

# Benefits of Exercise Sufficiency

restoring and maintaining balance

## DIABETES

Studies showed that **~30-50% of all cases of Type 2 diabetes**, coronary heart disease, and many cancers were prevented by **30 min of moderate-intensity exercise each day in middle-aged women (e.g., walking >3 miles/h)** compared with cohorts who exhibited lower levels of physical activity

*Colditz, GA, Cannuscio CC, and Frazier AL. Physical activity and reduced risk of colon cancer: implications for prevention. Cancer Causes Control 8: 649-666, 1997*

*Hu, FB, Manson JE, Stampfer MJ, Colditz G, Liu S, Solomon CG, and Willett WC. Diet, lifestyle, and the risk of type 2 diabetes mellitus in women. N Engl J Med 345: 790-797, 2001* *Huang, Z, Willett WC, Colditz GA, Hunter DJ, Manson JE, Rosner B, Speizer FE, and Hankinson SE. Waist circumference, waist:hip ratio, and risk of breast cancer in the Nurses' Health Study. Am J Epidemiol 150: 1316-1332, 1999*

The provocative report by Roberts et al. (6) in this issue of the Journal may help to overcome the above barriers of time and effect. Their study of just **3 wk of treatment showed a phenomenal clinical response of ~50% decrease in metabolic syndrome (defined using the WHO criteria) and Type 2 diabetes**. At the start of the study, 48 and 42% of the 31 subjects had metabolic syndrome and Type 2 diabetes, respectively. This number decreased to 19 and 23%, respectively, after the 3-wk intervention and was associated with enhanced insulin sensitivity. So what was the miracle treatment? **The treatment was intense lifestyle modification consisting of diet and physical activity**. To our knowledge, **no current pharmaceutical product has made a claim in a peer-reviewed publication for an approximate halving the metabolic syndrome and Type 2 diabetes in 3 wk**.

*Roberts CK, Won D, Pruthi S, Kurtovic S, Sindhu RK, Vaziri ND, and Barnard RJ. Effect of a short-term diet and exercise intervention on oxidative stress, inflammation, MMP-9, and monocyte chemotactic activity in men with metabolic syndrome factors. J Appl Physiol 100: 1657-1665, 2006*

From an epidemiological perspective, preventing such a stall in the feast-famine and activity-rest cycles via **regular doses of physical activity (2.5-3.0 h/wk of moderate-intensity physical activity, i.e., brisk walking) translates to a 30% reduction in stroke, Type 2 diabetes, and heart disease, as noted in the landmark Harvard Nurses Study (27-29, 35)**. Furthermore, walking has been associated with lower mortality across a diverse spectrum of adults with Type 2 diabetes, in that one death per year may be preventable for every 61 people who could be persuaded to walk at least 2 h/wk (22).

*Manu V. Chakravarthy<sup>1</sup> and Frank W. Booth, J Appl Physiol 96: 3-10, 2004; Eating, exercise, and "thrifty" genotypes: connecting the dots toward an evolutionary understanding of modern chronic diseases*

## Cardiovascular Disease

Cardiovascular disease was the primary cause of 949,619 deaths (41% of all deaths) in the United States in 1998. Inactivity contributed to these deaths. For example, **30% of coronary heart disease and stroke was prevented by 2.5 h of brisk walking (>3 miles/h) each week**, compared with those who performed less than this amount of physical activity in a large population of Harvard nurses. **If the preventive effects of undertaking moderate-intensity physical activity [i.e., activity performed at three to six times the basal metabolic rate, which is the equivalent of brisk walking at 3-4 miles/h for most healthy adults were to be similar for all causes of cardiovascular disease, then 284,886 deaths from cardiovascular disease would be prevented (12% of all deaths in the United States)**.

