Scand J Med Sci Sports. 2015 Dec;25 Suppl 3:1-72. doi: 10.1111/sms.12581.

Exercise as medicine - evidence for prescribing exercise as therapy in 26 different chronic diseases.

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Author information

Abstract

This review provides the reader with the up-to-date evidence-based basis for prescribing exercise as medicine in the treatment of 26 different diseases: psychiatric diseases (depression, anxiety, stress, schizophrenia); neurological diseases (dementia, Parkinson's disease, multiple sclerosis); metabolic diseases (obesity, hyperlipidemia, metabolic syndrome, polycystic ovarian syndrome, type 2 diabetes, type 1 diabetes); cardiovascular diseases (hypertension, coronary heart disease, heart failure, cerebral apoplexy, and claudication intermittent); pulmonary diseases (chronic obstructive pulmonary disease, asthma, cystic fibrosis); musculo-skeletal disorders (osteoarthritis, osteoporosis, back pain, rheumatoid arthritis); and cancer. The effect of exercise therapy on disease pathogenesis and symptoms are given and the possible mechanisms of action are discussed. We have interpreted the scientific literature and for each disease, we provide the reader with our best advice regarding the optimal type and dose for prescription of exercise.

Allergy. 2016 Jul;71(7):1031-6. doi: 10.1111/all.12885. Epub 2016 Apr 1.

Mouth breathing, another risk factor for asthma: the Nagahama Study.

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Author information

Abstract

BACKGROUND:

Allergic rhinitis, a known risk factor for asthma onset, often accompanies mouth breathing. Mouth breathing may bypass the protective function of the nose and is anecdotally considered to increase asthma morbidity. However, there is no epidemiological evidence that mouth breathing is independently associated with asthma morbidity and sensitization to allergens. In this study, we aimed to clarify the association between mouth breathing and asthma morbidity and allergic/eosinophilic inflammation, while considering the effect of allergic rhinitis.

METHODS:

This community-based cohort study, the Nagahama Study, contained a self-reporting questionnaire on mouth breathing and medical history, blood tests, and pulmonary function testing. We enrolled 9804 general citizens of Nagahama City in the Shiga Prefecture, Japan.

RESULTS:

Mouth breathing was reported by 17% of the population and was independently associated with asthma morbidity. The odds ratio for asthma morbidity was 1.85 (95% CI, 1.27-2.62) and 2.20 (95% CI, 1.72-2.80) in subjects with mouth breathing alone and allergic rhinitis alone, which additively increased to 4.09 (95% CI, 3.01-5.52) when mouth breathing and allergic rhinitis coexisted. Mouth breathing in nonasthmatics was a risk for house dust mite sensitization, higher blood eosinophil counts, and lower pulmonary function after adjusting for allergic rhinitis.

CONCLUSION:

Mouth breathing may increase asthma morbidity, potentially through increased sensitization to inhaled allergens, which highlights the risk of mouth-bypass breathing in the 'one airway, one disease' concept. The risk of mouth breathing should be well recognized in subjects with allergic rhinitis and in the general population.

Am J Cardiol. 2010 Apr 15;105(8):1181-5. doi: 10.1016/j.amjcard.2009.12.022. Epub 2010 Feb 20.

Relation of high heart rate variability to healthy longevity.

Zulfiqar U[1], Jurivich DA, Gao W, Singer DH.

Author information

Erratum in

- Am J Cardiol. 2010 Jul 1;106(1):142.

Abstract

The population's aging underscores the need to understand the process and define the physiologic markers predictive of healthy longevity. The findings that aging is associated with a progressive decrease in heart rate variability (HRV), an index of autonomic function, suggests that longevity might depend on preservation of autonomic function. However, little is known about late life changes. We assessed the relation between autonomic function and longevity by a cross-sectional study of HRV of 344 healthy subjects, 10 to 99 years old. The HRV was determined from 24-hour Holter records, using 4 time domain measures of HRV (the root mean square of the successive normal sinus RR interval difference [rMSSD], percentage of successive normal sinus RR intervals >50 ms [pNN50], standard deviation of all normal sinus RR intervals during a 24-hour period [SDNN], and standard deviation of the averaged normal sinus RR intervals for all 5-minute segments [SDANN]). Autonomic modulation of the 4 measures differs, permitting distinctions between changes in HRV-parasympathetic function, using rMSSD and pNN50, and HRV-sympathetic function using SDNN and SDANN. Decade values were compared using analysis of variance and t-multiple comparison testing. The HRV of all measures decreases rapidly from the second to fifth decades. It then slows. The HRV-sympathetic function continues to decrease throughout life. In contrast, the decrease in HRV-parasympathetic function reaches its nadir in the eighth decade, followed by reversal and a progressive increase to higher levels (p <0.05), more characteristic of a younger population. In conclusion, healthy longevity depends on preservation of autonomic function, in particular, HRV-parasympathetic function, despite the early age-related decrease. The eighth decade reversal of the decrease in HRV-parasympathetic function and its subsequent increase are key determinants of longevity. Persistently high HRV in the elderly represents a marker predictive of longevity.

