The Runner's Diet

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The Runner's Diet

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FOREWORD

Whenever you start to write anything about nutrition, you immediately make two enemies: the man who thinks you haven't given it enough credit, and the one who thinks you have given it too much.

The subject of nutrition has gotten something of a bad name because of these extremists—both the ones who say diet makes all the difference and those who say it makes none at all. Caught in the middle, between opposite philosophies, vaccilating individuals often end up adopting the worst features of both approaches. No wonder, then, that anything said or written about nutrition is looked on with some suspicion.

At the risk of alienating the people at both extremes, we're publishing a booklet that takes a *new* middle course. This one neither says that diet means everything in the success of a runner, nor that it makes no difference at all. What we have here is something of a balance between the two—based on the research of hard-headed realists. We're drawing equally on the experience of nutritional scientists, and the runners who put their theories into practice.

Certain types of dietary control do offer the runner hope for eventual improvement of his performances. But he should be careful not to rely too heavily on it, because food and drink aren't ends but beginnings. They are the fuel that powers training, which in turn is the basis for racing. Minimum amounts and types of food and drink are needed before the process can begin—before health, strength and energy are adequate. But once these minimums are met and running is underway, nutrition offers no substitute for work and no shortcut to success. It merely promotes work and opens the way to success.

No runner ever got anywhere just by eating. That's the one warning we'll give. Once runners realize this, they are better able to see what nutrition can offer them. It offers quite a lot, actually. At least four factors have a direct, measurable effect on running performance. Others work less directly. The main ones are:

- **Weight.** The big problem in running nutrition is not deficiency but overabundance—in this case too much eating leading to too much weight. Fat is the main limit on fitness in our overfed society, and in a real sense runners are what they *don't* eat.

- **Digestive Troubles.** Any stomach or intestinal pain that interferes with free running indicates a dietary problem—usually correctable by adjusting amounts or types of foods.

- **Water-Salt Balance.** Draining the body's fluid-electrolyte reserves leads to all sorts of complications. Long runs in hot weather require special attention to drinking habits.

- **Pre-Race Diet.** Scientific studies have revealed that changing food intake the week prior to distance races can benefit performance by increasing energy reserves.

These four factors should concern every runner, regardless of his dietary leanings.

Chapter One

An Experiment of One

TO EAT OR NOT TO EAT

BY IAN JACKSON

At age 37, Meinrad Nagele was overweight and out of shape. At age 46, he ran a 2:29 marathon, finishing fourth in the World Veterans championship. After that race, Meinrad wrote, "The vast improvement I attribute to endurance training carried out consistently over a period of many years, together with a special diet (involving natural foods and fasting). This combination is the only method guaranteed to permit acquisition of the highest possible endurance potential."

Meinrad's endurance training method is described in the *Guide to Distance Running* article "LSD with a German Flavor." This is a report on the work of Dr. Ernst van Aaken, who has been doing research on aerobic training since the 1920s. When I read the article, I was following up on interests generated by my own startling improvements on long slow distance training. Of course my "success" as a runner is not in the same class as Nagele's. I gauge it more by the enjoyment I get in my daily runs than by competitive performances. Nevertheless, the results of endurance training came as a very pleasant surprise. Just for fun, I entered a marathon and managed to finish in 3:14. Nine months of easy, slow training later, I ran a comfortable 2:33. That really made a believer of me, and encouraged me to learn more about the method.

I knew from personal experience that endurance training worked. So when I read Meinrad's statement that a *combination* of endurance training and a special diet was required, I thought it would be well worth my while to look into the dietary angle.

I knew nothing about "natural foods and fasting." I had assumed that all foods were natural, and I connected fasting with Biblical characters and mystics. It seemed to me that a runner, with his high daily energy expenditure, needed to eat more rather than to abstain from food. After reading around, however, I learned that the kind of "special diet" Meinrad recommended was used by several first-class athletes.

- From *Faith, Love and Seaweed* by Ian Rose, I learned about the diet of Murray Rose—the author's son—who was a triple gold medal winner in the 1956 Olympics, and who repeated with a gold medal for 400 meters in 1960. Murray was a complete vegetarian, never having tasted meat, and he used occasional days of juice fasting as part of his training.

