

ANALYSIS:

new "long john" swimming suits worn at the 2000 olympics

Richard N. Hinrichs, Ph.D., and Bryan J. Morrison, M.S.

Introduction

There is a new breed of swimming suits that hit the pool, big time, at the 2000 Olympic Games in Sydney. These suits look like "long johns" and cover up most of the body (both women and men). There are several variations on this theme. The smallest covers just the thighs on men with no covering on the torso (i.e., like bike shorts). The women's version of this covers

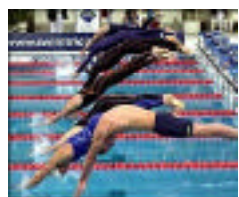


Figure 1: new swimsuit variations

the torso like a traditional competitive swimming suit but also covers the thighs. Other variations include covering the entire lower body to the ankles and/or covering the arms to the elbows or wrists (see Figures 1 and 2). These new larger suits appear to be helping performance. A substantially greater number of world records have fallen since the Federation Internationale de Natation Amateur (FINA) (the international governing body) approved their use in November 1999 than in any equal time period in previous years. Are the new suits fully or partly responsible for this? If so, how do they work?

Claimed Advantages of the New Suits
Swimmers used to think that the less material covering the body the faster the



Figure 2: new swimsuit design

performance, all else being equal (see Figures 3 and 4). Conventional wisdom was that human skin (without any hair) was more slippery than swimsuit material. This all changed with the introduction of the new "long john" suits. They are available from a variety of manufacturers. Speedo calls their new suits "Fastskin"; Adidas calls their new suits "Equipment Bodysuits". Other labels like TYR and Nike could be seen on the medal stand as well. Below we analyze some of the manufacturers' claims and discuss the experiences of some of the swimmers who have tried out these new suits. Can they really improve performance and if so, how?

- **Reduced frictional drag:** These suits are thought to reduce drag resulting from friction between the water and the body. The manufacturers have developed a material that has a lower coefficient of friction (in the water) than human skin, shaved or not. In fact, the full-body suits (ankles to wrists) make shaving unnecessary, because nearly all the skin is

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Letter from the Editor

Welcome to the fall issue of *ACSM's Fit Society Page*. With the recent completion of the 2000 Summer Olympics, it is our intent to try and answer some questions that you may have thought of while watching and reading about the Summer Games. Our lead article is designed to clarify issues about the new whole-body swimsuits used by many of the world's best swimmers. We have also included the latest information on protein and creatine supplementation and how it may potentially help improve athletic performance. Furthermore, many Olympic athletes employed sport psychologists and we thought our readers would be interested in the types of performance-enhancing techniques used by these athletes while training and competing. As usual, we have included news from the Athletes Kitchen and our Question and Answer section specifically focusing on ergogenic aids. We hope you enjoy this issue of *ACSM's Fit Society Page* and find information that you can use to enhance your exercise performance.

If you have any questions or comments please be sure to contact us.

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American College of Sports Medicine's

FIT SOCIETY PAGE

is published quarterly by ACSM's Fit SocietySM, an affiliated association of the American College of Sports Medicine, P.O. Box 1440, Indianapolis, IN 46206-1440.

The American College of Sports Medicine is the World's largest association devoted to sports medicine and exercise science. The College's mission is to promote and integrate scientific research and practical applications of sports medicine and exercise science to maintain and enhance physical performance, fitness, health, and quality of life.

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Q&A with ACSM

Bryan W. Smith, M.D., Ph.D.

Q: Since endurance athletes train at altitudes to increase red blood cell mass, what's the harm in using erythropoietin to accomplish the same goal?

A: This artificial method of stimulating red blood cell production carries significant risk for the population of patients with anemia from chronic disease for which this hormone therapy is intended. Complications such as death from thrombosis, hypertension, and seizures have been reported. In the athlete with a normal red blood cell mass, using EPO may cause polycythemia (too many red cells in the blood) which can lead to an increased life-threatening risk for thrombosis from hyperviscosity and hypervolemia.

Q: My 15-year-old son was advised to start taking creatine. Is that OK? Are there any side effects?

