

Psychological & Physiological Effects of Exercise

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Disclosure

- The speaker has no conflict of interest, financial agreement, or working affiliation with any group or organization.

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https://www.surveymonkey.com/r/Nov18_1515_Exercise

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Exercise improves outcomes

- Atherosclerosis
- Ischemic heart disease
- Hypertension
- Diabetes (types 1 & 2)
- Osteoarthritis
- Obesity
- Asthma & COPD
- Cancer



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Exercise benefits in Asthma

- 36 asthmatic subjects aged 16-40 years
 - Randomly allocated to control and training groups
 - 6 week run in period and after a further 3 months
- Significant increases in:
 - Mean maximal oxygen uptake from 23 (5) to 28 (6)
 - Oxygen pulse (ml/beat) from 8.8 (2.3) to 10.8 (2.4)
 - Anaerobic threshold (1/min) from 1.11 (0.27) to 1.38 (0.33).
- Significant fall in:
 - breathlessness scores (Borg ratings),
 - blood lactate
 - carbon dioxide output
 - minute ventilation during submaximal exercise



■ *Thorax 1990;45:345-351 doi:10.1136/thx.45.5.345*

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Exercise on Arthritis of the Knee



- Meta-analysis of 32 studies provided data on 3616 participants for knee pain
- Beneficial treatment effect with a standardized mean difference:
 - SMD of 0.40 (95% confidence interval (CI) 0.30 to 0.50) for pain
 - SMD 0.37 (95% CI 0.25 to 0.49) for physical function
- Reduces knee pain by 1 point on a scale of 0 to 20
- Improves knee function by 3 points on a scale of 0 to 68

□ *Cochrane Database of Systematic Reviews 2008, Issue 4.*

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Cardiovascular benefits



- Decr LDL, Triglycerides & Incr HDL
- Improved myocardial perfusion in presence of ischemia
(animal studies)
- Increased insulin sensitivity
- Improved fibrinolysis and lower levels of serum fibrinogen
- Reduced arterial stiffness and increased compliance

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Benefits for women

- Most studies done on men
- Nurses Health Study in 2000 showed a reduction in coronary events from 0.82 – 0.17



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Effect on Blood Pressure/Weight

- Meta-analysis on endurance training involved 72 trials and 105 study groups
 - Resting BP reduction in 30 hypertensive study groups showed decrease of -6.9/-4.9 mmHg
 - Systemic vascular resistance decreased by 7.
 - Plasma norepinephrine decreased by 29%
 - Plasma renin activity decreased by 20%
- Weight
 - Decreased by 1.2 kg
 - Decreased waist circumference by 2.8 cm
 - Decreased percentage body fat by 1.4%



■ *European Journal of Preventive Cardiology February 2007 vol. 14 no. 1 12-17*

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Preventing Type 2 DM



- 110,660 men and women from 33 health care clinics with glucose intolerance
- Cumulative incidence of diabetes at 6 years:
 - 67.7% (95% CI, 59.8–75.2) in the control group
 - 43.8% (95% CI, 35.5–52.3) in the diet group
 - 41.1% (95% CI, 33.4–49.4) in the exercise group

■ *Diabetes Care 1997 Apr; 20(4): 537-544*

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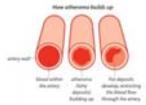
Effect in Type 1 DM



- 13 subjects with type 1 diabetes and 7 control subjects w/o DM
- Each group performed 45 min of cycle exercise three times per wk for 12 wks
- VO_2 MAX increased in both groups
 - Control (33.8 ± 1.7 to 43.2 ± 3.5 ml/min/kg)
 - Diabetic (38.7 ± 3.3 to 46.5 ± 3.6 ml/min/kg)
- Acute glucose-lowering effect occurred with each exercise session throughout the 12-wk training period (225.8 ± 16.1 to 148.5 ± 16.8 mg/dl)
- Fasting plasma glucose and HgbA1c remained essentially unchanged
 - Pretraining, 193.7 ± 27.5 mg/dl and $10.7 \pm 0.3\%$;
 - 6-wk training, 192.5 ± 27.1 mg/dl and $10.7 \pm 0.03\%$;
 - 12-wk training, 202 ± 30.1 mg/dl and $10.3 \pm 0.8\%$.
- Note improvements in physical fitness and insulin sensitivity.