- From the same book, I learned that Herb Elliott—probably through the influence of Percy Cerutty—was also on a natural foods diet.

- I remembered that Amby Burfoot, winner of the 1968 Boston marathon, was a vegetarian.

- I read in the July 1970 edition of *Condition* that six of the top 10 finishers at the World Veterans marathon were vegetarians.

- I read in *Runner's World* that Erik Ostbye, a Swedish senior marathoner who has run close to 2:20, used fasting during the last few days before a big race.

• And, of course, I read the recommendations of Dr. van Aaken. (See Chapter Four.)

I agree that each runner is an "experiment-of-one" who, rather than blindly following the training schedules of champions, should constantly be testing and refining ways of reaching his own performance potential. After gaining confidence in natural foods and fasting through reading, I decided to expand my own experiment-of-one into the dietary field.

EXPERIMENTS IN FASTING

I tried fasting first, because it had the appeal of unfamiliarity. I had a light dinner, one evening, consumed nothing but water throughout the next day, and broke the fast following my morning run on the third day. In this fast, and in all subsequent fasts, I continued with the same training mileage I had been maintaining. But I was careful to run as efficiently as possible, to conserve energy. I went on a 36-hour fast once a week for four consecutive weeks. The last one was on the day before a marathon-distance run, as recommended by Dr. van Aaken.

For the most part, I felt better when fasting than I usually do when eating. I felt more alert, lighter on my feet, and more collected and calm than usual. The only unpleasantness was in occasional brief periods of weakness and barely noticeable headaches. These are said to be a sign that the fast is working—that the body is consuming its own non-essential tissues and, in the process, is flushing out toxic residues into the bloodstream. (For instance, when fatty tissues are consumed, the accumulated DDT residues re-enter the bloodstream, and you feel the symptoms of DDT poisoning until the blood has passed through the kidneys and the DDT has been filtered into the bladder for excretion.)

Luckily, these unpleasant periods are usually short, lasting only 15-30 minutes. The best thing to do is to lie down and rest until they pass. Authorities on fasting point out that healthy people have a far easier time than the sick or overweight, and my own experiences support these observations.

On the whole, I have found going without food to be a fascinating experience. It was amusing to compare the reactions of people I knew. Those who were aware that I was fasting would always greet me with worried comments about how "haggard" and "sickly" I looked. Others were completely different. They would make surprised remarks about how suddenly I had become "racing fit" and how "lean and strong" I looked.

After the cautious experimentation of the first 36-hour fasts, I decided to try a longer one. I had originally intended to go for 48 or 60 hours. But I felt so much better day after day that I kept extending the limit. Finally, after seven full days, I broke the fast. I wasn't having any difficulties, and as a matter of fact, I was really enjoying myself. I simply thought it would be wiser to wait until I had more experience before going to a longer fast.

Those seven days were such a remarkable experience that I think it worth citing some comments from my running log. (I keep the log by elapsed time—in parentheses—rather than distance. The pace on these runs ranged from under 6:00 per mile to about 7:30.)

March 15 (2:30)—"*...pulse 33 at rest (evening.)*"
March 16 (2:10)—"*...felt vaguely (very vaguely) headachy.*"

March 17 (2:30)– *"felt much stronger today than I did yesterday."*

March 18 (1:55)–*(I ran in a 20-mile March of Dimes walkathon with Rich Delgado. We went off course for an additional mile or so)... "I was amazed to hear Rich say that he thought we were well under a 2:30 marathon pace and that his legs were sore. I have fasted since Tuesday and yet the pace felt easy. I feel I could have picked up the pace over another six miles if I had been in a race."*

March 19 (2:35)–*"...felt all right during the run, but tired and sluggish afterwards."*

March 20 (2:00)– *"felt mildly fatigued today."*

March 21 (2:25)–*"...fast run. Felt apprehensive about energy level, but I had no problems and I felt strong."*

The last day's run was quite an experience. Although the pace got hot, it was absurdly easy to stay with it. I remember experiencing a sense of calm detachment. My body was moving effortlessly, gliding along with no urging. Everything was smooth, mellow and peaceful. My senses were incredibly heightened, finely tuned in. I felt a natural unity with the dark trees and the drifting mist. The sighing of the wind in the pines, the clear bird calls and the occasional creaking of branches seemed to penetrate gently into the very center of my being. With a combination of elation and gratitude, I let my body move on while my mind and my senses touched their home.

