoSmithKline administered by the Royal Brompton Hospital, London, UK. N.S. Hopkinson was funded by the Wellcome Trust UK and the ENIGMA in COPD Project (European Union). S.A. Natanek was funded by the Wellcome Trust UK and an unrestricted educational grant from GlaxoSmithKline. W.D-C. Man was funded by the National Institute for Health (UK) Research Clinician Scientist Programme. A. Jackson was funded by the
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Singer et al (2011) has conducted a study on “Respiratory and skeletal muscle strength in chronic obstructive pulmonary disease: impact on exercise capacity and lower extremity function”. PURPOSE: We sought to quantify the impact of respiratory muscle and lower extremity strength on exercise capacity and lower extremity function (LEF) in patients with chronic obstructive pulmonary disease (COPD). METHODS: In 828 persons with COPD, we assessed the impact of reduced respiratory (maximum inspiratory pressure, MIP) and lower extremity muscle strength (quadriceps strength, QS) on exercise capacity (6-minute walk test, 6MWT), and LEF (short physical performance battery). Multiple regression analyses taking into account key covariates, including lung function and smoking, tested the associations between muscle strength and exercise and functional capacity. RESULTS: For each 0.5 SD decrement in QS, men walked 18.3 m less during 6MWT (95% confidence interval [CI], -24.1 to -12.4); women 25.1 m less (95% CI, -31.1 to -12.4). For each 0.5 SD decrement in MIP, men walked 9.4 m less during 6MWT (95% CI, -15.2 to -3.6); women 8.7 m less (95% CI, -14.1 to -3.4). For each 0.5 SD decrease in QS, men had a 1.32 higher odds (95% CI, 1.11 - 1.15) of poor LEF; women had a 1.87 higher odds (95% CI, 1.54 - 2.27). Lower MIP (per 0.5 SD) was associated with increased odds of poor LEF in women (odds ratio = 1.18; 95% CI, 1.00 - 1.39), but not in men (odds ratio = 1.10; 95% CI, 0.93 - 1.31). CONCLUSIONS: In COPD, reduced respiratory and lower extremity muscle strength are associated with decreased exercise and functional capacity. Muscle weakness is likely an important component of impairment and disability in patients with COPD.

Soicher et al (2010) has conducted a study on “Trajectories of Endurance Activity following Pulmonary Rehabilitation in COPD Patients”. Maintenance of physical activity following pulmonary rehabilitation remains a challenge for patients with chronic obstructive pulmonary disease (COPD). The objectives of this study were to identify
patterns of endurance activity after completion of pulmonary rehabilitation and to characterize people who succeed and those who have difficulty maintaining endurance activity. In a longitudinal study embedded within a randomized clinical trial, 206 individuals with COPD underwent a 3-month pulmonary rehabilitation program. Weekly duration of endurance activity was assessed at 4, 6, 8 and 12 months after rehabilitation start. Trajectory modeling was used to determine the most common patterns of activity during the post-rehabilitation phase from 4-12 months. Three distinct patterns were identified, two of which indicated difficulty in maintaining endurance activity: 61 individuals reported a high activity level at 4 months (2.7 hours·week(-1)) and stayed high, 114 individuals started at a low activity level (mean 1.0 & hour·week(-1)) and stayed low, and 31 individuals started high (3.0 hours·week (-1)) and declined. The low activity group was characterized by more severe disease and greater respiratory impairment. The high/decline group had less severe disease and respiratory impairment, but reported greater barriers to exercise. Pulmonary rehabilitation may need to include behavioral interventions aimed at minimizing barriers.

Stephen Bailey et al (2011) has conducted a study on “Inspiratory muscle training enhances pulmonary O₂ uptake kinetics and high-intensity exercise tolerance in humans.” Fatigue of the respiratory muscles during intense exercise might compromise leg blood flow, thereby constraining oxygen uptake (\(\dot{V}O_2\)) and limiting exercise tolerance. We tested the hypothesis that inspiratory muscle training (IMT) would reduce inspiratory muscle fatigue, speed \(\dot{V}O_2\) kinetics and enhance exercise tolerance. Sixteen recreationally active subjects (mean ± SD, age 22 ± 4 yr) were randomly assigned to receive 4 wk of either pressure threshold IMT [30 breaths twice daily at ~50% of maximum inspiratory pressure (MIP)] or sham treatment (60 breaths once daily at ~15% of MIP). The subjects completed moderate-, severe- and maximal -intensity “step” exercise transitions on a cycle ergometer before (Pre) and after (Post) the 4-wk intervention period for determination of \(\dot{V}O_2\) kinetics and exercise tolerance. There were no significant changes in the physiological variables of interest after Sham. After IMT, baseline MIP was significantly increased (Pre vs. Post: 155 ± 22 vs. 181 ± 21 cmH₂O; \(P < 0.001\)), and the degree of inspiratory muscle fatigue was reduced after severe- and maximal-intensity exercise. During severe exercise the \(\dot{V}O_2\) slow component was reduced (Pre vs. Post: 0.60 ±
0.20 vs. 0.53 ± 0.24 l/min; \( P < 0.05 \) and exercise tolerance was enhanced (Pre vs. Post: 765 ± 249 vs. 1,061 ± 304 s; \( P < 0.01 \)). Similarly, during maximal exercise, the \( \dot{V}O_2 \) slow component was reduced (Pre vs. Post: 0.28 ± 0.14 vs. 0.18 ± 0.07 l/min; \( P < 0.05 \)) and exercise tolerance was enhanced (Pre vs. Post: 177 ± 24 vs. 208 ± 37 s; \( P < 0.01 \)).

