

## POWERbreathe & IMT Related Research

### CLINICAL APPLICATIONS OF IMT

In this section you will find links to research papers that report the findings of clinical trials of IMT and studies of the effect of certain medical conditions upon the strength and function of the inspiratory muscles. The latter provides the rationale for IMT.

We have only included research that is published in peer-reviewed, high-quality scientific journals. As well as original studies, we have also included some articles that review IMT; these have been written by experts in this field of research.

### IMT, WARM-UP & COOL-DOWN IN SPORTS & EXERCISE

In this section you will find links to research papers that report the findings of research studies of IMT, as well as inspiratory muscle warm-up and cool-down.

We have only included research that is published in peer-reviewed, high-quality scientific journals. As well as original studies, we have also included some articles that review IMT; these have been written by experts in this field of research.

To help you find what you are looking for, we have provided the title of each research paper to give a flavour of its content, and each title is linked to a full copy of the paper, or its abstract.

### Inspiratory muscle training

#### *Rowing:*

- "Inspiratory muscle training improves rowing performance." <http://www.acsm-msse.org/pt/re/msse/abstract.00005768-200105000-00020.htm;jsessionid=LVLpXL6kJhS1n4BnWPfJYTQyMLF8yFOFG8yysBh922LMmqVDphxy!150813252!181195629!8091!-1>
- "The influence of inspiratory and expiratory muscle training upon rowing performance." <http://www.springerlink.com/content/k3154g28nkm03w40/>

#### *Cycling:*

- "Effects of inspiratory muscle training upon time trial performance in trained cyclists." <http://www.thieme-connect.de/ejournals/abstract/sportsmed/doi/10.1055/s-2008-1025647>
- "Inspiratory muscle fatigue in trained cyclists: effects of inspiratory muscle training." <http://www.acsm-msse.org/pt/re/msse/abstract.00005768-200205000-00010.htm;jsessionid=LVTL1SKGxm1pmw7b699Gy1YV2p9sJvyj1qL47pRSWvQgHCDtXvDw!1167962659!181195628!8091!-1>
- "Inspiratory muscle training improves cycling time-trial performance and anaerobic work capacity but not critical power." <http://www.springerlink.com/content/I9085718p7045216/>

Health Management Group Markets and Distributes the Following Products



- "Effect of high-intensity inspiratory muscle training on lung volumes, diaphragm thickness, and exercise capacity in subjects who are healthy."  
<http://ptjournal.org/cgi/content/abstract/86/3/345>
- "The effects of different inspiratory muscle training intensities on exercising heart rate and perceived exertion."  
<http://www.ingentaconnect.com/content/klu/421/2004/00000092/F0020001/art00008>
- "Inspiratory resistive loading improves cycling capacity: a placebo controlled trial."  
<http://bjsm.bmj.com/cgi/content/abstract/38/6/730>
- "Effects of Inspiratory Muscle Training on Whole Body Exercise Performance in Males."

#### Running:

- "Oxygen uptake kinetics and maximal aerobic power are unaffected by inspiratory muscle training in healthy subjects where time to exhaustion is extended."  
<http://www.springerlink.com/content/e7ybyq3dmxpcbnwxd/>
- "Inspiratory muscle training improves shuttle run performance in healthy subjects."  
[http://www.sciencedirect.com/science?\\_ob=ArticleURL&\\_udi=B7CVK-4HBB7HC-6&\\_user=10&\\_coverDate=12%2F31%2F1999&\\_alid=731263558&\\_rdoc=6&\\_fmt=high&\\_orig=search&\\_cdi=18081&\\_sort=d&\\_docanchor=&\\_view=c&\\_ct=268&\\_acct=C000050221&\\_version=1&\\_urlVersion=0&\\_userid=10&md5=f1225f55fa940676c236cb5e60f4fcde](http://www.sciencedirect.com/science?_ob=ArticleURL&_udi=B7CVK-4HBB7HC-6&_user=10&_coverDate=12%2F31%2F1999&_alid=731263558&_rdoc=6&_fmt=high&_orig=search&_cdi=18081&_sort=d&_docanchor=&_view=c&_ct=268&_acct=C000050221&_version=1&_urlVersion=0&_userid=10&md5=f1225f55fa940676c236cb5e60f4fcde)
- "Concurrent inspiratory muscle and cardiovascular training differentially improves both perceptions of effort and 5000-m running performance compared to cardiovascular training alone." <http://bjsm.bmj.com/cgi/content/abstract/bjsm.2007.045377v2>

