

# Hyperhydrating with glycerol: Implications for athletic performance

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## ABSTRACT

Small decreases in hydration status can result in a dramatic decrement in athletic performance and greatly increase the risk of thermal injury. Because of its osmotic properties, which enable greater fluid retention than the ingestion of water alone, glycerol has been proposed as a hyperhydrating agent. In fact, glycerol is now commercially available and marketed as a sport supplement to be ingested with water or sport drinks; thus, dietitians need to be cognizant of this new addition to the sports nutrition table. The results of glycerol-induced hyperhydration research have been equivocal, most likely because of methodologic differences between studies, such as variations in the intensity of exercise, environmental conditions, and concentration or dose of glycerol administered. Although the suggested dosage of glycerol depends on body size and varies between manufacturers, 1 g/kg body weight with an additional 1.5 L fluid taken 60 to 120 minutes before competition is standard. Some test subjects reported feeling bloated or nauseated after ingesting glycerol. This review examines glycerol-induced hyperhydration research and the safety of ingesting glycerol, discusses commercial availability of glycerol, and makes recommendations for glycerol-induced hyperhydration research. *J Am Diet Assoc.* 1999;99:207-212.

Under resting conditions, fluid balance is well maintained in the body; however, during exercise water loss is accelerated. Sweat rates can reach 2 to 3 L/hour during demanding exercise in hot conditions, but fluid ingestion is seldom more than 500 mL/hour during competition (1,2). The resulting dehydration leads to a decrease in plasma volume with concomitant increases in heart rate and core temperature, and ultimately, a decrease in performance. This decline in endurance performance is noticeable with dehydration as little as a 1% to 3% decrease in body weight (3). Furthermore, an athlete is at increased risk for thermal injury when dehydrated. For a more complete synopsis of the avenues of fluid loss, detrimental effects of dehydration, and recommendations for effective fluid replacement, consult the review article by Horswill (4).

It is generally accepted that hyperhydration before exercise can reduce, delay, or eliminate the deleterious effects of dehydration. The American College of Sports Medicine recommends drinking 500 mL water 2 hours before the start of competition (5). Unfortunately, the extra water obtained through traditional hyperhydrating techniques is transitory, as the kidneys are extremely efficient at rapidly excreting any excess fluid. Additionally, an athlete risks gastric discomfort or the inconvenience of voiding urine if attempts are made to ingest a large volume of water just before competition.

As indicated in the Table, some researchers have suggested that ingesting glycerol with water before exercise can enhance hyperhydration. Glycerol is a natural metabolite that is rapidly absorbed into the body. This clear, syrupy, extremely sweet liquid has osmotic properties such that it acts like a sponge to soak up additional water, thereby enabling greater fluid retention than ingestion of water alone. Thus, glycerol has great potential as a hyperhydrating agent. Other researchers, however, have been more critical of the ergogenic effect of glycerol. The purpose of this article is to review the literature relevant to using glycerol as a hyperhydrating agent and provide recommendations for future research.

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### MECHANISM OF GLYCEROL ACTION

The physiologic mechanism(s) responsible for the apparent effectiveness of glycerol in increasing water retention is not well understood. In an effort to delineate the mechanism(s) behind the effect of glycerol on body fluid regulation, Freund et al (6) took total body water, hormonal, renal, and vascular blood (erythrocyte) and plasma measurements simultaneously after subjects ingested glycerol. Based on their research, they hypothesized that effectiveness of glycerol in improving fluid retention is the result of multiple factors.

One hypothesis is that glycerol increases plasma osmolality, which in turn attenuates the decrease in plasma antidiuretic hormone concentrations that typically occurs with hyperhydration. The higher antidiuretic hormone concentrations after glycerol-induced hyperhydration compared with water-only hyperhydration could enable greater fluid retention. However, this hypothesis is difficult to prove. Although differences in antidiuretic hormone concentrations between glycerol-induced and water-only hyperhydration trials may be physiologically significant, Freund et al (6) found that they were small and near the sensitivity limits of the assay.