Int J Sports Med
DOI: 10.1055/a-0836-9011

Cerebral and Muscle Oxygenation during Repeated Shuttle Run Sprints with Hypoventilation

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,
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,
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,
Gregoire P. Millet
,
Aurelien Pichon

Abstract

Ten highly-trained Jiu-Jitsu fighters performed 2 repeated-sprint sessions, each including 2 sets of 8 x ~6 s back-and-forth running sprints on a tatami. One session was carried out with normal breathing (RSN) and the other with voluntary hypoventilation at low lung volume (RSH-VHL). Prefrontal and vastus lateralis muscle oxyhemoglobin ([O_2Hb]) and deoxyhemoglobin ([HHb]) were monitored by near-infrared spectroscopy. Arterial oxygen saturation (SpO_2), heart rate (HR), gas exchange and maximal blood lactate concentration ($[La]_{max}$) were also assessed. SpO_2 was significantly lower in RSH-VHL than in RSN whereas there was no difference in HR. Muscle oxygenation was not different between conditions during the entire exercise. On the other hand, in RSH-VHL, cerebral oxygenation was significantly lower than in RSN (−6.1±5.4 vs−1.5±6.6 µm). Oxygen uptake was also higher during the recovery periods whereas $[La]_{max}$ tended to be lower in RSH-VHL. The time of the sprints was not different between conditions. This study shows that repeated shuttle-run sprints with VHL has a limited impact on muscle deoxygenation but induces a greater fall in cerebral oxygenation compared with normal breathing conditions. Despite this phenomenon, performance is not impaired, probably because of a higher oxygen uptake during the recovery periods following sprints.

Sleep Med Rev. 2005 Dec;9(6):437-51. Epub 2005 Oct 19.

Sleep, breathing and the nose.

Pevernagie DA[1], De Meyer MM, Claeys S.

Author information

Abstract

During sleep there is a discrete fall in minute ventilation and an associated increase in upper airway resistance. In normal subjects, the nasal part of the upper airway contributes only little to the elevation of the total resistance, which is mainly the consequence of pharyngeal narrowing. Yet, swelling of the nasal mucosa due to congestion of the submucosal capacitance vessels may significantly affect nasal airflow. In many healthy subjects an alternating pattern of congestion and decongestion of the nasal passages is observed. Some individuals demonstrate congestion of the ipsilateral half of the nasal cavity when lying down on the side. Nasal diseases, including structural anomalies and various forms of rhinitis, tend to increase nasal resistance, which typically impairs breathing via the nasal route in recumbency and during sleep. A role of nasal obstruction in the pathogenesis of sleep-disordered breathing has been implicated by many authors. While it proves difficult to show a relationship between the degree of nasal obstruction and the number of disturbed breathing events, the presence of nasal obstruction will most likely have an impact on the severity of sleep-disordered breathing. Identification of nasal obstruction is important in the diagnostic work-up of patients suffering from snoring and sleep apnea.

Respir Physiol. 1980 Oct;42(1):61-71.

The switching point from nasal to oronasal breathing.

Niinimaa V, Cole P, Mintz S, Shephard RJ.

Abstract

The switching point from nasal to oronasal breathing during incrementally graded submaximal exercise was determined in 30 (14 M, 16 F) healthy adult volunteers. Nasal airflow was measured by a pneumotachograph attached to a nasal mask. Oral airflow was determined as the difference between nasal airflow and total pulmonary airflow, the latter being measured by a head-out exercise body plethysmograph. The airflow and pressure signals were sampled every 20 msec by a micropressor, which calculated respiratory volumes and nasal work of breathing, and produced an on-line print-out. Twenty of the 30 subjects (normal augmenters) switched from nasal to oronasal breathing at submaximal exercise of 105.0 W (SD = 30.1), four subjects (mouth breathers) breathed habitually oronasally, five subjects (nose breathers) persistently breathed through the nose only, and one subject showed no consistent nose/mouth breathing pattern. In normal augmenters, the onset of oronasal breathing (VE 35.3 +/- 10.81 . min-1) was quite consistent individually, but varied considerably between inividuals without showing a significant sex difference. The factors most closely related to the switching point were rating of perceived exertion of breathing and nasal work of breathing.

Pflugers Arch. 1978 Dec 15;378(1):65-9.

Oronasal breathing during exercise.

Saibene F, Mognoni P, Lafortuna CL, Mostardi R.

Abstract

The shift from nasal to oronasal breathing (ONBS) has been observed on 73 subjects with two independent methods. A first group of 63 subjects exercising on a bicycle ergometer at increasing work load (98--196 W) has been observed. On 35 subjects the highest value of ventilation attained with nasal breathing was 40.2 +/- 9.41 . min-1 S.D. Ten subjects breathed through the mouth at all loads, while 5 never opened the mouth. On 13 subjects it was not possible to make reliable measurements. On a second group of 10 subjects utilizing a different techniques which did not need a face mask, the ventilation at which one changes the pattern of breathing was found to be 44.2 +/- 13.51 . min-1 S.D. On the same subjects nasal resistance did not show any correlation with ONBS. It is concluded that ONBS is not solely determined by nasal resistance, though an indirect effect due to hypoventilation and hence to changes in alveolar air composition cannot be ruled out. It is likely that ONBS is also influenced by psychological factors.