A: The ACSM roundtable on creatine supplementation recommended that young people under the age of 18 not use creatine. The short-term safety is un-

known in the adolescent population, though many adolescents are taking creatine. Many anecdotal side effects have been reported such as nausea, diarrhea, weight gain and muscle cramping. Long-term safety of creatine use in the dosages used by athletes today is unknown. More serious side effects such as hypertension, kidney damage and heat illness have been postulated but inconclusively substantiated to date. Many athletes who take creatine take more than the standard dosages reported, which probably leads to more side effects.

Q: I've heard Ma Huang, an all-natural herbal supplement, can help me lose weight and give me increased energy. Since I can purchase it at the local health food store it must be safe, right?

A: Ma Huang is ephedrine, which is a stimulant banned by many sports organizations. As many as 50 deaths have been attributed to the misuse of ephedrine. It is a popular ingredient in products from weight-loss preparations to herbal teas.

Some of its common effects are to raise heart rate and blood pressure. This can be dangerous in individuals who have pre-existing heart problems. Taking ephedrine can lead to dehydration, which can predispose an individual to heat illness. It's always a good idea to get medical advice before starting any supplement.

Q: Does androstenedione have side effects similar to illegal anabolic steroids?

A: This most likely depends on the amount consumed. In small doses, side effects are usually minimal, but larger doses can result in steroidal side effects such as acne, increased blood pressure, lipid abnormalities, liver alterations, and mood swings. Men may have breast enlargement and testicular atrophy, while women may develop a deepened voice, menstrual irregularities and increased body hair. Studies are still lacking in terms of how much androstenedione or other testosterone enhancers will cause dangerous or unwanted side effects.

Commentary



SWIFTER, HIGHER, STRONGER, MORE MENTALLY TOUGH?

Scott Ward, Ph.D.

15,000 athletes and coaches represented their respective countries at the 2000 Summer Olympic Games in Sydney, Australia last month. At times these athletes who are so on top of their game seem super-human. But if you're like most people, you still were captivated when they accomplished the unexpected. If you felt the rush right along with them, it's not surprising. Perhaps the excitement resonates within us because we all have the potential for greatness.

Be assured even the best athletes didn't accidentally arrive at the Olympics and compete. There was a starting point for each of them, as well as a number of points along the way where they and their coaches paused to re-evaluate. It takes a well-designed plan to reach a pinnacle of competition like this.

Each time an athlete stepped up to accept his or her medal, no doubt at one time or another along the way some kind of mental training technique was in the mix. Never before has the use of sport psychology been so prevalent. Elite athletes and their coaches now understand and appreciate the edge that can be gained by going into competition mentally tough. You can, too.

Sport psychologists have developed a variety of mental toughness techniques, and they're available to anyone who vies for the gold. Athletes come in different forms, and so do the sport psychology techniques they utilize. A few techniques have stood the test of time, among them Goal Setting, Relaxation Training, Positive Self-Talk, and Visualization. These techniques were in full effect this summer in Sydney.

Goal Setting

In one way or another, all the athletes used goal setting techniques to help in their journey to the 2000 Games. These people and those who support them first broadly defined the outcome — in this case a trip to Australia — and then delineated each step essential to reaching that outcome. What needed to be done on a monthly, weekly, and daily basis was carefully charted to guide these athletes to their ultimate goal. Many of this summer's Olympians began their journey four years ago, right after the 1996 Games in Atlanta. Whether running the 100-meter dash, or diving from 10 meters above the water, goal setting gave these athletes direction, evaluation, and motivation toward Olympic gold.

Relaxation Training

The idea of competing against the world's best makes even the most experienced athletes tense and tight. These Olympians were no different — they used relaxation training such as biofeedback, meditation, and progressive relaxation in a variety of situations. Relaxation training aided the archer's precision, the marathoner's endurance, and the pitcher's ability to sleep the night before the game. In Sydney, athletes faced many tension-producing moments. Confronting everything from travel and lodging issues to the competition itself, relaxation training kept these well-trained bodies loose and ready for action. It also significantly reduced the chances for injury.

