

Review

Nutrition and exercise: The safest way to health

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*If we could get every individual the right amount of nourishment and exercise,
not too little and not too much, we could have found the safest way to health.*

Hippocrates 460–377 BC

ABSTRACT Hippocrates' wisdom still resonates, while finding "the right amount" continues to elude us. From Hippocrates to current times, nutrition and physical activity patterns have been defined mostly by economic, cultural, and social factors rather than scientific facts. Only recently, we began to make scientific progress in these two vital areas of human health. However, the road ahead remains long and arduous, with voluminous, and at times, esoteric information difficult to interpret or implement, with profiteers and flamboyant, self-proclaimed experts that lure the public by attractive half truths regarding weight management, fitness and overall health.

Key-words: Nutrition, physical activity, public health.

NUTRITION AND HEALTH

Is there a simple and perhaps enchanting message that will allure the public away from half truths and set it on the right path? In search of the "silver bullet" that will prevent or attenuate chronic diseases, it became obvious that comprehensive dietary approaches that consist of low saturated fats and high in fruits, vegetables, and whole grains are more effective in promoting health and longevity rather than any single food or nutrient. In this regard, it is now widely accepted that three types of dietary patterns are associated with good health and longevity. These include the Japanese, Chinese, and Mediterranean diets. Of the three, the Mediterranean diet provides

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a more practical and realistic choice for Western societies.¹

The Mediterranean diet is low in saturated and high in monounsaturated fat, high in complex carbohydrates, and high in fiber, mostly from vegetables and fruits. Perhaps the most important characteristic of Mediterranean diet is the consumption of olive oil as the main source of dietary fats. In addition to its several beneficial properties, olive oil facilitates the consumption of large quantities of raw or cooked vegetables, legumes and wild greens.²

Evidence that the Mediterranean diet promotes health and longevity has its origin in the findings of the Seven Countries Study.³ In particular, the investigators reported that the lower mortality rates observed in the two Greek cohorts of Corfu and Crete were likely attributable to the protective properties the Mediterranean diet against atherosclerosis, mainly due to the reduction of blood pressure and body mass index levels. These findings were later confirmed by the Lyon Diet Heart Study in post myocardial infarction individuals⁴ and the CARDIO2000 in treated, untreated or uncontrolled hypertensive subjects.⁵ Greater adherence to the Mediterranean diet was also inversely associated with coronary heart disease mortality⁶ and lower prevalence of and progression to the metabolic syndrome.⁷ In diabetics, Mediterranean diet was more effective in weight reduction and glycemic control when compared to a low-fat diet.⁸

PHYSICAL ACTIVITY AND HEALTH

Increased physical activity of adequate volume leads to a higher capacity to perform work and results in certain physiologic adaptations that encompass the musculoskeletal, cardiovascular and metabolic systems. These exercise-related physiologic adaptations have significant clinical implications in the prevention and management of chronic diseases. A plethora of evidence now supports unequivocally that a physically active lifestyle or structured exercises of adequate intensity, duration and volume is associated with a reduced risk for cardiovascular and all-cause mortality in healthy and diseased populations. The physical activity-mortality risk relationship is graded and persists regardless of age, gender, race, risk factors, or other co-morbidities. The

reduction in mortality risk for each 1-MET increase in exercise capacity ranges between 10–25%.^{9–11}

An age-related exercise capacity threshold also exists for a mortality risk reduction of approximately 20% at the exercise capacity of 4–6 METs. Mortality risk continues to decline with increased fitness to approximately 70%, reaching an exercise capacity asymptote of approximately 10 METs.^{10,11} The recommended exercise intensity is in the range of 3 to 6 METs and an overall energy expenditure of at least 1,000 kcal/week, the equivalent of walking for roughly 30 minutes per day.^{9,10} It also appears that exercise intensity and duration are inversely related to mortality risk independent of overall exercise volume. Limited evidence also suggests that the reduction in coronary heart disease risk achieved by participation in resistance training is similar to that provided by brisk walking, but is approximately half of that provided by running.⁹

The exercise-related reduction in mortality risk has also been reported in special populations, i.e. older populations and those with various co-morbidities. For example, the association between exercise capacity and mortality risk for individuals >70 years of age was inverse and graded, similar to younger individuals.^{10,11} Significantly lower mortality rate were also observed in as moderately fit and high-fit individuals with type 2 diabetes mellitus, when compared to those in the lowest-fit category (≤ 5 METs)¹² and in hypertensive individuals with and without additional risk factors.¹³ A noteworthy finding was that the higher mortality risk observed in hypertensive individuals with additional risk factors was eliminated if they achieved an exercise capacity of just over 5 METs. Furthermore, the mortality risk in those with an exercise capacity of more than 7 METs is approximately 50–60% lower regardless of the presence or absence of additional risk factors.¹³