When we began the long climb out of the park, I had a momentary flash of apprehension. This was the acid test. Surely I wouldn't be able to handle the hills after seven days without food. But the hills presented no difficulties. My body was still gliding, still moving smoothly without any conscious urging. I seemed to be floating up the hills like a feather being wafted by gentled breezes.

Since then, I have had similar experiences on other fasts. As far as I'm concerned, they are reason enough to continue regular, moderate fasting. I don't know what they should be called. A psychologist would probably come up with something like "psycho-spiritual enhancement." I would call them pure awareness of joyful existence.

But I think that competitive performances could also be improved through fasting. I have often wondered what would have happened if I had been running a marathon on that seventh day of fasting. I have a feeling that I would have been capable of a very good time since I seemed to have unlimited speed and endurance.

Notice that I said "seemed" I have to emphasize that. I am not an expert on fasting, nor on the natural foods diet for that matter. Anyone who is interested can soon learn as much as I know simply by reading the books listed at the end of this article and by trying some of these things himself.

HOW AND WHY FASTING WORKS

I'm sure there is a lot of controversy about the theoretical grounds of fasting and natural foods, just as there is about training theories. But why should we runners wait for a resolution of theoretical matters? We don't need to. A little personal experimentation is worth far more than volumes of theoretical discussions.

I asked Meinrad Nagele a questions about a controversial aspect of vegetarian diet. He gave me a wry smile and said, "Who knows? Diet is a battlefield." He's absolutely right. Nutrition is such a young science and so full of uncertainties that we'll get no where if we want to wait for absolute scientific validation of dietary practices. But what's to stop us from trying a few unconventional approaches? Certainly no harm can come from eating natural foods. And—provided you inform yourself about fasting and try it cautiously —no harm can come from it, either. I'm sure that my own experiences aren't unusual, and that anyone making the same dietary experiments will find out that running is easier this way.

I haven't been able to find an explanation of why running becomes easier with fasting. But I can think of two possible answers.

1. The first is obvious. When you lose weight, your power-to-weight ratio improves, and you can maintain a faster average pace. Not only do you save the work of carrying unnecessary tissues. You also conserve the oxygen that would otherwise have been used to supply them. For these reasons, Dr. van Aaken has been recommending weight loss for many years.

2. The second answer is not so obvious. It involves the reduction of internal "friction." I am not qualified to judge its scientific validity, but it sounds plausible.

Running efficiency is based ultimately on metabolic efficiency, which involves the processing of raw materials (air, water, food) to produce energy. As by-products of the metabolic processes, many waste materials are formed. If everything is in order, the waste materials are eliminated through sweat, urine, feces and exhaled air. But if metabolism is inefficient, residual wastes-can accumulate in the cells and tissues, and create obstructions by their presence. For instance, uric acid—a waste produce caused by excessive protein consumption—can form a crystalline structure that lodges in the tissues. Some other undesirable accumulations are carbonic acid, cholesterol, chlorine and calcium carbonate. Most of these waste products are found in the connective tissues. But they can also end up in organs, glands and nerve coverings. German physicians have termed these products *Zellenschlacken,* or "cell cinders."

Now consider the bloodstream, the medium through which the metabolic process is carried out. It transports nutritive elements and oxygen to the cells, and carries waste products—including carbon dioxide—to the organs of elimination (the lungs, the bowels, the kidneys and the skin). Blood does not actually enter into the cells, but makes the exchange through osmosis—permeation through the porous cell membranes. If the cell membranes are partially blocked by waste products (e.g., cholesterol), osmosis is rendered inefficient and consequently metabolism is too. Inefficient metabolism affects all body functions, including running.

During a fast, the body must consume its own tissues to provide energy. This self-consumption is known as "autolysis." It is amazingly precise in the selection of tissues, consuming them in the reverse order of importance. Fat tissues, tumors and accumulated residual wastes are first to go. What cannot be used for energy is flushed out of the body, primarily through the urine. The more internal obstructions flushed out, the greater the reduction of internal "friction," and the greater the improvement in metabolic efficiency. With improved metabolic efficiency, a runner is capable of coming closer to his performance potential.