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Effect on Lipids



- Meta-analysis of 3000 studies;
 - 1,260 subjects (580 exercise, 680 control)
 - Increase of 9% in HDL-C
 - Decrease of 11% in TG
 - No statistically significant decreases in TC or LDL-C
 - [J Cardiopulm Rehabil. 2006; 26\(3\): 131-144](#)
- Meta-analysis of 13 studies in obese participants
 - Decrease TC - 3.4 ± 1.7 mg/dl
 - Decrease TG - 16.1 ± 7.3 mg/dl
 - No changes in HDL or LDL
 - [International Journal of Obesity \(2005\) 29, 881-893](#)

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Effect on Myocardial Perfusion

- Vascular stenoses reduced by regression of coronary atherosclerosis or bypassed by formation of new collaterals.
- The dynamic part of epicardial stenoses may be attenuated by improvement of endothelial function in coronary conduit vessels.
- Exercise training could improve exercise-induced flow through coronary resistance vessels and the microcirculation.
- Micro rheology and platelet function may be positively influenced.
 - [Cardiology Clinics Aug 2001 Vol 19, Is 3, PP 357-368](#)

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Exercise and Outcomes

- **The effect of exercise intensity on lipid peroxidation**
 - LEAF, DAVID A.; KLEINMAN, MICHAEL T.; HAMILTON, MICHELLE; BARSTOW, THOMAS J.
 - *Medicine & Science in Sports & Exercise*: August 1997 - Volume 29 - Issue 8 - pp 1036-1039
- **Exercise: A drug-free approach to lowering high blood pressure**
 - Mayo Clinic Staff
 - <http://www.mayoclinic.com/health/high-blood-pressure/H100024>



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Exercise and Cancer

- Adults ages 18 to 98, with the average age at 59 in 1987
- Average of 11 years, 186, 932 people
- Risk of developing seven cancer types was **20 percent (or more) lower** among the most active participants as compared with the least active
 - Most active, those in the 90th percentile, corresponds to approximately 22.5 MET-hours/week
 - Equal to 7 hours a week of brisk walking or 2.5 hours a week of jogging
- Higher levels of leisure-time physical activity linked to a 7 percent lower risk of total cancer

ACS's Cancer Research Update: May 2016
JAMA Intern Med. 2016;176(6):816-825



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"Importantly, people with lower activity levels, such as those who do 2.5 hours a week of brisk walking, still had notably lower cancer risk, even if it was not quite as low as those who did more activity."

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Autonomic Nervous System



- Role recognized as very important in cardiovascular health
- Cardiovascular disease is associated with autonomic dysfunction
- Parasympathetic tone (PST)
 - Incr HR during exercise – Decr PST
 - Decr HR after exercise – Incr PST
- *Delay recovery of HR after exercise associated w/ increased risk of mortality*

□ *Swiss Med Wkly '04; 134: 514-22*

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Autonomic dysfunction

- Early: Decr Parasympathetic tone
 - Vagal nerve
- Later: Incr Sympathetic tone
- Leads to both Incr HR and Incr variability of the HR during activity
- HR recovery after exercise
 - Delay associated w/ Incr mortality
 - Recovery: 1-2 minutes



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Endurance training

- Incr Parasympathetic (Vagal) tone
- Resting bradycardia
 - Sinus pauses & arrhythmias - Benign
 - Athletic Heart Syndrome
- Reduced max HR during exercise
- More rapid fall in HR after exercise



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Psychological Benefits

- Enhanced Mood
- Decreased Depression
- Improved Self Esteem
- Less Issues with Body Image
- Stress Reduction
- Slowing of Dementia
- Increased social interaction



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Exercise and Anxiety Levels

- 86 participants for this randomized, experimental study
 - 41 in experimental group; 42 in control group
- Participants were asked to complete a pretest:
 - Before the 3-month exercise program,
 - Posttest at 1 week
 - Follow-up test at 3 months after
- Trait anxiety levels were significantly improved from pretest to follow-up test in the experimental group.
- Improvements also noted in
 - Body Mass Index
 - HDL Cholesterol levels
 - Metabolic syndrome