Positive Self-Talk

Self-doubt during competition is devastating to performance. Athletes at all levels face situations that challenge their self-confidence. It's hard to believe that

an Olympic athlete's self-confidence can actually be challenged, but at times it is. When this happened in Sydney, athletes used an effective sport psychology technique called positive self-talk. With this thought management method, the athlete learns to recognize negative and destructive thoughts and replace them with positive, confidence-building thoughts. I guarantee that the gold medal weight lifter was not telling himself, "I've never lifted this much before." Instead, he was telling himself, "It's time for a new personal best."

Visualization

"Seeing is believing" is not just a familiar saying. It can make all the difference for an athlete. Visualization is considered to be one of the most powerful techniques for enhancing the athlete's performance. When athletes practice visualization before competing, they significantly enhance their mental toughness, confidence, and potential for success. All over Sydney, Olympic athletes were finding quiet places to close their eyes and visualize a perfect performance — hours or moments before they put their muscles to the test. You can be sure that many of them repeatedly and consciously visualized a medal being placed around their neck during their days, weeks, and months of training leading up to the Games.

Sport psychology techniques like these can serve to increase the mental toughness of any athlete. And being more mentally tough can make a big difference. After all, our personal best is always something that can be bettered — just ask the athletes who competed in the 2000 Games. Maybe it's time we modified the Olympic creed: Swifter... Higher... Stronger... More Mentally Tough.

Nutrition



PROTEIN AND CREATINE: SOME BASIC FACTS

L. Chris Eschbach

At all levels of competition, the ability to perform well in an athletic event is dependent primarily upon two factors: genetic endowment and state of training. Beyond these factors, nutritional status of the athlete may also have significant impact. It is

this perceived impact, real or not, and commercial promotion of nutritional supplements that drives the multi-billion dollar sports supplement market. Recently, great interest has been given to the use of supplements of protein and/or creatine, especially for strength and power athletes. Considering nutritional supplementation, one should carefully consider the potential risks and benefits. Supplementation is not for everyone; arming yourself with knowledge is the key to success. There are countless sources of information from both scientific and non-scientific sources, each of which should be examined closely.

Protein is the basic building block for the body. Within the body, protein is formed from amino acids. Eleven "non-essential" amino acids are made within our bodies, but we must obtain the nine other "essential" amino acids from the foods we eat. Together these 20 amino acids are a major component of muscle, blood, enzymes, cell membranes, and some hormones. The anabolic role of protein — as a building block for body components — leads some athletes to believe more is better. This may be true to an extent, but excessively high protein intakes have not proven to be beneficial and may be harmful in some circumstances. Recently, several popular dietary regimens promoted by the popular media have advocated high protein intake, which requires above 30 percent of total food intake. In response to these trends the American College of Sports Medicine, the American Dietetic Association, the Cooper Institute for Aerobics Research, and the Women's Sports Foundation have jointly released a statement saying that high-protein, low-carbohydrate diets are not a recommended weight loss strategy, will not help exercise performance, and may be harmful.

So how much protein is enough? First, you must consider the quality. That is, do the foods supply adequate amounts of essential amino acids? Complete proteins supply all nine essential amino acids in adequate amounts. These proteins generally come from animal sources such as meat, fish, poultry, eggs, and milk (eggs being highest quality and most complete protein source). Incomplete proteins supply the amino acids, but are usually lower than necessary in one or more of the essential amino acids. These incomplete proteins usually come from plant sources.

Protein intake is usually expressed in one of two ways: grams of protein per kilogram of body weight per day (g/kg/day) or as a percentage of total caloric intake. It has been determined that the recommended daily allowance of protein for healthy adults is 0.8 g/kg/day or 12-15 percent of daily caloric intake. However, research has demonstrated that athletes, both strength/power and endurance, have an increased need for protein, especially during times of intense training. These data suggest that the recommended daily allowance for athletes in training, ranges from 1.2 to 1.8 g/kg/day, which when coupled with increased food consumption that accompanies training remains 12-15 percent of their daily caloric need. The general population currently consumes at least 1.0 g/kg/day, and most athletes routinely consume 1.2 to 2.0 g/kg/day because of their high total energy intake. Therefore, as long as caloric intake meets energy expenditure via a well balanced diet, protein insufficiency will not be a problem. Vegetarians or persons on a restricted diet may consume a majority of incomplete proteins. In these cases, a greater amount of protein may be required, possibly via supplementation, to meet the necessary amounts of essential amino acids.

