



# What Can We Learn About Diet and Physical Activity From Master Athletes?

Christine Rosenbloom, PhD, RD  
Michele Bahns, MS, RD

**Only 13% of those 65 years and older engage in vigorous physical activity 3 or more days a week and obesity rates are increasing by 45% in adults over the age of 60. Physical activity helps prevent chronic disease and improves quality of life, yet few adults of any age are active. One exception is master athletes who participate in competitive sports during the middle and later years. The aerobic fitness of master athletes, as measured by maximal oxygen consumption, shows some decline, but not nearly as much as in sedentary controls. Master athletes have lipid profiles similar to those of young adults, which decreases their risk of heart disease. Master athletes also have better glucose tolerance and lower waist-to-hip ratios than sedentary adults, decreasing their risk for metabolic syndrome and type 2 diabetes. In the few dietary studies that have been conducted, master athletes consume more food energy while maintaining lower body weights than sedentary adults. Learning what motivates master athletes to stay highly active may help health professionals develop strategies to encourage exercise in the sedentary population of older adults.**

*Those who think they have no time for bodily exercise will sooner or later have to find time for illness. (Edward Stanley [1826–1893] address delivered at Liverpool College, December 20, 1873)*

**W**e've all heard the numbers: By 2030, the number of older Americans is expected to double from 35 million to 70 million. Today

mean life expectancy for a woman at age 65 is another 19 years; men who reach age 65 can expect to live another 16 years.<sup>1</sup> Yet, only 13% of adults between the ages of 65 and 74 report engaging in vigorous activity for 20 minutes, 3 or more days per week, and only 6% of adults over 75 years report such physical activity.<sup>2</sup> As health professionals, we know that physical activity is key to preventing disease. Regular physical activity improves health by a variety of means. It reduces risk of premature death from heart disease, of developing diabetes and hypertension, as well as reduces blood pressure in individuals who are hypertensive.<sup>2–4</sup> It also helps maintain a healthy weight, balance and gait (which leads to fewer falls), helps reduce feelings of anxiety and depression, promotes psychological well-being, as well as builds and maintains healthy bones, muscles, and joints.<sup>2–4</sup> The benefits of physical activity on health are endorsed by every health professional organization and most government agencies.<sup>3–5</sup> Couch potatoes need to find 30 minutes a day to get active. The lack of physical activity among Americans is so dire that some exercise physiologists would like us to stop using the term “couch potato” and start calling the crisis “SeDs” or Sedentary Death Syndrome to get people off the sofa and into the gym!<sup>6</sup> So, how do we get adults to carve out just 30 minutes of the 1,440 minutes in a day (only 2% of a 24-hour day) to be active?

## Lessons From Master Athletes

The National Weight Control Registry<sup>7</sup> studies “successful losers,” (individuals who have lost weight and successfully maintained the weight loss) to find patterns to motivate overweight Americans. Perhaps we can learn from master athletes to encourage Americans to be more active. Who are master athletes, why do they do what they do, and do they have improved health and dietary patterns?

## Who Are Master Athletes?

Master athletes are competitors in events designed specifically for older adults in various sports. Masters competitions are growing around the world, with over 50 countries sponsoring masters events in sports ranging from swimming to marathon running. Events can be highly structured and sanctioned by official governing bodies<sup>8</sup> with regularly scheduled intense competitions (eg, masters competitions sponsored by USA Track and Field or the World Masters Athletic Championships), or they can be competitive coupled with recreational and social activities, such as the Huntsman World Senior Games held yearly in Utah.<sup>9</sup> The age at which one becomes a master athlete varies by sport, but generally, women are 35 years and older and men are 40 years and older. Competition is age-graded, usually at 5-year intervals. For the “senior” game events, participation is limited to those 50 years and older. Most of the research on master athletes comes from those adults involved in sanctioned, competitive events such as running and cycling. Much of it is cross-sectional, comparing older athletes with age-matched sedentary controls. However, recently longitudinal data have also been published.