Respiration characteristics in subjects diagnosed as having nasal obstruction

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PlumX Metrics
DOI: https://doi.org/10.1016/0278-2391(88)90081-X

Abstract

The purpose of this study was to determine the respective oral and nasal contributions to total respiration in patients scheduled for surgical corrections of nasal obstruction. The effect of anterior nares expansion and/or nasal decongestant administration on the nasal component of breathing was also examined in these patients. Although variability among subjects was demonstrated in the ratio of nasal respiration to total respiration, 25% of the "nasally-obstructed" patients were 100% nasal brethers and no patient had a nasal component less than 18% of total respiration. Great variability existed among the patients in their response to nares expansion and/or decongestant administration. Collectively, they demonstrated no significant mean increase in nasal respiration with nares expansion alone. The patients demonstrated an increase with administration of the decongestant and with decongestant combined with nares expansion. The latter condition resulted in an increase that was greater than with decongestant alone. The implication of this study is that the traditional diagnostic terms "mouth breathing" or "nasal obstruction" are not useful. They do not describe the type, location, or severity of an obstruction or the relative contribution of the nose and mouth to respiration. Many patients who experience symptoms or have signs of nasal obstruction can functionally compensate to maintain 100% nasal breathing.

Maximum airflow through the nose in humans

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,
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1 Mar 1991 https://doi.org/10.1152/jappl.1991.70.3.1369

Inspiratory and expiratory flow via the nose and via the mouth during maximum-effort vital capacity (VC) maneuvers have been compared in 10 healthy subjects. Under baseline conditions maximum flow via the nose was lower than that via the mouth in the upper 50-60% of the VC on expiration and throughout the VC on inspiration. The mean ratio of maximum inspiratory to maximum expiratory flow at mid-VC was 1.38 during mouth breathing and 0.62 during nasal breathing. Inspiratory flow limitation with no increase in flow through the nose as driving pressure was increased above a critical value (usually between 12 and 30 cmH2O) was found in all six subjects studied. Stenting the alae nasi in seven subjects increased peak flow via the nose from a mean of 3.49 to 4.32 l/s on inspiration and from 4.83 to 5.61 l/s on expiration. Topical application of an alpha-adrenergic agonist in seven subjects increased mean peak nasal flow on inspiration from 3.25 to 3.89 l/s and on expiration from 5.03 to 7.09 l/s. Further increases in peak flow occurred with subsequent alan stenting. With the combination of stenting and topical mucosal vasoconstriction, nasal peak flow on expiration reached 81% and, on inspiration, 79% of corresponding peak flows via the mouth. The results demonstrate that narrowing of the alar vestibule and the state of the mucosal vasculature both influence maximum flow through the nose; under optimal conditions, nasal flow capacity is close to that via the mouth.

Respirology. 1999 Dec;4(4):331-8.

The breathing route dependence of ventilatory responses to hypercapnia and exercise is modulated by upper airway resistance.

Shi YX[1], Seto-Poon M, Wheatley JR.

Author information

Abstract

OBJECTIVE:

The ventilatory response to hypercapnia is greater breathing orally than nasally.

METHODOLOGY:

We hypothesize that this is due to higher nasal resistance to airflow compared with oral resistance. Seven normal male subjects were studied during both progressive hyperoxic hypercapnia (HC) and exercise (EX) until ventilation exceeded 40 L/min. Under each condition, subjects breathed via the nose only or the mouth only. For each breathing route, ventilation and pathway resistance were calculated simultaneously at the highest common exercise workload (140 +/- 20 watt; mean +/- SE) or the same end-tidal CO2 level (8.0 +/- 0.5%).

RESULTS:

The ventilatory response breathing nasally was decreased by a similar amount for both EX and HC when compared with the oral route. The difference between nasal and oral ventilation was highly correlated with the difference between nasal resistance and oral resistance for both EX and HC (linear regression analysis; r = 0.91 for EX and r = 0.86 for HC; both P < 0.01).

CONCLUSION:

We conclude that the breathing route dependence of ventilatory responses to respiratory stimuli in normal subjects is independent of the method of stimulation and is substantially determined by the added resistance of nasal breathing.

The breathing route dependence of ventilatory responses to hypercapnia and exercise is modulated by upper airway resistance

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First published: 05 January 2002
https://doi.org/10.1046/j.1440-1843.1999.00201.x

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Results: The ventilatory response breathing nasally was decreased by a similar amount for both EX and HC when compared with the oral route. The difference between nasal and oral ventilation was highly correlated with the difference between nasal resistance and oral resistance for both EX and HC (linear regression analysis; $r = 0.91$ for EX and $r = 0.86$ for HC; both $P < 0.01$).

Conclusion: We conclude that the breathing route dependence of ventilatory responses to respiratory stimuli in normal subjects is independent of the method of stimulation and is substantially determined by the added resistance of nasal breathing.