Currently, there is no evidence that very high protein diets, greater than 2.0 g/kg/day, will improve performance, increase muscle size, or increase strength. Excess consumption, in very high protein diets, may also come with health risks. Excess calories above individual energy expenditure, from any source, will be stored as fat. Animal foods, which are high in quality protein, often contain large amounts of saturated fat and cholesterol, both of which have been implicated in increasing risk for heart disease. Individuals with potential liver or kidney problems and diabetics should be especially mindful of consuming excess protein; those organs must work harder to deal with the disposal of excess amino acids. Finally, because the components of excess protein must be excreted in the urine, dehydration could occur from excessive fluid loss, compromising exercise performance. There is no advantage, other than convenience, to consuming commercially available protein products over natural protein that is readily obtained in high quality foods. With appropriate dietary intake, protein supplementation does not appear to be necessary. In general, a diet that provides approximately 55 percent of the calories from carbohydrate, 15 percent from protein, and 30 percent from fat will meet the healthy individual's as well as the athlete's needs.

Creatine is promoted variously as increasing muscle mass, power and strength, and delaying fatigue. Creatine has been

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shown to increase phosphocreatine levels in the muscles of some people. Phosphocreatine is utilized by the body to maintain levels of adenosine triphosphate (ATP), the most basic form of energy within the body. Therefore increasing the creatine levels within the muscle—and theoretically increasing phosphocreatine—will allow ATP/energy levels to be maintained for a longer period, thereby delaying fatigue during short duration (<10 sec), high intensity exercise. It has also been suggested that creatine delays the onset of lactate accumulation in the blood and possibly the muscle. The human body manufactures only small amounts of creatine, so it is important that we obtain the necessary amounts from food. The richest sources occur in animal meats, which puts vegetarians at a disadvantage.

Ingesting commercially available creatine in a relatively high “loading” dose of 20-25 g/day for five to seven days or a smaller “loading” doses of three g/day over 28 days has been shown to significantly increase muscle levels of creatine. Theoretically, this increases phosphocreatine levels and improves performance in high intensity, short duration activity. This improvement most likely stems from the fatigue-delaying capabilities

of creatine supplementation reported in the scientific literature. In contrast, there has been little evidence of acutely increased power with its use. Supplementation with creatine has been shown to be especially beneficial for high intensity, repeated bout exercise, although no benefits have been shown during endurance exercise. Once the loading phase has been completed, maintenance of the increased creatine levels can be accomplished with supplementation of two g/day. Approximately 20 percent of individuals have been shown to be non-responsive to creatine ingestion. That is to say, these individuals may already maintain high levels of creatine within the muscle, and further supplementation may not benefit them.

Besides improving performance in high intensity exercise, several researchers say, creatine can cause weight gains of 2.0-4.5 pounds over a week of supplementation. The source of this acute weight gain has not been wholly determined, but it is believed to be retention of water within the body. There has been no direct evidence of increased muscle mass with its consumption. Creatine shows promise in short duration, high intensity events; if this benefit holds true, in theory, the fatigue-delaying properties

may allow an athlete to train more intensely, which could result in a greater increase in muscle mass as well as gains in strength and power.

No negative effects on health have been shown with acute supplementation of creatine, although there is little knowledge of its long-term consequences. As with protein, persons with potential liver or kidney problems and diabetics should be especially mindful of supplementation. Athletes need to keep adequately hydrated at all times when utilizing creatine to prevent potential dehydration and possible electrolyte abnormalities.

If athletes, coaches, and the general public are educated on the importance of a well balanced diet, as well as on when and why supplementation might be effective, perhaps the myth of many nutritional aids will be minimized. Creatine has shown promise in specific athletic situations, especially repeated bout activities. The optimal benefits may be derived from decreased fatigue, allowing for greater effort during subsequent bouts or in training. All supplements should be used with caution. If creatine is used, coaches and athletes should understand its effects and benefits before allowing its use during competition.