## Aerobic Fitness of Master Athletes

Aerobic fitness, as measured by maximal oxygen consumption ( $\text{VO}_2\text{max}$ ), declines with age at an average of ~10% per decade after the age of 25.<sup>10</sup> In a 1985 study of endurance athletes with 18 years of follow-up, Katch et al<sup>11</sup> stated that two-thirds of the declines in  $\text{VO}_2\text{max}$  with age in sedentary individuals was due to disuse. Early research showed that master athletes had declines in aerobic fitness, but tended to have about half the rate of decline of nonathletes.<sup>12</sup> Recent longitudinal studies have reported that the decline in maximal oxygen consumption in master athletes is greater than previously believed.<sup>13</sup> Katznel et al<sup>14</sup> compared longitudinal changes in  $\text{VO}_2\text{max}$  in healthy middle-aged and older athletes and sedentary men during a treadmill test. They found a 22% decline in  $\text{VO}_2\text{max}$  in older endurance athletes over the 8 years of follow up. The greatest decrease in  $\text{VO}_2\text{max}$  occurred in those athletes who could not maintain a high volume of training, suggesting that the decline in  $\text{VO}_2\text{max}$  is less related to aging but more related to lifestyle.<sup>14</sup> In this study, 42 athletes were enrolled, but only 7 (17%) were still training at high volume at the end of the study. It was found that maintaining a high level of aerobic fitness, even for the highly motivated athlete, became more difficult with advancing age. Eskurza et al<sup>15</sup> found similar declines in  $\text{VO}_2\text{max}$  in older female master athletes. In a 7-year follow-up study with endurance-trained

women whose habitual exercise declined with age,  $\text{VO}_2\text{max}$  levels were similar to sedentary women.<sup>15</sup> However, although the absolute rates of decline in  $\text{VO}_2\text{max}$  were greater with age in endurance-trained compared to sedentary controls, the endurance-trained individuals had higher absolute levels of  $\text{VO}_2\text{max}$  and a higher level to perform physical tasks of daily life.<sup>16</sup>

## Cardiovascular Disease Risk Reduction in Master Athletes

Physical activity is a most powerful cardiovascular risk reduction strategy. Master athletes have lipid profiles that are similar to younger adults. Seals et al<sup>17</sup> published results on the elevation of high-density lipoprotein-cholesterol (HDL-C) in master athletes over 20 years ago. Seals et al reported the favorable lipid profiles seen in master athletes were related to high HDL-C levels. The master athletes had average HDL-C levels of 66 mg/dL, significantly higher than levels seen in the younger comparison groups as well as the older untrained men. They had total cholesterol/HDL-C ratios as low as the young endurance-trained athletes, giving them a low atherogenic index of  $3.0 \pm 0.1$ .<sup>17</sup> The high HDL-C levels of the master athletes appeared to be the result of physical activity rather than differences in body composition or diet.

*Physical activity is a powerful tool  
for reducing cardiovascular risk.*

Goldberg et al<sup>18</sup> and Yataco et al<sup>19</sup> also found higher concentrations of HDL-C in master athletes compared to lean and obese males. HDL-C concentration was independently associated with increased cardiovascular fitness and reduced total body fat, as well as abdominal fatness in older men. Yataco et al<sup>19</sup> observed HDL-C levels to be 25% higher in male master athletes compared to lean sedentary men, and 42% higher than obese sedentary men in a cross-sectional study. But, like the declines in  $\text{VO}_2\text{max}$  seen with decreased training volume, Giada et al<sup>20</sup> found that a 2-month hiatus from training resulted in a reversal of the favorable lipid profile found in trained cyclists. Thus, it appears that continued exercise is necessary to maintain a favorable lipid profile in older athletes.

## Metabolic Syndrome Risk Reduction in Master Athletes

No specific studies on metabolic syndrome and master athletes have been published. However, master athletes have improved glucose tolerance, enhanced insulin sensitivity, and lower waist-to-hip ratios compared to sedentary older adults. Seals et al<sup>21</sup> found that master athletes (average age of 60 years) had normal glucose tolerance and lower plasma insulin levels (both fasting and after glucose ingestion) compared to older, untrained men. The master athletes' blood glucose and insulin levels were as low as the young athletes (average age 26 years). Declines in glucose tolerance and insulin sensitivity may not be an inevitable consequence of aging but can be prevented with regular physical activity.

*Physical activity can prevent some decline in glucose tolerance and insulin sensitivity.*

Pratley et al<sup>22</sup> found that endurance-trained master athletes (runners and triathletes with an average age of 63.5 years) had enhanced insulin sensitivity and a lower waist-to-hip ratio compared to sedentary older men. These data suggest that regular endurance activity may prevent abdominal obesity and insulin resistance that are frequent in aging individuals.

In a more recent study, Clevenger et al<sup>23</sup> reported that regular endurance exercise did not prevent a decline in insulin action. They measured an index of whole body insulin sensitivity (using data obtained during a glucose tolerance test) in 33 older male and female master athletes and compared results with sedentary as well as younger adults. The endurance-trained athletes had lower insulin action than was expected, based on previous reports in the literature. However, endurance-trained older adults were more insulin sensitive than the sedentary adults. Part of the decline could be due to a reduction in training intensity, as this is common in master athletes.