Once the internal cleansing has been started through regular, moderate fasting, it should be helped along by the avoidance of dietary habits which tend to produce more residual wastes. And this is where natural foods come in.

WAERLAND NATURAL FOODS DIET

Natural foods are simply foods that have not been tampered with in any way—that have not been refined or processed, that have not been adulterated by the addition of artificial flavors and colors, or chemical preservatives. The natural foods diet involves fresh fruits and vegetables, whole grains, nuts and seeds, raw milk products and raw honey.

I must admit that I made many mistakes when I began the transition to natural foods. Fresh fruit sounded appetizing, and so did raw honey and things made with it. But vegetables didn't appeal to me at all. I started living on fruit, honey ice cream, carob bars, halvah and honeycomb. I ate haphazardly, and I ate too much.. Pretty soon I realized that I didn't feel any better than before, except when I was fasting. When I was eating, I felt bloated and sluggish. I was about to give up the natural foods idea when I had the good fortune to meet Meinrad Nagele, whose comment about a special diet had originally sparked my interest.

We talked extensively on training and diet, and I came to recognize my mistakes. His special diet is the "Waerland" diet, which is famous in Europe but almost unknown in the United States. He told me that Erik Ostbye was on the diet, too. I learned that it is not enough to eat a few good foods. You must be sure that there is enough variety to provide balanced nutrition. The Waerland diet has proved its effectiveness with thousands of Europeans over the past few decades. There is no need to worry about missing some nutritive element if you follow its pattern carefully.

The diet was developed over 20 years ago by Are Waerland, an unusually energetic, brilliant scholar of Swedish descent. The diet itself is only a part of a biologically correct system of living which includes plenty of fresh air, sunshine and aerobic exercise. It involves avoiding all table salt and cooking salt (there is plenty of the right kind of salt in vegetables), also coffee, strong tea, meat, fish, eggs (the last three provide a culture medium for putrefactive bacteria), drinking at meals, very hot drinks, tobacco, alcohol, sweets, chocolate, white bread and cakes made of white flour.

Breakfast—Since the body is eliminating waste products up to about noon, the breakfast is a light, easily digested meal of fresh fruit and sour milk. This goes against the current emphasis on eating heavy, high-protein breakfasts, but my own experience tells me that the light breakfast is a wiser practice. I usually run before breakfast, sometimes in the 20-30 mile range. And yet a light fruit breakfast gives me far more energy than the high-protein breakfasts I used to eat.

Lunch is a whole-grain cereal called "Kruska." The whole grains (wheat, barley, rye, oats and millet) are ground up immediately before cooking in order to preserve the nutritive elements. Exposre to air destroys the enzymes and plant hormones.

(Incidentally, the Waerland diet is surprisingly inexpensive. It costs far less than a conventional diet. Whole grains, for instance, cost only 8-12 cents a pound. Any whole food is usually cheaper than a refined, processed and packaged food. The reason is obvious. The more the food is handled, the more it will cost because the processors must make a profit. Ironically, the expensive, processed foods are also inferior nutritionally. You end up paying more for less food value.)

Dinner—The Waerland dinner is based on potatoes, baked or boiled in their skins, mashed and with raw beets and carrots grated over them. In addition, there is a large helping of salad greens and sour milk. Everything except for the cereals and the potatoes is eaten raw, because all processing—including cooking—reduces nutritive value.

When I first saw what the diet involved, I groaned inwardly. Except for the fruit breakfast, it seemed bland and unappetizing. Now, I'm surprised how much I look forward to each and every meal. Perhaps my taste buds have been somehow sensitized by cutting out all foods with chemical additives. For the first time in my life, I find that I really relish vegetables.

TRY IT—YOU'LL LIKE IT

The diet is so simple, appetizing, inexpensive and health-building that I think it worthy of the attention of all runners. If Hans Selye is right about the effects of stress, anything that reduces stress will enable a runner to take training and racing with less chance of breakdown. The Waerland diet reduces the stress of internal waste products. I have no idea of the racing improvement to be expected. But I'm sure that increased biologic strength must make a difference, if only indirectly by improving stress tolereance so that a heavier training load can be handled without fear of stress injuries.