Most likely glycerol has the greatest benefit in athletes participating in ultra-endurance sports conducted in hot, humid conditions where threat of dehydration is the greatest

Freund et al (6) suggested that the reabsorption of glycerol by the renal tubules, independent of hormonal responses, might be a more likely mechanism for the relative effectiveness of glycerol at increasing fluid retention. As glycerol is reabsorbed, the concentration gradient in the medullary collecting duct of the kidney increases, which leads to more water reabsorption. These researchers (6) also report that other fluid-regulating mechanisms, such as blood pressure, glomerular filtration rate, and other diuretic hormones, do not appear to be factors in the water retention ability of glycerol.

Regardless of how it occurs, through small changes in plasma antidiuretic hormone or a direct effect on the kidney, Freund et al (6) found that glycerol lowers the rate of free-water clearance. Free-water clearance can be calculated by subtracting the rate at which particles are removed (osmolar clearance) from the rate of urine flow. Ultimately, a lower rate of free-water clearance translates into lower urine flow rates and greater fluid retention for glycerol-induced hyperhydration compared with water-only hyperhydration.

### GLYCEROL-INDUCED HYPERHYDRATION RESEARCH

Regardless of the mechanism(s) of glycerol action, the implications for enhanced sports performance have made glycerol-induced hyperhydration a fervid and controversial topic for

research. The findings have been equivocal: research both supports and rejects the theory that glycerol enhances hyperhydration and sports performance. A summary of the research that has focused on glycerol-induced hyperhydration is presented in the Table.

Riedesel and Lyons conducted much of the early glycerol-induced hyperhydration research at the University of New Mexico. The experiments of Riedesel et al (7) involved giving different doses of glycerol (0.5, 1.0, and 1.5 g/kg) to men and women and varying the time period in which water was ingested. They found that glycerol-induced hyperhydration resulted in a greater volume of water retention compared with water retention in control subjects and that this remained significant over a 4-hour time period. Lyons and Riedesel (8) also reported a 50% increase in fluid retention with a 5% glycerol solution compared with water in a sample of rats.

By giving subjects small, multiple doses of glycerol and a large volume of water over the course of 49 hours, Koenigsberg et al (9) showed that it was possible to keep subjects in a hyperhydrated state for extended periods. They noted a difference in urine volumes of about 700 mL between the control condition and glycerol-ingested state. However, in a 60-hour simulated desert exposure, Meyer et al (10) found that water alone supported the overall physiologic response as well as a 5% carbohydrate-electrolyte beverage and a solution of 4% carbohydrate and 1% glycerol. In this study, soldiers performed three 40-minute bouts of treadmill walking (4.8 km/hour at 0% grade) over a 4-hour period in a hot, dry environment each day. The many methodologic differences between the 2 studies probably account for the confounding results. For example, the subjects in the study of Koenigsberg et al (9) were on a regimented schedule for fluid ingestion, whereas those in the study of Meyer et al (10) drank *ad libitum*. Furthermore, the glycerol concentration was much greater in the study of Koenigsberg et al (9) (as high as a 20% solution) compared with the 1% solution in the study of Meyer et al (10).

### Impact on Sports Performance

Much of the research on glycerol-induced hyperhydration focuses on the direct impact it may have on sports performance. Lyons et al (11) were the first to indicate that ingestion of glycerol may diminish the thermal stress of exercise in the heat. In their study, 4 men and 2 women performed 90 minutes of treadmill exercise at 60% of maximum oxygen consumption ( $\dot{V}_{O_2\max}$ ) in a dry, hot environment (25% relative humidity and 42°C). Exercise was initiated 2.5 hours after the administration of glycerol. At this time, 80% of fluid intake was retained in the subjects who ingested glycerol compared with only 50% in those who drank water alone; thus, glycerol enhanced the hyperhydration of the subjects. Urine volume remained reduced by 54% at 4.5 hours after ingestion of glycerol. In addition to increased water retention, the researchers reported lower rectal temperatures and increased sweat rates during exercise, which indicates improved thermoregulation with glycerol-induced hyperhydration.