Four weeks of IMT, which reduced inspiratory muscle fatigue, resulted in a reduced \( \dot{V}O_2 \) slow-component amplitude and an improved exercise tolerance during severe and maximal-intensity exercise. The results indicate that the enhanced exercise tolerance observed after IMT might be related, at least in part, to improved \( \dot{V}O_2 \) dynamics, presumably as a consequence of increased blood flow to the exercising limbs.

Sveinung Berntsen (2011) has conducted a study on “Physical Activity in Childhood Asthma: Friend or Foe?” Physical activity has been considered as a double-edged sword for children with asthma. Children with asthma are recommended to participate in physical activities like their healthy nonasthmatic peers because regular physical activity positively affects psychological functioning, quality of life, morbidity, and aerobic fitness in children with asthma. However, uncontrolled asthma with ongoing exercise-induced bronchoconstriction may limit participation in sports, free play, and daily living. Observations also suggest that high-intensity exercise performed in cold air, seasonal allergens, pollutants, or respiratory virus infections may increase the risk for asthma in the highly active child. In contrast, a sedentary lifestyle has been highlighted as the explanation for the increased prevalence of asthma in the past decades. However, there is no consensus on whether a low level of physical activity increases the severity or risk of asthma. Use of asthma medications and good asthma control can make the conditions favorable for a physically active lifestyle and influence physical activity level and the level of aerobic fitness.

Tapas Pramanik et al. (2009) has conducted a study on “Immediate Effect of Slow Pace Bhashrika Pranayama on Blood Pressure and Heart Rate” Objectives: The objective of this study was to evaluate the immediate effect of slow pacebhashrika pranayama (respiratory rate 6/min) for 5 minutes on heart rate and blood pressure and the effect of the same breathing exercise for the same duration of time (5 minutes) following oral intake of hyoscine-N-butylbromide (Buscopan), a parasympathetic blocker drug. Subjects and methods: Heart rate and blood pressure of volunteers (\( n = 39 \),
age = 25–40 years) was recorded following standard procedure. First, subjects had to sit comfortably in an easy and steady posture (sukhasana) on a fairly soft seat placed on the floor keeping head, neck, and trunk erect, eyes closed, and the other muscles reasonably loose. The subject is directed to inhale through both nostrils slowly up to the maximum for about 4 seconds and then exhale slowly up to the maximum through both nostrils for about 6 seconds. The breathing must not be abdominal. These steps complete one cycle of slow pace bhastrika pranayama (respiratory rate 6/min). During the practice the subject is asked not to think much about the inhalation and exhalation time, but rather was requested to imagine the open blue sky. The pranayama was conducted in a cool, well-ventilated room (18–20°C). After 5 minutes of this breathing practice, the blood pressure and heart rate again were recorded in the aforesaid manner using the same instrument. The other group (n = 10) took part in another study where their blood pressure and heart rate were recorded following half an hour of oral intake of hyoscine-N-butylbromide 20 mg. Then they practiced the breathing exercise as stated above, and the abovementioned parameters were recorded again to study the effect of parasympathetic blockade on the same pranayama. Results: It was noted that after slow bhastrika pranayamic breathing (respiratory rate 6/min) for 5 minutes, both the systolic and diastolic blood pressure decreased significantly with a slight fall in heart rate. No significant alteration in both blood pressure and heart rate was observed in volunteers who performed the same breathing exercise for the same duration following oral intake of hyoscine Butyl bromide Discussion: Pranayama increases frequency and duration of inhibitory neural impulses by activating pulmonary stretch receptors during above tidal volume inhalation as in Hering Bruer reflex, which bring about withdrawal of sympathetic tone in the skeletal muscle blood vessels, leading to widespread vasodilatation, thus causing decrease in peripheral resistance and thus decreasing the diastolic blood pressure. After hyoscine-N-butylbromide, the parasympathetic blocker, it was observed that blood pressure was not decreased significantly as a result of pranayama, as it was observed when no drug was administered. Conclusions: Vagal cardiac and pulmonary mechanisms are linked, and improvement in one vagal limb might spill over into the other. Baroreceptor sensitivity can be enhanced significantly by slow breathing (supported by a small reduction in the heart rate observed during slow
breathing and by reduction in both systolic and diastolic pressure). Slow pacebhastrika pranayama (respiratory rate 6/min) exercise thus shows a strong tendency to improving the autonomic nervous system through enhanced activation of the parasympathetic system.