#### Team Sports:

- "Effects of inspiratory muscle training upon recovery time during high intensity, repetitive sprint activity." <http://www.ncbi.nlm.nih.gov/pubmed/12165887>

#### Swimming:

- "Respiratory muscle training improves swimming endurance in divers."  
<http://www.springerlink.com/content/djg6876j76ml9561/>
- "Resistive respiratory muscle training improves and maintains endurance swimming performance in divers." <http://www.ncbi.nlm.nih.gov/pubmed/17672173>

#### High Altitude:

- "Effects of inspiratory muscle training on exercise responses in normoxia and hypoxia."  
[http://www.sciencedirect.com/science?\\_ob=ArticleURL&\\_udi=B6X16-4KY88PB-1&\\_user=10&\\_rdoc=1&\\_fmt=&\\_orig=search&\\_sort=d&\\_view=c&\\_acct=C000050221&\\_version=1&\\_urlVersion=0&\\_userid=10&md5=fba63105e000e3dbe0be17df337b79e8](http://www.sciencedirect.com/science?_ob=ArticleURL&_udi=B6X16-4KY88PB-1&_user=10&_rdoc=1&_fmt=&_orig=search&_sort=d&_view=c&_acct=C000050221&_version=1&_urlVersion=0&_userid=10&md5=fba63105e000e3dbe0be17df337b79e8)
- "High-Altitude Exposure Reduces Inspiratory Muscle Strength." <http://www.thieme-connect.com/ejournals/abstract/sportsmed/doi/10.1055/s-2006-924367;jsessionid=0674355CA78F97DCE72DEB21821293F6.jvm5>

## Warm-up and cool-down

- "Specific respiratory warm-up improves rowing performance and exertional dyspnoea."  
<http://www.acsm-msse.org/pt/re/msse/abstract.00005768-200107000-00017.htm;jsessionid=LVbfnCn9Q4svsXX1XQYsnlsGBpgSny2TvmGyHJmSgJP4POGPVBm!1167962659!181195628!8091!-1>
- "Effect of specific inspiratory muscle warm-up on intense intermittent run to exhaustion."  
<http://www.springerlink.com/content/9031370152040277/>
- "Specific inspiratory muscle warm-up enhances badminton footwork performance."  
<http://rparticle.web-p.cisti.nrc.ca/rparticle/AbstractTemplateServlet?journal=apnm&volume=32&year=&issue=&sno=h07-077&calyLang=eng>
- "Blood lactate during recovery from intense exercise: impact of inspiratory loading."  
<http://www.acsm-msse.org/pt/re/msse/abstract.00005768-200801000-00016.htm;jsessionid=LVpHSDHSP8yLnwBnrV1N85zOZjR9G3rh4pTTJmwWK21NJTOyLjWD!1167962659!181195628!8091!-1>