Montner et al (12) also reported an ergogenic effect from glycerol-induced hyperhydration in a 2-study design. In the first of the 2 double-blind studies, 11 subjects were given either a 20% glycerol solution or a placebo 1 hour before cycling at 60% of maximal workload. The same procedure was repeated for the second study with the addition of 3 mL/kg of a 5% dextrose solution every 20 minutes. Unlike the study of Lyons et al (11), there was no change in rectal temperature or sweat rates of subjects who received glycerol-induced hyperhydration compared with subjects who received the placebo. However, Montner et al (12) reported lower mean heart rates and an

**Table**  
Summary of glycerol-induced hyperhydration studies with human subjects<sup>a</sup>

Reference no.	No. of subjects	Sample	Treatments	Glycerol dose	Environment	Exercise	Major findings
6	11	Healthy men	Control H <sub>2</sub> O C <sub>3</sub> H <sub>8</sub> O <sub>3</sub>	1.5 g/L TBW in 5.0 mL/L TBW solution; total=37 mL/L TBW	Unknown	None	C <sub>3</sub> H <sub>8</sub> O <sub>3</sub> ingestion ↓ urine flow rates and ↑ fluid retention compared with other trials.
7	13 9	Men Women	Placebo C <sub>3</sub> H <sub>8</sub> O <sub>3</sub>	Either 0.5, 1.0, or 1.5 g/kg plus 21.4 mL/kg H <sub>2</sub> O	Unknown	None	C <sub>3</sub> H <sub>8</sub> O <sub>3</sub> ingestion ↑ plasma osmolality and ↓ urine volume; similar H <sub>2</sub> O retention for 1.0 and 1.5 g/kg doses
9	7	Men	Placebo C <sub>3</sub> H <sub>8</sub> O <sub>3</sub>	Varied over 49-h period; daily total=3.12 g/kg in 13.54 g/kg orange juice plus 34.43 mL/kg H <sub>2</sub> O	Unknown	None	C <sub>3</sub> H <sub>8</sub> O <sub>3</sub> ingestion ↓ urine volume, demonstrating that hyperhydration could be extended for 32 to 49 h
10	9	Non-acclimated healthy men	H <sub>2</sub> O 5% CHO CHO and C <sub>3</sub> H <sub>8</sub> O <sub>3</sub> mix	Ad libitum of 1% C <sub>3</sub> H <sub>8</sub> O <sub>3</sub> solution in 4% CHO drink	25° to 45°C exercise at 35° to 45°C; 20% RH	3×40 min treadmill at 4.8 km/h over a 4-h period	H <sub>2</sub> O alone appeared to provide adequate hydration for submaximal work in desert-like conditions
11	4 2	Men Women	Placebo C <sub>3</sub> H <sub>8</sub> O <sub>3</sub>	1.0 g/kg in 3.3 mL/kg orange juice, plus 21.4 mL/kg H <sub>2</sub> O	42°C; 25% RH	90-min treadmill at 60% Vo <sub>2</sub> max (2.5-h after treatment)	↓ urine vol before exercise; ↑ sweat rate and ↓ rectal temperature during exercise