Van Helvoort et al (2011) has conducted a study on “Exercises commonly used in rehabilitation of patients with chronic obstructive pulmonary disease: cardiopulmonary responses and effect over time” To compare conventional exercise-based assessment of pulmonary rehabilitation (PR) with improvement in training exercises employed during a PR program, and to describe the cardiopulmonary response of different training exercises during PR of patients with chronic obstructive pulmonary disease (COPD). DESIGN: Observational study. SETTING: Inpatient PR Patients with moderate to very severe (N=18). intervention not applicable.: Cardiopulmonary responses to interval cycling, arm exercise, and a test of functional activities of daily living (ADLs) were evaluated during the PR training program using a mobile telemetric breath-by-breath system. The effects of PR were evaluated by comparing pre-PR and post-PR training activities, incremental and constant work-rate cycling, and a 6-minute walk test. RESULTS: Interval cycling and the ADLs test were moderate-intensity to heavy-intensity exercises (70%-80% of maximal oxygen consumption), while the arm exercise was a low-intensity activity (40% of maximal oxygen consumption). After 12 weeks of PR, cycle load, arm weights, and walking distances during training activities had increased alongside increased muscle mass. At iso-intensities, no cardiopulmonary changes in the training exercises were observed. Exercise duration of constant work-rate cycling and 6-minute walk distance increased by 160% and 14%, respectively, after PR, with concurrent right-shifts of anaerobic threshold and a decrease in heart rate. CONCLUSIONS: Supervised increases in weight, load, and walking distance during training activities were useful clinical outcomes for patients, demonstrating the beneficial effects of progressive training on physical performance. However, for physiologic evaluation of PR, conventional tests, such as maximal incremental cycling, endurance cycling, and a 6-minute walk test, had greater validity. Physiologic evaluation of the training exercises showed that the training program complied with the training recommendations for PR.
Vogiatzis (2011) has conducted a study on “Strategies of muscle training in very severe COPD patients”. There is strong evidence that exercise training, constituting the cornerstone of pulmonary rehabilitation, improves patients' exercise tolerance, dyspnoea sensations, functional capacity and quality of life in patients with severe COPD. However, intolerable sensations of breathlessness and or peripheral muscle discomfort may prevent such patients to tolerate high intensity exercise levels for sufficiently long periods of time to obtain true physiological training effects. Accordingly, the major issue that arises is the selection of the appropriate training strategy that is tailored to the cardiovascular, pulmonary and peripheral muscle limitations of the individual patient and is aimed at maximizing the effect of exercise conditioning. Within this context the present review article explores the application of strategies that optimize exercise tolerance by reducing dyspnoea sensations, namely non-invasive mechanical ventilation, oxygen and/or heliox supplementation. Administration of heliox or oxygen during exercise also increases peripheral muscle oxygen delivery, thereby delaying the onset of peripheral muscle fatigue. Particular emphasis is also given to interval exercise and resistance muscle training as both modalities allow the application of intense loads on peripheral muscles with tolerable levels of dyspnoea sensations. In patients with profound muscle weakness and intense breathlessness upon physical exertion, execution of short bouts of interval or local muscle strength conditioning, along with oxygen breathing, may constitute a feasible and effective approach at the pulmonary rehabilitation setting.