## Osteoporosis Risk Reduction in Master Athletes

Maintaining the mineral mass of the skeleton is important to preventing osteoporosis in an aging

population. Exercise, especially weight bearing, has long been recognized as a strategy to build and maintain strong bones, and therefore, master athletes might be expected to have greater bone mineral density than inactive adults. Suominen and Rahkila<sup>24</sup> studied bone mineral density, using the heel bone, in 111 male athletes who were active in the Finnish sports organizations for master athletes. The participants ranged in age from 70 to 81 years old and athletes from several sports (runners, cross-country skiers, sprinters, jumpers, and weightlifters) were included. Master athletes had superior trabecular bone density (19–28% higher), even at advanced ages, compared to the average older male in the population.

Etherington et al<sup>25</sup> designed a retrospective cohort study on bone mineral density in 83 formerly elite female athletes and matched controls, ranging in age from 40 to 65 years. The women had participated in a variety of sports. Bone density was measured with dual energy x-ray absorptiometry. Former athletes had greater bone mineral density at the lumbar spine and femoral neck. Benefits of exercise on bone mineral density were evident even after cessation of the physical activity.

## Body Composition of Master Athletes

Nearly 50 million adults or 27% of the adult population are obese and more than 108 million adults (61%) are either obese or overweight.<sup>3</sup> The Centers for Disease Control and Prevention reported that between 1991 and 1998, obesity rates for US adults aged 60 to 69 years increased 45%.<sup>26</sup> Studies on master athletes of both sexes find that body composition changes occur but overall measures of body composition (weight, percent body fat, percent lean mass, and intra-abdominal fat) are superior compared to age-matched sedentary controls. Pollock et al<sup>27</sup> measured body composition in 27 male master track athletes and followed them for 20 years. Body weight remained stable in the male athletes who remained active, yet percent body fat increased by about 3% per decade. The 16 athletes who strength-trained in addition to endurance training maintained lean mass better than endurance-trained-only athletes.

Ryan et al<sup>28</sup> and Van Pelt et al<sup>29</sup> studied different groups of female master athletes. Ryan and colleagues found that athletes had lower percent body fat and total fat mass than younger controls although both groups had body mass indices (BMIs) of <25 kg/m<sup>2</sup>. The female master athletes had increases in intra-abdominal fat with age, but were lower than in older controls. Subcutaneous fat did not increase with age in the older athletes. Van Pelt et al<sup>29</sup> found that runners who engaged in vigorous endurance exercise did not gain body weight and had only modest increases in body fat percentage.

## Dietary Patterns of Master Athletes

Several cross-sectional studies have assessed the energy intake of master athletes with sedentary controls. Master athletes consume more calories despite their lower body weights. Blair et al<sup>30</sup> studied 34 male and 27 female runners (age range of 35–59 years), who ran on average 40 miles/wk and 34 miles/wk, respectively. A control group of 38 males and 42 females (age range of 35–59 years) was randomly drawn from the community. After examining 3-day diet records, the researchers found that the runners reported significantly higher daily energy intake (2,959 kcal/d for male runners and 2,386 kcal/d for female runners) when compared to controls (2,361 kcal/d for males and 1,871 kcal/d for females). Because the runners were considerably lighter than the controls, when energy intake was expressed as kilocalories per kilogram, the differences were even more striking (42 vs. 30 kcal/kg for males and 42 vs. 27 kcal/kg for females). The runners reported eating more energy as carbohydrate and fat than the controls, but the distribution of macronutrients as a percent of total calories was not different between the runners and the controls.

Nieman et al<sup>31</sup> analyzed 3-day food records from 291 men and 56 women (average age for men was 40 years and 38 years for women) who participated in the 1987 Los Angeles Marathon. The average BMI of runners showed a lean group with only 12% of the sample having a BMI >25 kg/m<sup>2</sup>. As a comparison group, the researchers used national survey data from USDA Continuing Survey of Food Intakes by Individuals (CSFII). The male marathoners averaged 2,526 kcal/d versus 2,426 kcal/d from CSFII data from males; the female marathoners averaged 1,868 kcal/d versus 1,602 kcal/d. In this study, the marathoners ate a greater percentage of their calories from carbohydrate and a smaller percentage of calories from fat compared to data for the general population.