12	11	Fit adults	H <sub>2</sub> O C <sub>3</sub> H <sub>8</sub> O <sub>3</sub>	1.2 g/kg in 20% solution plus H <sub>2</sub> O; total=26 mL/kg	23.5° to 24.5°C; 25% to 27% RH	Cycle at 60% of maximum workload to exhaustion (1-h after treatment)	↓ mean heart rate and ↑ exercise time to exhaustion with C <sub>3</sub> H <sub>8</sub> O <sub>3</sub>
12	5 2	Fit men Fit women	H <sub>2</sub> O C <sub>3</sub> H <sub>8</sub> O <sub>3</sub>	Addition of 3 mL/kg 5% CHO per 20 min			
13	4 5	Men Women	H <sub>2</sub> O 6% CHO CHO and C <sub>3</sub> H <sub>8</sub> O <sub>3</sub> mix 10% C <sub>3</sub> H <sub>8</sub> O <sub>3</sub>	1.2 g/kg LBM; 3 mL drink/kg LBM every 15 min for 60 min	30°C; 45% RH	90-min cycle at 50% Vo <sub>2</sub> peak	No substantial metabolic, hormonal, cardiovascular, or thermoregulatory advantages for consuming C <sub>3</sub> H <sub>8</sub> O <sub>3</sub>
14	8	Trained male cyclists	Placebo C <sub>3</sub> H <sub>8</sub> O <sub>3</sub>	0.8 mL/kg in 6.0 mL/kg orange juice plus 18 mL/kg H <sub>2</sub> O	24°C; 47% RH	106-min intervals (65% to 80% Vo <sub>2</sub> max)	↑ fluid retention, but no cardiovascular or thermoregulatory benefits
15	8	Heat-acclimated fit men	Euhydration H <sub>2</sub> O H <sub>2</sub> O and rehydrate C <sub>3</sub> H <sub>8</sub> O <sub>3</sub> C <sub>3</sub> H <sub>8</sub> O <sub>3</sub> and rehydrate	1.2 g/kg LBM in 3.9 mL/kg LBM solution plus 25.2 mL/kg LBM H <sub>2</sub> O; total fluid=29.1 mL/kg LBM	35°C; 45% RH	120-min treadmill at 45% Vo <sub>2</sub> max (1-h after treatment)	No difference in physiologic or thermoregulatory responses between treatments
16	8	Heat-acclimated fit men	Euhydration H <sub>2</sub> O C <sub>3</sub> H <sub>8</sub> O <sub>3</sub>	1.2 g/kg LBM in 3.9 mL/kg LBM solution plus 25.2 mL/kg LBM	35°C	Treadmill run to exhaustion (1-h after treatment)	No difference in physiologic or thermoregulatory responses between treatments
17	6	Men	Placebo C <sub>3</sub> H <sub>8</sub> O <sub>3</sub>	1.0 g/kg in 5 mL/kg H <sub>2</sub> O plus 21.4 mL/kg H <sub>2</sub> O	Unknown	Lower body negative pressure tests (2.5-h after treatment)	↑ tolerance of lower body negative pressure
18	9	Navy divers	H <sub>2</sub> O C <sub>3</sub> H <sub>8</sub> O <sub>3</sub>	1.2 mL/kg LBM; total=30 mL/kg LBM	13°C water submersion	3-h cold-water dive	C <sub>3</sub> H <sub>8</sub> O <sub>3</sub> ineffective at ↓ body water loss during prolonged cold-water immersion