*Frank W. Booth<sup>1</sup>, Manu V. Chakravarthy<sup>2</sup>, Scott E. Gordon<sup>3</sup>, and Espen E. Spangenburg. 00073.2002*

*Vol. 93, Issue 1, 3-30, July 2002 Waging war on physical inactivity: using modern molecular ammunition against an ancient enemy*

**Exercise also appears to exert an acute protective effect in heart muscle**. A single 30-min bout of running by rats on a treadmill conferred a cardioprotective effect on the myocardium that resulted in a limitation of infarct size 24 h later

*Yamashita, N, Baxter GF, and Yellon DM. Exercise directly enhances myocardial tolerance to ischaemia-reperfusion injury in the rat through a protein kinase C mediated mechanism. Heart 85: 331-336, 2001*

# CANCER

## *Colon Cancer*

A **50% reduction in the incidence of colon cancer was observed among those with the highest level of physical activity** across numerous studies (42). Thus 50,000 cases and 24,000 deaths from colon cancer could have been prevented each year in the United States by more physical activity. Sedentary individuals have twice the incidence of colon cancer compared with those with the highest level of activity across numerous studies that used different measures of activity (occupational or leisure-time activity)

-Colditz, GA, Cannuscio CC, and Frazier AL. Physical activity and reduced risk of colon cancer: implications for prevention. *Cancer Causes Control* 8: 649-666, 1997

-Cronin, KA, Krebs-Smith SM, Feuer EJ, Troiano RP, and Ballard-Barbash R. Evaluating the impact of population changes in diet, physical activity, and weight status on population risk for colon cancer (United States). *Cancer Causes Control* 12: 305-316, 2001

## *Pancreatic Cancer*

Evidence that inactivity increases incidence. **Walking or hiking <20 min/wk was associated with twice the risk of pancreatic cancer when compared with >4 h/wk** in 164,000 men and women (175).

-175. Michaud, DS, Giovannucci E, Willett WC, Colditz GA, Stampfer MJ, and Fuchs CS. Physical activity, obesity, height, and the risk of pancreatic cancer. *JAMA* 286: 921-929, 2001

## *Skin Cancer-Melanoma*

Evidence that inactivity increases incidence. Sedentary men and women had a 56 and 72%, respectively, higher incidence of melanomas than those exercising 5-7 days/wk. **Exercising 4 days or less per week provided no protection from melanomas.**

219. Shors, AR, Solomon C, McTiernan A, and White E. Melanoma risk in relation to height, weight, and exercise (United States). *Cancer Causes Control* 12: 599-606, 2001

## *Immune Function*

With regard to the acute exercise effects on the immune response, it has been shown that **natural immunity is enhanced during moderate exercise** (198) Habitual moderate physical activity increases macrophage antitumor activity in mice of different ages but also reduces macrophage myosin heavy chain 2 expression and antigen-presentation capacity

-Pedersen, BK, and Hoffman-Goetz L. Exercise and the immune system: regulation, integration, and adaptation. *Physiol Rev* 80: 1055-1081, 2000

# Congestive Heart Failure & Hypertension

\Brodney (23) found the following. 1) Regular **physical activity appears to provide substantial protection against coronary heart disease**, especially in overweight men. 2) Regular physical activity appears to **reduce the risk of developing hypertension in men with elevated BMI**, and this reduction was greatest in men with the high BMI categories. 3) **Physical fitness has the same protective effect in normal-weight diabetic men as in overweight diabetic men.**

-Blair, SN, and Brodney S. Effects of physical inactivity and obesity on morbidity and mortality: current evidence and research issues. *Med Sci Sports Exerc* 31: S646-S662, 1999.

# Mortality-1 mile difference

**Nonsmoking 61- to 81-yr-old men who walked <1 mile/day had twice the rate of mortality than those who walked >2 miles/day** (89)

-89. Hakim, AA, Petrovitch H, Burchfiel CM, Ross GW, Rodriguez BL, White LR, Yano K, Curb JD, and Abbott RD. Effects of walking on mortality among nonsmoking retired men. *N Engl J Med* 338: 94-99, 1998[Abstract/Free Full Text].

# Osteoporosis

The results from the National Osteoporosis Risk Assessment (221) indicated that **people who regularly exercised had a significantly reduced risk of developing osteoporosis.**

-221. Siris, ES, Miller PD, Barrett-Connor E, Faulkner KG, Wehren LE, Abbott TA, Berger ML, Santora AC, and Sherwood LM. Identification and fracture outcomes of undiagnosed low bone mineral density in postmenopausal women: results from the National Osteoporosis Risk Assessment. *JAMA* 286: 2815-2822, 2001.