Hallfrisch et al<sup>32</sup> recruited 16 male master athletes (participating in a variety of sports including running, cycling, swimming, and race walking) with an average age of 67 years and compared them to group of 24 age- and BMI-matched controls from the Baltimore Longitudinal Study of Aging (BLSA). Both groups completed 7-day food records and the results showed that the athletes consumed an average of 2,561 kcal/d or 35.3 kcal/kg versus 2,240 kcal/d or 30.0 kcal/kg for the controls.

Chatard et al<sup>33</sup> studied 23 French cyclists, runners, swimmers, walkers, and tennis players, who averaged 63 years of age. Dietary intakes were recorded twice during 3 consecutive weekdays and compared to the French Recommended Dietary Allowances (RDA). The athletes consumed an average of 2,760 kcal/d compared to the RDA of 2,200 kcal/d—a difference of 24% higher

energy intakes than the recommended intakes for the population.

*Physically active athletes can eat more and still weigh less.*

The results of these studies suggest the “eat more, weigh less” dietary strategy holds true for those engaged in regular, vigorous exercise. Older athletes can maintain desirable body weight while eating more calories than sedentary individuals. Several of the studies reviewed also indicated that dietary quality was improved in the master athletes through the consumption of more calories.<sup>31,33</sup>

Improved micronutrient intakes were not present for all nutrients, however. Nieman et al<sup>31</sup> found that the women runners had low intakes of vitamin D and zinc, and Chatard et al<sup>33</sup> found the men had low intakes of vitamin D and magnesium compared to the RDA. A recent study of 25 female master cyclists and runners (mean age 50 years) compared supplement users with nonsupplement users.<sup>34</sup> Athletes who took dietary supplements consumed significantly more vitamin C, vitamin E, calcium, and magnesium when compared to nonsupplementing athletes. When the diets of the athletes who took supplements were analyzed without the supplements, their average intakes of vitamin D, vitamin E, folic acid, calcium, magnesium, and zinc were below the RDA.

## What Can We Learn From Master Athletes?

Master athletes can maintain healthy weight, desirable body composition, maintain a high level of fitness, and significantly reduce their risk for the major health problems facing aging Americans. Another benefit of being a master athlete is the ability to consume more food energy compared to one’s more sedentary peers without the addition of unwanted weight gain,<sup>35</sup> and if food choices are appropriate, to improve diet quality.

Some aging experts criticize the use of master athletes as “models” of successful aging because for most older adults in the population their athletic prowess is out of reach.<sup>36</sup> However, by studying master athletes, we can hope to discover the motivations of their continued participation in physical activity, even in advanced years of life, and identify the minimum amount of physical activity needed to delay or reduce the outcome of usual aging.<sup>36</sup> Roper et al<sup>37</sup> studied an 88-year-old master male

athlete who holds records in the 400-, 800-, and 1,500-meter events at World Association of Veteran Athletes Championships (the organization was renamed to World Masters Athletics in 2001). This elderly master athlete

*We need to know better how to motivate older people to become more physically active.*

did not begin to run until age 65, after his retirement. Perhaps retirement is a time when older adults have the time to engage in exercise, even though the cultural norm is to do less physical work in retirement.<sup>38</sup> Perhaps we should give the retiree a pair of running shoes or a gym membership instead of a gold watch or a rocking chair.

Some would-be athletes fear sudden death when undertaking an exercise program in the later years. The prevalence of sudden death during masters competitions is unknown, but based on data in older participants in marathons, it is estimated to be 1:15,000 joggers per year or 1:50,000 marathon participants.<sup>10</sup> Of course, it is prudent for master athletes to be screened medically before entry into training and competition.<sup>10</sup> Nevertheless, as Per-Olof Astrand, called the father of exercise physiology, has put it, “There is less risk in activity than in continuous inactivity—it is more advisable to pass a careful physical examination if one intends to be sedentary in order to establish whether one’s state of health is good enough to stand the inactivity.”<sup>38</sup>

In the National Blueprint on Increasing Physical Activity Among Adults Age 50 and Older,<sup>39</sup> it is suggested that health professionals conduct more studies on those adults “who are currently active to construct a profile of who they are, what they do, what got them started, what sustains them, and how they have overcome barriers.” Such a profile could help us motivate individual clients, direct community-based interventions, and be used to formulate public health interventions.

**Christine Rosenbloom, PhD, RD**, is an associate dean in the College of Health and Human Sciences and a professor in the Department of Nutrition at Georgia State University, Atlanta, and conducts research on nutrition and aging and sports nutrition.