SYNERGISTIC EFFECTS OF NUTRITION AND EXERCISE ON HEALTH

Is there a synergistic effect of nutrition and exercise on health? Was Hippocrates correct? Although studies exploring the health benefits of lifestyle modifications are relatively few, the findings support a favorable synergistic effect between exercise and nutrition. A lifestyle intervention program that included at least

150 minutes per week of brisk walk and low-fat, low calorie diet was more effective in reducing body weight and the incidence of diabetes than metformin.¹⁴

The synergistic effect of exercise and nutrition is perhaps more evident on body weight control. It is now well accepted that the impact of exercise alone on weight reduction is modest. This is not surprising if one considers that the chemical energy stored in one kilogram (kg) of fat tissue (a weekly weight loss advocated by most professionals) is approximately 7,700 kcal. Since walking one km requires approximately 65 kcal, to lose one kg of body fat per week by exercise alone, one needs to walk briskly for approximately 120 kilometers. This of course is impractical for most people.

Weight control through dietary restrictions alone is also not the answer. Weight loss by caloric restriction alone leads to substantial losses of lean body mass, water electrolytes, and minerals. This, leads to muscle weakness including atrophy of the heart muscle, poor heart function and (in extreme cases) sudden death. In addition, almost all of the weight lost by diet alone is gained back in 1–5 years.⁹

Is there a practical and healthy approach to weight control? The scientific evidence supports that combining proper diet and exercise results in better outcomes than either approach alone for the following reasons. First, increased physical activity contributes independently an additional weight reduction attributable to caloric restriction.¹⁵ Second, when caloric restriction is combined with exercise most lean body mass is preserved. Third, exercise alone exerts health benefits in lean and obese individuals,

even in the absence weight reduction.^{16,17} Thus, the American College of Sports Medicine recommends that exercise must be the key component in any weight loss program. If exercise is not included, the program is incomplete and likely to fail.⁹

The obesity epidemic presents a serious health issue for modern societies with no practical or effective approaches to halt it. Most experts agree that obesity is the outcome of chronic imbalance between caloric intake and caloric expenditure.⁹ It is important to recognize that a relatively small, inconspicuous but habitual increase in daily caloric intake can lead to substantial changes in weight over time. For example, an increase in caloric intake of just 150 kcal a day (the calories found in one can of most soft drinks) amounts to approximately 55,000 kcal per year and a weight gains of approximately 7 kg. Conversely, even small lifestyle changes should mitigate or reverse such trend. In this regard, a brisk walk of 3–5 km, five days per week, will lead to approximately 1,000 to 1,500 kcal per week or 52,000 to 78,000 in one year. This caloric expenditure is equivalent to the energy stored in approximately 7–10 kg of fat. Combining this amount of exercise with a greater adherence to the Mediterranean diet and small sacrifices in unnecessary caloric intake (i.e. drinking water instead of soda) is likely to foster even greater weight reduction. This approach is certainly within the capacity of most adults and more than adequate to a weekly reduction of body weight by one kg. Although this is not as easy as taking a pill, safe and effective weight-reducing medication is still years away and a society of younger diabetics and large-scale gastric bypass surgery is certainly not the answer.

Διατροφή και άσκηση: Η ασφαλέστερη οδός για την υγεία

Π. Κόκκινος

ΠΕΡΙΛΗΨΗ Ενώ η σοφία του Ιπποκράτη αντηχεί ακόμα, η εύρεση της «χρυσής τομής» συνεχίζει να μας διαφεύγει. Από την εποχή του Ιπποκράτη έως σήμερα, τα πρότυπα της διατροφής και της φυσικής δραστηριότητας έχουν καθοριστεί ως επί το πλείστον από οικονομικούς, πολιτιστικούς και κοινωνικούς παράγοντες, αντί βάσει επιστημονικών δεδομένων. Μόλις πρόσφατα ξεκίνησε η επιστημονική πρόοδος σε αυτούς τους δύο ζωτικής σημασίας τομείς της υγείας του ανθρώπου. Εντούτοις ο δρόμος παραμένει δύσκολος και μακρύς, με ογκώδη, και κατά καιρούς κρυφά δεδομένα, τα οποία είναι δύσκολο να ερμηνευθούν ή να εφαρμοστούν, με κερδοσκόπους και επιδεικτικούς αυτοαποκαλούμενους ειδικούς που παρασύρουν το κοινό μέσω ελκυστικών ημιμαθειών αναφορικά με τη διαχείριση βάρους, τη φυσική κατάσταση και τη γενική υγεία.