Biol Res Nurs, 2016 Oct 11, pii: 1099800416672581

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Exercise and Depression

- Conducted between 1998 and 2001 and analyzed in 2002 and 2003 whether exercise is an efficacious treatment for mild to moderate major depressive disorder (MDD)
- Participants were randomized to one of four aerobic exercise treatment groups
 - total energy expenditure (7.0 kcal/kg/week or 17.5 kcal/kg/week)
 - frequency (3 days/week or 5 days/week)
 - placebo control (3 days/week flexibility exercise)
- Results using 17-item Hamilton Rating Scale for Depression (HRSD₁₇).
 - Adjusted mean HRSD₁₇ scores at 12 weeks were reduced 47% from baseline for PHD (Public Health Dose = highest level exercise group)
 - 30% for Low Dose exercise group and 29% for control group



American Journal of Preventive Medicine, Volume 28, Issue 1, January 2005, Pages 140-141

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Exercise and Fibromyalgia



- 215 FMS patients with depression were assessed with the Beck Depression Inventory, and were additionally classified as inactive, insufficiently active, or active.
- Inactive patients with FMS have a higher rate of moderate to severe depression (29.1%) and major depression (25%) when compared with active patients.

Journal of Affective Disorders,
10/21/2016 Andrade A, et al.

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Exercise and Dementia



- Aerobic exercise may attenuate cognitive impairment and reduce dementia risk
- Meta-analyses of prospective studies documented a significantly reduced risk of dementia associated with midlife exercise
 - Mayo Clinic Proceedings September 2011 | Volume 86, Issue 9, Pages 876-884
- 1740 participants 65 y/o & older in cohort study.
- Rate of dementia was:
 - 13.0 per 1000 person-years in those who exercised 3 or more times per week
 - 19.7 per 1000 person-years in those who exercised less than 3 times per week
 - Larson et al; Ann Int Med Jan 06

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Physiological Effects of Exercise

- Increase activity in the brain's frontal lobes and hippocampus
 - Increased levels of serotonin, dopamine and norepinephrine - Elevated mood
 - Same effect found with anti-depressants
- Increased Brain-Derived-Neurotrophic-Factor (BDNF)
 - Aids in survival of brain cells
 - ?? Factor in slowing dementia



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Effects of Exercise on the Brain

■ Prophylactic Activation of Neuroprotective Stress Response Pathways by Dietary and Behavioral Manipulations

- Mark P. Mattson, Wenzhen Duan, Ruqian Wan, and Zhihong Guo
- NeuroRx. 2004 January, 1(1): 111–116.

■ Showed that diet and exercise both increased levels of BDNF in the brain

- Involved in a range of adaptive neuronal responses
- Also similar to Growth Hormone

■ Both felt to be mild cellular stresses



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Physiological Effects

■ Increased Endorphins

- Bind to neuro-receptors in the brain
- Decreased pain (“Runner’s high”)
- *The Antidepressive Effects of Exercise. Neurochemistry* [cited 2003 December Available from: URL: http://sulcus.berkeley.edu/mcb/165_001/papers/manuscripts/512.html]



■ Increased body temperature

- Seems to have calming effect

■ Decreased immune system chemicals

- Effect on auto-immune diseases

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How to Begin

- Choose an activity that is enjoyed
- Make it a routine (daily, etc.)
- Group activities may help patient continue in activity
- Set realistic goals
- Keep a record of progress
- Wear proper clothing
- Forget the saying “No Pain, No Gain!”



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Type of Activity

- Medical status
- Level of fitness
- Interests / preferences
- Facilities available (costs)
- Climate
- Geographic location



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Frequency / Duration

- AAFP: Preferably EVERY day!!
- ACSM: Min 3-5 days/week
- VO2 Max increases with frequency of training but plateaus at 3 days/week

- AAFP: 30 min
- ACSM: 20 – 60 minutes
 - Continuous OR Intermittent
 - Min of 10 minute bouts



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Case Study Home Exercise

- 50 y/o male
- Long term obesity since childhood
- FHx of
 - Diabetes Type 2
 - Hypertension
 - Obesity
- Started bicycling after skiing injury in 1985 (as initial PT)
- Became much more active 1998



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Case Study Home Exercise

- | | |
|--------------------------------|--------------------------------|
| ■ 1998 | ■ 2007 |
| ■ Wt 230 | ■ Wt 205 |
| ■ BMI 33.0 | ■ BMI 29.4 |
| ■ BP 145/88 | ■ BP 130/78 |
| <input type="checkbox"/> On Rx | <input type="checkbox"/> On Rx |
| ■ T Chol 190 | ■ T Chol 176 |
| ■ HDL 38 | ■ HDL 45 |

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