<sup>a</sup>H<sub>2</sub>O=water; C<sub>3</sub>H<sub>8</sub>O<sub>3</sub>=glycerol; CHO=carbohydrate; TBW=total body water; LBM=lean body mass; RH=relative humidity; Vo<sub>2</sub>max=maximum oxygen consumption; ↑=increase; ↓=decrease.



increase in exercise time to exhaustion by 21% (study 1) and 24% (study 2) in instances of glycerol-induced hyperhydration compared with the placebo.

The results from the study of Montner et al (12) are somewhat puzzling in that exercise time to exhaustion increased dramatically with glycerol ingestion without any significant changes in thermoregulatory measures such as sweat rate and rectal temperature. The authors did address this issue but stated that methodologic differences, such as a lower ambient temperature relative to other studies, may have diminished glycerol's ability to show an enhanced thermoregulatory effect. Furthermore, they did not find their results entirely inconsistent with others and cited several hyperhydration infusion studies that reported a lowering of heart rate without a concomitant reduction in rectal temperature. However, Montner et al (12) were unable to offer a specific mechanism for the improved performance after glycerol-induced hyperhydration; to date, these findings of improved performance have not been replicated.

As with any sport drink or nutritional aid, if an athlete decides to try glycerol-induced hyperhydration, he or she should experiment with it in training before using it in competition

Other exercise studies have shown no improvement in endurance performance after glycerol-induced hyperhydration. In a study by Murray et al (13), 5 women and 4 men ingested 3 mL/kg lean body mass of either a water placebo, a 6% carbohydrate-electrolyte beverage, the carbohydrate-electrolyte drink plus 4% glycerol, or a 10% glycerol solution at 15, 30, 45, and 60 minutes during exercise. The exercise consisted of cycling at 50%  $\dot{V}_{O_2}$  peak for 90 minutes in a 30°C, 45% relative humidity environment. The glycerol solutions attenuated the decrease in plasma volume and resulted in lower ratings of perceived thirst, but there were no differences in heart rate, sweat rate, temperature, ratings of perceived exertion, or changes in hormonal levels among subjects who received the different beverages.

Several abstracts at the 1997 American College of Sports Medicine annual meeting were also disparaging toward the proposed ergogenic properties of glycerol-induced hyperhydration. Wendtland et al (14) reported that although glycerol enhanced fluid retention, it offered no cardiovascular or thermoregulatory benefits for 8 trained cyclists who underwent 106 minutes of moderate (65%  $\dot{V}_{O_2}$  max) to intense (80%  $\dot{V}_{O_2}$  max) cycling intervals. Similarly, research presented at the American College of Sports Medicine meeting and published by Latzka et al concluded that glycerol-induced hyperhydration provides no significant physiological or thermoregulatory advantage over water hyperhydration during compensable (15) or uncompensable (16) exercise-induced heat stress. Compensable heat stress was defined as a condition in which the body's thermoregulatory system can compensate for increased

body-heat storage and maintain a steady-state core temperature; whereas uncompensable heat stress was defined as a continual rise in core temperature until exhaustion (16). In both of the studies of Latzka et al (15,16) the same 8, fit, heat-acclimated men exercised on a treadmill in a 35°C environment. The compensable heat-stress study involved exercising for 120 minutes at 45% of  $\dot{V}_{O_2}$  max under conditions of euhydration, glycerol hyperhydration with and without rehydration, and water hyperhydration with and without rehydration (15). During the uncompensable heat-stress study subjects exercised to exhaustion while wearing a full chemical protective suit (16). Glycerol provided no meaningful benefit in either study.

Methodologic differences are probably at least partially responsible for the disparity of findings in the glycerol-induced hyperhydration research. Latzka et al (15) suggested that previous studies touting the benefits of glycerol-induced hyperhydration and hyperhydration in general have been confounded by subjects starting exercise in a hypohydrated state or becoming dehydrated during exercise. Proponents of glycerol-induced hyperhydration would argue that researchers who found this natural metabolite to be ineffective had subjects start exercise too soon after glycerol ingestion (not allowing adequate time for absorption), not exercise long enough, not exercise intensely enough, not ingest an adequate concentration or dose of glycerol, or not exercise in an environment that stressed the thermoregulatory system.

The focus of this review and most glycerol-induced hyperhydration studies is on sports performance, but the US space program and military also have an interest in glycerol-induced hyperhydration. For example, Bondar et al (17) studied the effectiveness of glycerol-induced hyperhydration as a countermeasure for orthostatic intolerance after a spaceflight. They noted an improved response to lower body negative pressure after glycerol ingestion. Arnall and Goforth (18) found no benefit to using glycerol as a means of reducing body water loss in US Navy SEAL divers during a 3-hour cold-water immersion.

#### CAUTIONS AND RECOMMENDATIONS

According to Lin (19), glycerol is well tolerated and safe at an oral dosage of 1 g/kg of body weight every 6 hours. Several researchers have reported no adverse effects from glycerol-induced hyperhydration in their studies (7,11,12), and Koenigsberg et al (9) noted that only 1 subject complained of slight nausea after receiving the placebo and the glycerol solutions. In contrast, other studies have shown that for at least some persons there are negative side effects after glycerol ingestion. Latzka et al (15) reported that 1 of 9 subjects was unable to complete the study because of nausea, and 2 of the remaining 8 subjects vomited after drinking the glycerol solution. Similarly, Murray et al (13) reported an increased incidence of nausea, bloated feeling, and light-headedness after glycerol ingestion. They also cautioned that ingestion of larger amounts of glycerol increases the risk of inducing cerebral and intraocular dehydration because of the extremely slow rates at which glycerol enters the cerebrospinal fluid and aqueous humor.