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The Athlete's Kitchen



WOMEN, WEIGHT, AND MENOPAUSE

Nancy Clark, M.S., R.D., FACSM

"Is it true women inevitably gain weight with menopause...?"

"I can't understand why I've gained five pounds. ... I'm eating and exercising the same as I've always done, but my weight has gone up!!"

"My waist is expanding. Thank goodness for elastic waist bands!"

It is no secret: Women aged 45 to 50 constantly complain about weight gain and a thickened waist. Based on their stories, one could assume perimenopausal (the years surrounding menopause) weight gain is inevitable. This may not be the case. Here are the answers to some questions middle-aged women (and their family members) commonly ask about weight and menopause.

Is midlife weight gain inevitable?

Despite popular belief, women do not inevitably gain weight with menopause. Yes, women commonly gain weight and get thicker around the middle as the fat settles in and around the abdominal area. However, the changes are not due to the hormonal shifts of menopause, but rather to reduced metabolic rate, less activity, and a calorie imbalance.

Why do women gain weight with age?

When people age, they tend to lose muscle mass (unless they do regular strength training). Because muscle drives your metabolic rate, less muscle means a lower metabolic rate and fewer calories burned. In addition, if you are feeling chronically fatigued due to poor sleep and the hormonal shifts of menopause, you may lack the desire to exercise. This perpetuates more muscle loss and further the drop in metabolism.

Menopause also occurs during a time when many women become less active.

That is, if your children have grown up and left home, you may find yourself sitting and reading, rather than running up and down stairs, carrying endless loads of laundry. By the time you are fiftyish, you may also be more affluent and have more money to spend on restaurant eating, vacations, and cruises. Moreover, you may be attending more business meetings that involve abundant food. The combination of easy access to delicious food, lower activity level, and the attitude "I'm tired of dieting and depriving myself of tasty food" that accompanies 35 or more years of restrictive eating, can sneakily contribute to the excess calories that settle around your waist. But don't blame menopause! A study with 541 women ages 42 to 50 suggests the women, on average, gained the same amount of weight whether or not they had gone through menopause.

How can I prevent midlife weight gain?

The best way to prevent weight gain is to exercise and maintain an active lifestyle. Research with women who walked for two to three miles a day, ate a low-fat diet, and monitored their calorie intake indicates they did not gain the five pounds their non-exercising peers gained between the ages of 45 to 50. In another study, 57 active women who followed an exercise program for two years gained less weight, and less weight around their middles, and had stronger bones than 130 women of the same age who did not exercise.

What is the best exercise program for women?

Your exercise program should include both aerobic exercise (to enhance your cardiovascular fitness) and strengthening exercise (to preserve muscles and bone density).

I'm afraid to take hormones. Is it true they contribute to weight gain?

Research suggests taking hormones to counter the symptoms of menopause (as well as to protect against heart disease and osteoporosis) does not contribute to weight gain. If anything, hormone replacement therapy may help women lose weight, or not contribute to extra weight gain on top of that commonly gained at midlife.

Do menopausal women have special nutritional needs?

Menopausal women need a strong calcium intake: 1,200 to 1,500-mg calcium/day, or the equivalent of a serving of milk or yogurt at each meal. If you are tempted to take a supplement instead of consuming low-fat dairy foods, think again. One supplement does not replace the whole package of health-protective nutrients in low-fat milk and yogurt. In addition, recent research suggests women who drink three or more glasses of milk a day tend to be leaner than milk-abstainers. Milk can help you manage your weight, not fatten you up.

I feel desperate to lose the weight I've gained. What's the best diet for quickly shedding five to ten pounds?

The best way to lose weight is to think about eating healthfully. If you have been dieting for 35 to 40 years of your adult life, you should have learned by now that dieting doesn't work. Rather, you need to learn how to manage food. This means learning how to eat smaller portions of your trouble foods (such as eating one cookie, not three); eating more whole foods and unrefined foods (such as whole grain breads, fresh fruits, vegetables, low-fat dairy foods, fish, tofu and other soy foods, lentils, dried beans, and nuts).