Λέξεις ευρετηρίου: Διατροφή, φυσική δραστηριότητα, δημόσια υγεία.

References

1. The Mediterranean Diet: Origins and Myths. *NEJM* 2011, 344:1–2
2. Kokkinos P, Polychronopoulos E, Panagiotakos DB. Mediterranean Diet and Hypertension, From the Clinical and Epidemiologic Evidences to Prevention. *Curr Hypertens Rev* 2005, 1:123–128
3. Keys A, Menotti A, Karvonen MJ et al. The diet and 15-year death rate in the Seven Countries Study. *Am J Epidemiol* 1986, 124:903–915
4. de Lorgeril M, Salen P, Martin JL, Monjaud I, Delaye J, Mamelle N. Mediterranean diet, traditional risk factors, and the rate of cardiovascular complications after myocardial infarction: final report of the Lyon Diet Heart Study. *Circulation* 1999, 99:779–785
5. Pitsavos C, Panagiotakos DB, Chrysoshoou C et al. The effect of the combination of Mediterranean diet and leisure time physical activity on the risk of developing acute coronary syndromes, in hypertensive subjects. *J Hum Hypert* 2002, 16:517–524
6. Trichopoulou A, Costacou T, Bamia C, Trichopoulos D. Adherence to a Mediterranean diet and survival in a Greek population. *N Engl J Med* 2003, 348:2599–2608
7. Kastorini CM, Milionis HJ, Esposito K, Giugliano D, Goudevenos JA, Panagiotakos BD. The Effect of Mediterranean Diet on Metabolic Syndrome and its Components. A Meta-Analysis of 50 Studies and 534,906 Individuals. *J Am Coll Cardiol* 2011, 57:1299–1313
8. Shai I, Schwarzfuchs D, Henkin et al. Weight Loss with a Low-Carbohydrate, Mediterranean or Low-Fat Diet. *N Engl J Med* 2008, 359:229–241
9. Kokkinos P. *Physical Activity and Cardiovascular Disease Prevention*. Sudbury, MA. Jones and Bartlett Pub, 2001
10. Kokkinos P, Myers J. Exercise and Physical Activity: Clinical Outcomes and Applications. *Circulation* 2010, 112:1637–1648
11. Kokkinos P, Myers J, Faselis C, Panagiotakos D, Doumas M, Pittaras A, Manolis A, Kokkinos JP, Karasik P, Greenberg M, Papademetriou V, Singh S, Fletcher R. Exercise Capacity and Mortality in Older Men: A 20-year Follow-up Study. *Circulation* 2010, 122:790–797
12. Kokkinos P, Myers J, Nylen E, Panagiotakos D, Manolis A, Pittaras A, Blackman M, Jacob-Issac R, Faselis C, Abella J, Singh S. Exercise Capacity and All-Cause Mortality in African American and Caucasian Men With Type 2 Diabetes. *Diab Care* 2009, 32:623–628
13. Kokkinos P, Manolis A, Pittaras A, Doumas M, Giannelou A, Panagiotakos DB, Faselis C, Narayan P, Singh S, Myers J. Exercise capacity and mortality in hypertensive men with and without additional risk factors. *Hypertension* 2009, 53:494–499
14. Knowler WC, Barrett-Connor E, Fowler SE, Hamman RF, Lachin JM, Walker EA, Nathan DM. Reduction in the incidence of type 2 diabetes with lifestyle intervention or metformin. *N Engl J Med* 2002, 346:393–403
15. Mozaffarian D, Hao T, Rimm EB, Willett W, Hu FB. Changes in Diet and Lifestyle and Long-Term Weight Gain in Women and Men. *N Engl J Med* 2011, 364:2392–2404
16. Praet Stephan FE, van Loon Luc JC. Optimizing the therapeutic benefits of exercise in Type 2 diabetes. *J Appl Physiol* 2007, 103:1113–1120
17. McAuley PA, Kokkinos PF, Oliveira RB, Emerson BT, Myers JN. Obesity Paradox and Cardiorespiratory Fitness in 12,417 Male Veteran Patients Aged 40 to 70. *Mayo Clinic Proc* 2010, 85:115–121