## Exercise-induced inspiratory muscle fatigue

- "Inspiratory muscle fatigue in swimmers after a single 200 m swim."  
<http://www.ingentaconnect.com/content/tandf/rjsp/2003/00000021/00000008/art00008>
- "Inspiratory muscle fatigue in trained cyclists: effects of inspiratory muscle training."  
<http://www.acsm-msse.org/pt/re/msse/abstract.00005768-200205000-00010.htm;jsessionid=LVfcmh0J1B2ZQ2GXIPkpvVVJmQGvfRNVkRJmmtPJGVV1BH5QyLIG!1167962659!181195628!8091!-1>
- "Inspiratory muscle training improves rowing performance." <http://www.acsm-msse.org/pt/re/msse/abstract.00005768-200105000-00020.htm;jsessionid=LVfYpRh866nnJhv1Vzt6VT948HFvSmZ91ykyhXHI23jwDF6vsOnh!1167962659!181195628!8091!-1>
- "Influence of environmental temperature on exercise-induced inspiratory muscle fatigue."  
<http://www.springerlink.com/content/g5r20bpx46qgdf52/>
- "Aerobic fitness effects on exercise-induced low-frequency diaphragm fatigue."  
<http://jap.physiology.org/cgi/content/abstract/81/5/2156>
- "Exercise-induced diaphragmatic fatigue in healthy humans."  
<http://jp.physoc.org/cgi/content/abstract/460/1/385>
- "The effect of exercise modality on respiratory muscle performance in triathletes."  
<http://www.ms-se.com/pt/re/msse/abstract.00005768-200112000-00010.htm;jsessionid=LVgJI9tvWsGvVhSpsWC4yp7MTdn7T1dQYvpzQG6Q2c6jxNwJOnHJ!1838886723!181195629!8091!-1>

- "A comparison of inspiratory muscle fatigue following maximal exercise in moderately trained males and females." <http://www.springerlink.com/content/n40t3jl4xh075067/>
- "Inspiratory muscles experience fatigue faster than the calf muscles during treadmill marching." [http://www.sciencedirect.com/science?\\_ob=ArticleURL&\\_udi=B6X16-4KR4C0V-1&\\_user=10&\\_rdoc=1&\\_fmt=&\\_orig=search&\\_sort=d&\\_view=c&\\_acct=C000050221&\\_version=1&\\_urlVersion=0&\\_userid=10&md5=df2ecc7beb9920e5e05fd918a05a96ca](http://www.sciencedirect.com/science?_ob=ArticleURL&_udi=B6X16-4KR4C0V-1&_user=10&_rdoc=1&_fmt=&_orig=search&_sort=d&_view=c&_acct=C000050221&_version=1&_urlVersion=0&_userid=10&md5=df2ecc7beb9920e5e05fd918a05a96ca)

### Miscellaneous

- "Development and evaluation of a pressure threshold inspiratory muscle trainer for use in the context of sports performance." <http://www.blackwell-synergy.com/doi/abs/10.1046/j.1460-2687.2000.00047.x?journalCode=spe>
- "Specificity and reversibility of inspiratory muscle training." <http://www.acsm-msse.org/pt/re/msse/abstract.00005768-200302000-00010.htm;jsessionid=LVvXpMPGfpOT1mGcpfCFJFz7gJ4cGT88419KnRslZrBvrhH2JTPk!271767458!181195628!8091!-1>
- "Inspiratory muscle training: a simple cost-effective treatment for inspiratory stridor." <http://bjsm.bmj.com/cgi/content/abstract/41/10/694?maxtoshow=&HITS=10&hits=10&RESULTFORMAT=&author1=dickinson&andorexactfulltext=and&searchid=1&FIRSTINDEX=0&sortspec=relevance&volume=41&resourcetype=HWCIT>

### Review Articles

- "Does training of respiratory muscles affect exercise performance in healthy subjects?" [http://www.resmedjournal.com/article/S0954-6111\(05\)00381-1/abstract](http://www.resmedjournal.com/article/S0954-6111(05)00381-1/abstract)
- "Respiratory muscle energetics during exercise in healthy subjects and patients with COPD." [http://www.resmedjournal.com/article/S0954-6111\(06\)00110-7/abstract](http://www.resmedjournal.com/article/S0954-6111(06)00110-7/abstract)
- "Respiratory muscle training in healthy humans: resolving the controversy." <http://www.thieme-connect.com/ejournals/abstract/sportsmed/doi/10.1055/s-2004-815827>