Glycerol is currently available commercially from at least 2 sources: Glycerate (Advanced Kinetics, Boulder, Colo) and ProHydrator (InterNutria, Framingham, Mass). Both products are marketed as 99.5% pure glycerol, and the suggested volume of water to be taken with each of these glycerol products is similar (about 22 mL/kg body weight). The recommended glycerol dose, however, differs between the products. The dose of Glycerate is about 1 g/kg body weight (for a 70-kg person, the manufacturer recommends 60 mL glycerol mixed

with 1,540 mL water). The makers of ProHydrator recommend a dose that is about 3 times greater (for a 70-kg person, the manufacturer recommends 6 oz, or 177 mL, glycerol mixed with 1,500 mL water). These fluid volumes are substantial, and some athletes may find it difficult to consume these amounts. Both manufacturers recommend preloading with their glycerol product 60 to 120 minutes before competition. For events of great duration, they suggest additional ingestion of glycerol during competition with a maintenance dose that is much less than the loading dose.

Glycerol-induced hyperhydration has applications for spaceflights; it has been studied as a means of decreasing lower body negative pressure that occurs at spaceflight reentry

Although glycerol is commercially available for interested athletes, there are still many unanswered questions regarding the oral ingestion of this natural metabolite.

■ *To what extent does glycerol affect the rate of gastric emptying?* Hyperosmolar solutions decrease the rate of gastric emptying. This effect could cause a bloated feeling and should be a consideration for athletes who are trying to hyperhydrate before competition.

■ *What is the optimal glycerol solution for maximal hyperhydration?* Riedesel et al (7) experimented with varied amounts of glycerol and found a dose of 1 g/kg body weight to be more effective at retaining water than a dose of 0.5 g/kg body weight but not substantially better than 1.5 g/kg body weight. Most researchers have used a glycerol dose approximating 1 g/kg body weight. Nevertheless, more research is needed to determine the optimal glycerol concentration/solution for maximal hyperhydration and palatability.

■ *How long before competition should glycerol be ingested?* Glycerol is thought to be absorbed rapidly (19). In the research studies ingestion time has ranged from after exercise has already commenced (13) to 2.5 hours before exercise has begun (11). The recommendation on the commercially available products is to ingest glycerol with the appropriate amount of water or sport drink 60 to 120 minutes before competition. The timing and amount of subsequent glycerol ingestion during exercise are even less clear.

■ *How effective is glycerol at preventing dehydration during ultra-endurance events?* Most exercise research on glycerol-induced hyperhydration has been limited to exercise duration of less than 2 hours. It is possible that athletes in events lasting for 4 hours or more (eg, ultra-marathon runs, triathlons) in hot, humid conditions or multistage events (eg,

bicycle racing over several days) would benefit the most from glycerol-induced hyperhydration.

■ *Are there any health risks associated with long-term ingestion and/or large doses of glycerol?* Research is lacking on the metabolic effects of ingesting large volumes of glycerol over a prolonged period of time.

## APPLICATIONS

Glycerol-induced hyperhydration has applications for spaceflights and the military. For example, it has been studied as a means of decreasing lower body negative pressure that occurs at spaceflight reentry (17) and as a means of maintaining hydration status and thermoregulation in soldiers who work in desert conditions (10). Most of the research regarding the oral ingestion of glycerol, however, has focused on its use as a hyperhydrating agent for athletes.

Because glycerol has been proposed as a means of enhancing hyperhydration, and hyperhydration is thought to help combat the deleterious effects of dehydration on athletic performance, glycerol has been touted as a potential ergogenic aid. Most likely it has the greatest benefit in athletes participating in ultra-endurance sports conducted in hot, humid conditions when the threat of dehydration is the greatest. Although there is general agreement that glycerol ingestion enhances fluid retention, the effectiveness of glycerol in improving athletic performance is a controversial issue and largely unsubstantiated.