If you feel at a loss for ways to start eating well, meet with a registered dietitian (RD) who specializes in sports nutrition. This professional can develop a personalized food plan that fits your needs. To find a local RD, go to www.eatright.org.

Swimming Suits

(continued from page 1)

covered. Speedo designed its material to simulate sharkskin with V-shaped ridges. If these claims are true, it is not surprising that the men are busy "covering up" the bare bodies they have spent years showing off.

- Better body position in the water (and hence better streamlining): Before FINA approved these suits, they tested them to make sure they were neutrally buoyant. In other words, they bunched up the suits and held them underwater. When they let them go, the suits didn't float to the surface. In other words, the material has essentially the same density as water. However, the human body does not. Legs typically have a much higher density than water; so covering the legs with a neutrally buoyant material will decrease the density of the legs, thereby reducing their tendency to sink. Many swimmers have reported that they feel these suits make them "ride higher in the water" and it is not surprising. We're not sure FINA considered this issue fully before approving these suits. Anything that helps "hold the feet up" in swimming will make the swimmer more streamlined and reduce "form drag" by reducing the frontal area exposed to the water. *

- Compressing the muscles: This new suit is designed to be very tight and usually takes 15 minutes to put on. This is to compress the muscles and create a sleeker aerodynamic swimmer. This is a great idea, but in longer races will it slow blood flow to the extremities?

- "Gripper". Many swimmers have worried about losing their "feel for the water" when wearing a suit with long sleeves. In response to this Speedo developed the "Gripper", which is a piece of fabric placed in the forearm region. This material is thought to increase friction and allow swimmers to increase their feel for the water. Speedo is not really

clear as to which interface has increased friction—the arm-suit interface or the suit-water interface. If it were the suit-water interface, this would increase the swimmer's ability to catch water, propelling with more power. If this were true, then this would be a flagrant violation of the FINA rule (see below).

Controversy: Should These Suits Have Been Allowed?

As with any new or revolutionary product, there are two sides to the issue. Purists believe that swimming is human-against-water, and that technology should not interfere with this general concept. Enthusiasts want to obtain and use anything that will give them an added edge and raise



Figure 4: conventional womens' swimsuit design

the level of excitement in their sport. If the claimed advantages are true, should these new suits be allowed? FINA rule SW 10.7 says "No swimmer shall be permitted to use or wear any device that may aid his speed, buoyancy or endurance during a competition (such as webbed gloves, flippers, fins, etc.). Goggles may be worn." Interpreting this rule is where the difficulty lies. Reducing coefficient of friction to a value below that of bare skin clearly "aids his speed", but is not a direct source of propulsion (unless the "Gripper" concept is true—see above). Reducing the density of the legs clearly "aids his buoyancy" by changing the body position in the water, yet the suit itself is the same density as water.

The decision of FINA to approve these new "long john" suits was rushed due to manufacturers' late debut of their suits, indeed, United States Swimming (USS) had banned them from the Olympic trials

because only one manufacturer met a USS deadline to ensure all athletes equal opportunity to wear the suit. This ban was lifted due to pressure from the manufacturers and to avoid a possible grievance.



Figure 4: conventional mens' swimsuit design

Swimming purists say that these new suits should be considered equipment rather than clothing. Based on our interpretation of FINA rule SW 10.7, these suits may have been approved prematurely and without sufficient time to study all the issues discussed here. If FINA had had more time, it may have been more difficult to get these new "long john" suits approved for competition.

The suits appear to help performance, but the level of that help is not clear. How many of this year's world records are directly due to the new suit? There are three distance-swimming records that the new suits should have helped break but did not. Ten-year-old distance records were not even approached. There are clearly factors other than the suits: training, technique and fast pools.

Should You Buy One of These High Tech Swim Suits?

Now that the Olympics are over, these new swimming suits are available to the public. Are these suits just for world-class swimmers, or should less elite competitive swimmers or those who swim only for recreation and exercise buy one? It depends on how much one is willing to pay to get the latest technology in the pool. The new suits might make sense for serious competitive swimmers if it truly gives them an advantage. It makes little sense, however, for someone who has no intention of competing and swims for exercise and/or fun. Many of us have barely an hour to swim during lunch break. Why give up 15 minutes putting on a suit?