### THE UNDERLYING PHYSIOLOGY OF IMT AND INSPIRATORY WARM-UP

- "The influence of inspiratory muscle work history and specific inspiratory muscle training upon human limb muscle fatigue." <http://jp.physoc.org/cgi/content/abstract/577/1/445>
- "Inspiratory muscle training attenuates the human respiratory muscle metaboreflex." <http://jp.physoc.org/cgi/content/abstract/584/3/1019>
- "The effect of inspiratory muscle training upon maximum lactate steady-state and blood lactate concentration." <http://www.springerlink.com/content/r506778526462348/>

- "Effects of changes in inspiratory muscle strength on the sensation of respiratory force." <http://jap.physiology.org/cgi/content/abstract/70/1/240?ck=nck>
- "Effect of inspiratory muscle work on peripheral fatigue of locomotor muscles in healthy humans." <http://jp.physoc.org/cgi/content/abstract/571/2/425>
- "Influence of acute inspiratory loading upon diaphragm motor-evoked potentials in healthy humans." <http://jap.physiology.org/cgi/content/abstract/102/5/1883>
- "Diaphragm and intercostal surface EMG and muscle performance after acute inspiratory muscle loading." [http://www.sciencedirect.com/science?\\_ob=ArticleURL&\\_udi=B6X16-4KF6BRR-1&\\_user=10&\\_rdoc=1&\\_fmt=&\\_orig=search&\\_sort=d&\\_view=c&\\_acct=C000050221&\\_version=1&\\_urlVersion=0&\\_userid=10&md5=493ab3938459dd6398d3cd353889a4c7](http://www.sciencedirect.com/science?_ob=ArticleURL&_udi=B6X16-4KF6BRR-1&_user=10&_rdoc=1&_fmt=&_orig=search&_sort=d&_view=c&_acct=C000050221&_version=1&_urlVersion=0&_userid=10&md5=493ab3938459dd6398d3cd353889a4c7)

#### **Studies showing that IMT is helpful:**

- "The Effects of 1 Year of Specific Inspiratory Muscle Training in Patients With COPD." <http://www.chestjournal.org/cgi/content/abstract/128/5/3177>
- "Ventilatory muscle training improves exercise capacity in chronic obstructive pulmonary disease patients." <http://www.ncbi.nlm.nih.gov/pubmed/7362134>
- "Targeted resistive ventilatory muscle training in chronic obstructive pulmonary disease." <http://jap.physiology.org/cgi/content/abstract/65/6/2726>
- "Resistive breathing training in patients with chronic obstructive pulmonary disease." <http://www.chestjournal.org/cgi/content/abstract/90/5/662?ck=nck>
- "High-intensity inspiratory muscle training in patients with chronic obstructive pulmonary disease and severely reduced function." <http://www.jcrjournal.com/pt/re/jcardiorehab/abstract.00008483-200107000-00008.htm;jsessionid=LGfJX37McyjZH6l2vjgphL6NFvpMkTCOfG5YkH71f8w51KyLYD9LI-1990489359!181195628!8091!-1>
- "Training of inspiratory muscles in chronic obstructive lung disease. Its impact on functional changes and exercise tolerance." <http://www.ncbi.nlm.nih.gov/pubmed/9557177>
- "Targeted inspiratory muscle training improves respiratory muscle function and reduces dyspnea in patients with chronic obstructive pulmonary disease." <http://www.ncbi.nlm.nih.gov/pubmed/2742247>
- "Nocturnal saturation improves by target-flow inspiratory muscle training in patients with COPD." <http://ajrccm.atsjournals.org/cgi/content/abstract/153/1/260>
- "High-intensity inspiratory muscle training in COPD." <http://www.erj.ersjournals.com/cgi/content/abstract/27/6/1119>
- "Inspiratory muscle training in patients with chronic obstructive pulmonary disease." <http://www.ncbi.nlm.nih.gov/pubmed/8247819>