**Michele Bahns, MS, RD**, is a graduate of the Department of Nutrition at Georgia State University, Atlanta, and is studying the dietary intakes and lifestyle habits of master cyclists compared to moderately active controls. Corresponding author: Christine Rosenbloom, PhD, RD, Office of the Dean, College of Health and Human Sciences, Georgia State University, PO Box 3995, Atlanta, GA 30302-3995 (e-mail: crosenbloom@gsu.edu).

## REFERENCES

1. U.S. Department of Health and Human Services. Administration on Aging. *A Profile of Older Americans*. 2001.
2. Physical activity and older Americans: benefits and strategies. June 2002. Agency for Healthcare Research and Quality and the Centers for Disease Control. Available at: <http://www.ahrq.gov/ppip/activity.htm>. Accessed December 29, 2003.
3. U.S. Department of Health and Human Services. Office of the Assistant Secretary for Planning and Evaluation. *Physical Activity Fundamental to Preventing Disease*. June 20, 2002.
4. U. S. Department of Health and Human Services. *Physical Activity and Health: A Report of the Surgeon General*. Atlanta, GA: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion; 1996.
5. Mazzeo RS, Cavanagh P, Evans WJ, et al. American College of Sports Medicine position stand on exercise and physical activity for older adults. *Med Sci Sports Exerc*. 1998;30:992–1008.
6. SeDs facts: sedentary death syndrome. Available at: [http://www.cvm.missouri.edu/hac/seds\\_facts.html](http://www.cvm.missouri.edu/hac/seds_facts.html). Accessed December 29, 2003.
7. Klem ML, Wing RR, McGuire MT, Seagle HM, Hill JO. A descriptive study of individuals successful at long-term maintenance of substantial weight loss. *Am J Clin Nutr*. 1977;66:239–246.
8. World Master Athletics at <http://www.world-masters-athletics.org>. Accessed December 29, 2003.
9. Hunstman World Senior Games at <http://www.seniorgames.net/>. Accessed December 29, 2003.
10. Maron BJ, Araujo CGS, Thompson PD, et al. Recommendations for preparation screening and the assessment of cardiovascular disease in masters athletes. *Circulation*. 2001;103:327–334.
11. Katch FW, Wallace JP, Van Camp SP. Effects of 18 years of endurance exercise on the physical capacity of older men. *J Cardiopulm Rehabil*. 1985;5:308–312.
12. Morley JE. The aging athlete. *J Gerontol Med Sci*. 2000;55A:M627–M629.
13. Wiswell RA, Jaque SV, Marcell TJ, et al. Maximal aerobic power, lactate threshold, and running performance in master athletes. *Med Sci Sports Exerc*. 2000;32:1165–1170.
14. Katzel LI, Sorkin JD, Fleg JL. A comparison of longitudinal changes in aerobic fitness in older endurance athletes and sedentary men. *J Am Geriatr Soc*. 2001;49:1657–1664.
15. Eskurza I, Donato AJ, Moreau KL, Seals DR, Tanaka H. Changes in maximal aerobic capacity with age in endurance-trained women: 7-yr follow-up. *J Appl Physiol*. 2002;92:2303–2308.
16. Tanaka H, Seals DR. Dynamic exercise performance in Masters athletes: insight into the effects of primary human aging on physiological functional capacity. *J Appl Physiol*. 2003;95:2152–2162.
17. Seals DR, Allen WK, Hurley BF, Dalsky GP, Ehsani AA, Hagber JM. Elevated high-density lipoprotein cholesterol levels in older endurance athletes. *Am J Cardiol*. 1984;54:390–393.