Regardless of questions about its effectiveness as a hyperhydrating agent and ergogenic aid, glycerol is on the market and being used by athletes. Thus, dietitians have a responsibility to become knowledgeable about glycerol ingestion so that athletes who consult them can make well-informed decisions about use of glycerol products. To this end, the pros and cons of glycerol-induced hyperhydration research, as well as recommendations and warnings for its use, were discussed in this article. The fluid volumes recommended for hyperhydration by product manufacturers are substantial and may result in a heavy, bloated feeling for some athletes. Also, some researchers have reported that glycerol ingestion might cause nausea and/or vomiting in some people (13,15). Montner et al (12) suggested administering a lower concentration of glycerol and dividing the dose over a period of time to alleviate symptoms of bloating and nausea. The quantity of glycerol that is tolerable and its effectiveness will probably vary widely among people. As with any sport drink or nutritional aid, if an athlete decides to try glycerol-induced hyperhydration, he or she should experiment with it in training (eg, varying concentration, fluid volumes) before using it in competition.

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## PRACTICE POINTS: Translating research into practice

### Physical activity—it's not reserved for athletes

Much time and many dollars go into developing shoes, clothes, rackets, balls, clubs, and sports nutrition foods and drinks to optimize the output of high-performance and endurance athletes. But for each professional and amateur competitor there are many who are struggling to meet the challenge of fitting even moderate exercise into their lifestyles, as part of a weight-loss plan, weight-maintenance strategy, or healthful-lifestyle goal. **Bob Wilson**, DTR, is a member of the Dietetic Technicians in Practice dietetic practice group, a nutrition specialist with Kaiser Permanente, Portland Ore, a computer nutrition analyst, a motivational speaker, and a nondiet-approach wellness counselor. He advises his clients to develop a plan of personal wellness that celebrates regular physical activity in addition to focusing on healthful eating and positive self-care and finding time for spiritual renewal and establishing balance in life.

For many, the thought of becoming physically active is a daunting prospect. To encourage persons who are reluctant to add a physical activity component to their daily routines, Wilson offers this advice (1,2):

■ **Change your attitude** Stop thinking about grueling workouts and start thinking about zestful playtimes. Moving your body does not have to (and, in fact, should not) hurt. Start by incorporating 30 minutes of some form of activity into every day. It does not have to be done all at once. Spread exercise throughout the day in 5- to 10-minute increments.

■ **Redefine the "E" word** Change "exercise" to "enjoyment." Choose to perform activities you like to do and you will never have to force yourself to exercise. Remember the fun you had as a child while doing active things like running, jumping, and skipping.

■ **Be flexible with your interests** Jump into a variety of physical activities. Try something new or stick to an old favorite: Dance, garden, bike, swim, walk, or lift weights—anything you enjoy that fits your lifestyle.

■ **Feel the power** Celebrate the inner strength and sense of well-being that come from allowing your body to experience the freedom of movement. To heighten your confidence and body awareness, look into walking meditation, t'ai chi, yoga, or movement therapy.

■ **Make fitness a priority** Plan family and personal vacations around fitness, or invite a colleague to "do business" over a walk rather than over lunch, coffee, or drinks. Sneak fitness into your day by stretching for 5 minutes before you get out of bed in the morning, or doing arm curls while waiting for the microwave to heat up your food.

■ **Enhance your day with exercise** Make physical activity part of the things you already do. Walk to the bank to use the automatic teller machine instead of using the drive-through. If your task is to wash your car, do it by hand. If you are at the mall running errands, take the stairs instead of the escalator.

Regardless of fitness level or athletic ability, the physical, spiritual, and emotional benefits of regular exercise are immeasurable. Wilson, who has successfully maintained his own weight loss of approximately 200 lb for 26 years, counsels clients in his wellness practice and audiences at his motivational presentations to mix and match activities to create a do-able, personal plan. He asserts that attitude is key to incorporating fitness into a daily routine and making it part of a healthful lifestyle. "Move with joy each day. Get physical with your family, use muscle power for transportation, challenge yourself, and celebrate every success, no matter how small. Five minutes of movement is 500% better than nothing!"

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