Health Management Group Markets and Distributes the Following Products



- "Inspiratory muscle training in pulmonary rehabilitation program in COPD patients." [Link to: http://www.resmedjournal.com/article/S0954-6111\(07\)00013-3/abstract](http://www.resmedjournal.com/article/S0954-6111(07)00013-3/abstract)
- "Inspiratory muscle training protocol using a pressure threshold device: effect on dyspnea in chronic obstructive pulmonary disease." <http://www.ncbi.nlm.nih.gov/pubmed/9915380>
- "Inspiratory muscle training in patients with chronic obstructive pulmonary disease: structural adaptation and physiologic outcomes." <http://ajccm.atsjournals.org/cgi/content/abstract/166/11/1491>
- "Inspiratory muscle training in patients with COPD: effect on dyspnea, exercise performance, and quality of life." <http://www.chestjournal.org/cgi/content/abstract/120/3/748>
- "Effect of inspiratory muscle training on muscle strength and quality of life in patients with chronic airflow limitation: a randomized controlled trial." <http://www.ncbi.nlm.nih.gov/pubmed/16324598>
- "Increased exercise performance in patients with severe COPD following inspiratory resistive training." <http://www.chestjournal.org/cgi/content/abstract/81/4/436>
- "Feasibility of High-Intensity, Interval-Based Respiratory Muscle Training in COPD." <http://www.chestjournal.org/cgi/content/abstract/123/1/142>
- "Effect of inspiratory muscle training with an intermediate load on inspiratory power output in COPD." <http://www.erj.ersjournals.com/cgi/content/abstract/11/1/28>
- "Effects of combined inspiratory muscle and cycle ergometer training on exercise performance in patients with COPD." <http://erj.ersjournals.com/cgi/content/abstract/7/12/2205>
- "Inspiratory muscle training combined with general exercise reconditioning in patients with COPD." <http://www.chestjournal.org/cgi/content/abstract/102/5/1351>
- "Maintenance of inspiratory muscle training in COPD patients: one year follow-up." <http://www.erj.ersjournals.com/cgi/content/abstract/23/1/61>
- "The cumulative effect of long-acting bronchodilators, exercise, and inspiratory muscle training on the perception of dyspnea in patients with advanced COPD." <http://www.chestjournal.org/cgi/content/abstract/118/3/672>
- "Inspiratory Muscle Training May Increase Peak Inspiratory Flow in Chronic Obstructive Pulmonary Disease." <http://content.karger.com/ProdukteDB/produkte.asp?Doi=88095>

*Expert reviews of IMT:*

- "Inspiratory muscle training: a way to breathe more easily." <http://content.karger.com/ProdukteDB/produkte.asp?Doi=91529>

Health Management Group Markets and Distributes the Following Products



- "Target-flow inspiratory muscle training during pulmonary rehabilitation in patients with COPD." <http://www.chestjournal.org/cgi/content/abstract/99/1/128>
- "Inspiratory muscle training in COPD patients." <http://www.ncbi.nlm.nih.gov/pubmed/2679605>
- "Effects of controlled inspiratory muscle training in patients with COPD: a meta-analysis." <http://erj.ersjournals.com/cgi/content/abstract/20/3/570>
- "What is the role of inspiratory muscle training in the treatment of chronic obstructive pulmonary disease?" <http://www.ncbi.nlm.nih.gov/pubmed/16324596>
- "Inspiratory muscle training: integrative review." <http://www.ingentaconnect.com/content/springer/rtnp/2006/00000020/00000004/art00005>
- "Respiratory muscle training in chronic obstructive pulmonary disease: inspiratory, expiratory, or both?" <http://www.ncbi.nlm.nih.gov/pubmed/15699786>
- "Inspiratory muscle training: a way to breathe more easily." <http://content.karger.com/ProdukteDB/produkte.asp?Aktion=ShowPDF&ArtikelNr=91529&Ausgabe=231710&ProduktNr=224278&filename=91529.pdf>

Health Management Group Markets and Distributes the Following Products