18. Goldberg AP, Busby-Whitehead MJ, Katzel LI, Krauss RM, Lumpkin M, Hagberg JM. Cardiovascular fitness, body composition, and lipoprotein metabolism in older men. *J Gerontol Med Sci*. 2000;55A:M342–M349.
19. Yataco AR, Busby-Whitehead J, Drinkwater DT, Katzel LI. Relationship of body composition and cardiovascular fitness to lipoprotein lipid profiles in master athletes and sedentary men. *Aging Clin Exp*. 1997;9:88–94.
20. Giada F, Vigna GB, Vitale E, et al. Effect of age on the response of blood lipids, body composition, and aerobic power to physical conditioning and deconditioning. *Metabolism*. 1995;44:161–165.
21. Seals DR, Hagberg JM, Hurley BF, Dalsky GP, Ehsani AA, Holloszy JO. Glucose tolerance in young and older athletes and sedentary men. *J Appl Physiol*. 1984;56:1521–1525.
22. Pratley RE, Hagberg JM, Rogus EM, Goldberg AP. Enhanced insulin sensitivity and lower waist-to-hip ratio in master athletes. *Am J Physiol*. 1995;268:E484–E290.
23. Clevenger CM, Jones PP, Tanaka H, Seals DR, DeSouza CA. Decline in insulin action with age in endurance-trained humans. *J Appl Physiol*. 2002;93:2105–2111.
24. Suominen H, Rakkila P. Bone mineral density of the calcaneus in 70- to 81-yr-old male athletes and a population sample. *Med Sci Sports Exerc*. 1991;23:1227–1233.
25. Etherington J, Harris PA, Nandra D, et al. The effect of weight-bearing exercise on bone mineral density: a study of female ex-athletes and the general population. *J Bone Miner Res*. 1996;11:1333–1338.
26. Mokdad AH, Serdula MK, Dietz WH, Bowman BA, Marks JS, Koplan JP. The spread of the obesity epidemic in the United States, 1991–1998. *JAMA*. 1999;282:1519–1522.
27. Pollock ML, Mengelkoch LJ, Graves JE, et al. Twenty-year follow-up of aerobic power and body composition of older track athletes. *J Appl Physiol*. 1997;82:1508–1516.
28. Ryan AS, Nicklas BJ, Elahi D. A cross-sectional study on body composition and energy expenditure in women athletes during aging. *Am J Physiol*. 1996;271:E916–E921.
29. Van Pelt RE, Davy KP, Stevenson ET, et al. Smaller differences in total and regional adiposity with age in women who regularly perform endurance exercise. *Am J Physiol*. 1998;275:E626–E634.
30. Blair SN, Ellsworth NM, Haskell WL, Stern MP, Farquahar JW, Wood PD. Comparison of nutrient intake in middle-aged men and women runners and controls. *Med Sci Sports Exerc*. 1981;13:310–315.
31. Nieman DC, Butler JC, Pollett LM, Dietrich SJ, Lutz RD. Nutrient intake of marathon runners. *J Am Diet Assoc*. 1989;89:1273–1278.
32. Hallfrisch J, Drinkwater DT, Muller DC, et al. Physical conditioning status and diet intake in active and sedentary older men. *Nutr Res*. 1994;14:817–827.
33. Chatard JC, Boutet C, Tourny C, Garcia S, Berthouze S, Guezennec CY. Nutritional status and physical fitness in elderly sportsmen. *Eur J Appl Physiol*. 1998;77:157–163.
34. Beshgetoor D, Nichols JF. Dietary intake and supplement use in female master cyclists and runners. *Int J Sport Nutr Exerc Metab*. 2003;13:166–172.
35. Maharam LG, Bauman PA, Kalman D, Skolnik H, Perle SM. Masters athletes: factors affecting performance. *Sports Med*. 1999;28:273–285.
36. Hawkins SA, Wiswell RA, Marcell TJ. Exercise and the master athlete—a model of successful aging? *J Gerontol Med Sci*. 2003;58A:1009–1011.
37. Roper EA, Molnar DJ, Wrisbert CA. No “old food”: 88 years old and still running. *J Aging Phys Act*. 2003;11:370–387.
38. Astrand PO. Exercise physiology of the mature athlete. In: Sutton JR, Brock RM, eds. *Sports Medicine for the Mature Athlete*. Indianapolis, Ind: Benchmark Press; 1986:3–13.
39. The Robert Wood Johnson Foundation. *National Blueprint: Increasing Physical Activity Among Adults Age 50 and Older*. New Jersey: Princeton; 2001.

### Vitamin Controls Backed by Europe

The European Court of the European Union (EU) has decided to tighten up rules on the sale of vitamin and minerals. The proposals will ban around 200 supplements from sale and put restrictions on the upper limits of vitamin doses. Some health experts wanted to see vitamins and minerals controlled in the same way as conventional medicines. But critics argued the new rules were unnecessarily restrictive, and would deny consumers choice. Under the EU Food Supplements Directive, due to come into effect in

August, European supplements will only be able to include vitamins and minerals taken from an approved list. However, European manufacturers of products already on the market will have until the end of December 2009 to change any of the banned ingredients to ensure that their product can continue to be sold in the future. Also, the ban on nonlisted supplements will not apply at all to vitamins and minerals, which are found normally in or consumed as part of the diet, which the Alliance for Natural Health (ANH) welcomed.

Source: *BBC News*