Vogiatzis et al (2011) has conducted a study on “Effect of helium breathing on intercostal and quadriceps muscle blood flow during exercise in COPD patients.” Emerging evidence indicates that, besides dyspnea relief, an improvement in locomotor muscle oxygen delivery may also contribute to enhanced exercise tolerance following normoxic heliox (replacement of inspired nitrogen by helium) administration in patients with chronic obstructive pulmonary disease (COPD). Whether blood flow redistribution from intercostal to locomotor muscles contributes to this improvement currently remains unknown. Accordingly, the objective of this study was to investigate whether such redistribution plays a role in improving locomotor muscle oxygen delivery while breathing heliox at near-maximal [75% peak work rate (WR(peak))], maximal (100%WR(peak)), and supramaximal (115%WR(peak)) exercise in COPD. Intercostal
and vastus lateralis muscle perfusion was measured in 10 COPD patients (FEV(1) = 50.5 ± 5.5% predicted) by near-infrared spectroscopy using indocyanine green dye. Patients undertook exercise tests at 75 and 100%WR(peak) breathing either air or heliox and at 115%WR(peak) breathing heliox only. Patients did not exhibit exercise-induced hyperinflation. Normoxic heliox reduced respiratory muscle work and relieved dyspnea across all exercise intensities. During near-maximal exercise, quadriceps and intercostal muscle blood flows were greater, while breathing normoxic heliox compared with air (35.8 ± 7.0 vs. 29.0 ± 6.5 and 6.0 ± 1.3 vs. 4.9 ± 1.2 ml·min(-1)·100 g(-1)), respectively; P < 0.05; mean ± SE). In addition, compared with air, normoxic heliox administration increased arterial oxygen content, as well as oxygen delivery to quadriceps and intercostal muscles (from 47 ± 9 to 60 ± 12, and from 8 ± 1 to 13 ± 3 mlO(2)·min(-1)·100 g(-1), respectively; P < 0.05). In contrast, normoxic heliox had neither an effect on systemic nor an effect on quadriceps or intercostal muscle blood flow and oxygen delivery during maximal or supramaximal exercise. Since intercostal muscle blood flow did not decrease by normoxic heliox administration, blood flow redistribution from intercostal to locomotor muscles does not represent a likely mechanism of improvement in locomotor muscle oxygen delivery.

Villiot-Danger et al (2011) has conducted a study to determine “Respiratory muscle endurance training in obese patients”. OBJECTIVE: Increased respiratory muscle work is associated with dyspnea and poor exercise tolerance in obese patients. We evaluated the effect of respiratory muscle endurance training (RMET) on respiratory muscle capacities, symptoms and exercise capacity in obese patients. DESIGN: A total of 20 obese patients hospitalized for 26 ± 6 days to follow a low-calorie diet and a physical activity program were included in this case-control study. Of them, 10 patients performed RMET (30-min isocapnic hyperpnea at 60-80% maximum voluntary ventilation, 3-4 times per week during the whole hospitalization period: RMET group), while the other 10 patients performed no respiratory training (control (CON) group). RMET and CON groups were matched for body mass index (BMI) (45 ± 7 kg m(-2)) and age (42 ± 12 years). Lung function, respiratory muscle strength and endurance, 6-min walking distance, dyspnea (Medical Research Council scale) and quality of life (short-form health survey 36 questionnaire) were assessed before and after intervention. RESULTS: Similar
BMI reduction was observed after hospitalization in the RMET and CON groups (-2 ± 1 kg m(-2), P < 0.001). No significant change in lung function and respiratory muscle strength was observed except for vital capacity, which increased in the RMET group (+0.20 ± 0.26 l, P = 0.039). Respiratory muscle endurance increased in the RMET group only (+52 ± 27%, P < 0.001). Compared with the CON group, the RMET group had greater improvement in 6MWT (+54 ± 35 versus +1 ± 7 m, P = 0.007), dyspnea score (-2 ± 1 versus -1 ± 1 points, P = 0.047) and quality of life (total score: +251 ± 132 versus +84 ± 152 points, P = 0.018) after hospitalization. A significant correlation between the increase in respiratory muscle endurance and improvement in 6MWT distance was observed (r (2) = 0.36, P = 0.005).

Conclusion: The present study indicates that RMET was feasible in obese patients and can induce significant improvement in dyspnea and exercise capacity.

Vivodtzev et al (2011) has conducted a study on “Physiological correlates of endurance time variability during constant-workrate cycling exercise in patients with COPD”. The endurance time (T(end)) during constant-workrate cycling exercise (CET) is highly variable in COPD. We investigated pulmonary and physiological variables that may contribute to these variations in T(end).

METHODS Ninety-two patients with COPD completed a CET performed at 80% of peak workrate capacity (W(peak)). Patients were divided into tertiles of T(end) [Group 1: <4 min; Group 2: 4-6 min; Group 3: >6 min]. Disease severity (FEV(1)), aerobic fitness (W(peak), peak oxygen consumption [VO2(peak)], ventilatory threshold [VO2(VT)], quadriceps strength (MVC), symptom scores at the end of CET and exercise intensity during CET (heart rate at the end of CET to heart rate at peak incremental exercise ratio [HR(CET)/HR(peak)]) were analyzed as potential variables influencing T(end).

RESULTS: W(peak), VO2(peak), VO2(VT), MVC, leg fatigue at end of CET, and HR(CET)/HR(peak) were lower in group 1 than in group 2 or 3 (p≤0.05). VO2(VT) and leg fatigue at end of CET independently predicted T(end) in multiple regression analysis (r=0.50, p=0.001). CONCLUSION: T(end) was independently related to the aerobic fitness and to tolerance to leg fatigue at the end of exercise. A large fraction of the variability in T(end) was not explained by the physiological parameters assessed in the present study. Individualization of exercise intensity during CET should help in reducing variations in T(end) among patients with COPD.