I encourage you to give it a try, and I'd like to hear about your experiences. If you notice a significant improvement, or if you feel worse on the diet, please let me know (write to me at *Runner's World*). Only by experimentation will we be able to find out if diet is a factor in running performance. If the ideas I have presented here are worthless, let's prove them so by exposing their ineffectiveness. But don't condemn them before you've looked into them. If you venture to expand your experiment of one to include diet, you can only gain. No matter what results you get, you'll be more aware of your own needs and your approach to running will be more comprehensive, more intelligent.

We runners have all had plenty of the petty persecution from the unenlightened. We have all endured sneers and catcalls during our training runs. Surely we can put up with a little ridicule about "food fanaticism," too. You already know that the cat-callers have no idea what they're missing in running. I think you'll find the same thing when you try natural foods and fasting.

RECOMMENDED READING (all in paperback)

1. *Health Secrets from Europe,* Paavo Airola, Arc Books.
2. *Rebuilding Health,* Ebba Waerland, Arc Books.
3. *Faith, Love and Seaweed,* Ian Rose, Award Books.
4. *Fasting Can Save Your Life,* Herbert Shelton, Natural Hygiene Press, Inc.
5. *Food Combining Made Easy,* Herbert Shelton, Natural Hygiene Press, Inc.

Chapter Two

Ingredients of Fitness

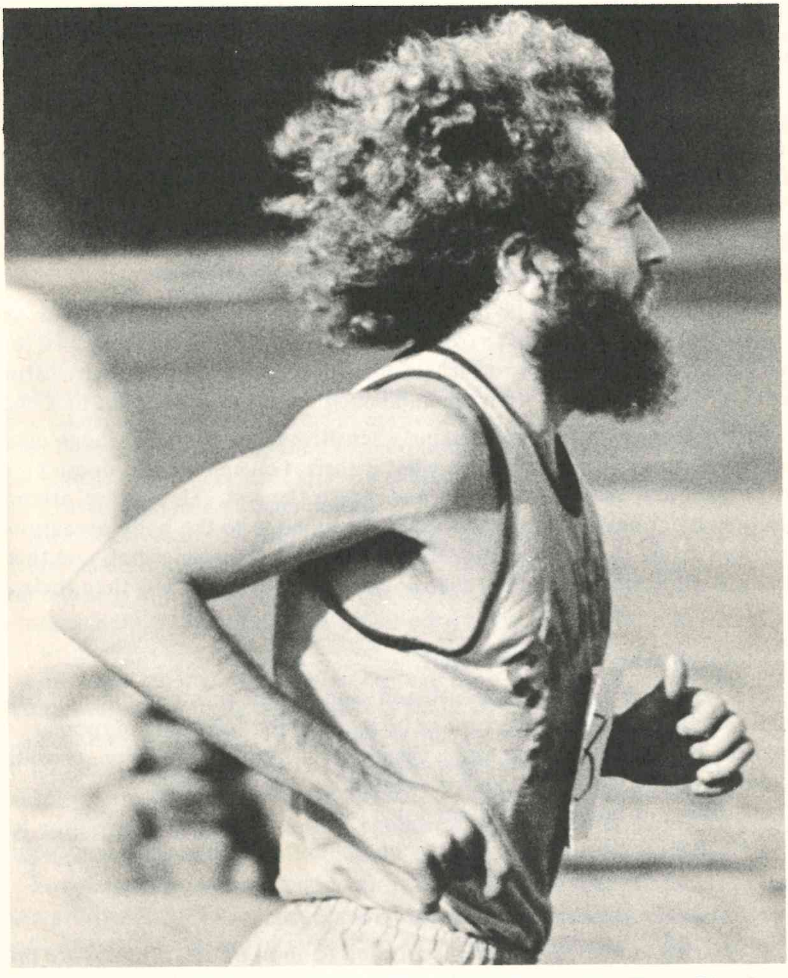

Photo by Don Chadez

• **Vitamins**—crucial forces in the body's regulation and growth systems. Key vitamins for runners are A, C, E and the B-complex group (thiamin, riboflavin, niacin, etc.).

• **Water**—growth and control factor.

Water, carbohydrates, fats and proteins are by far the most abundant substances in food. Most foods are combinations of these four. Minerals and vitamins are present in only tiny amounts—so small, in fact, that some of them have just recently been identified.

Humans need all of these nutrients, and more, in certain minimum quantities to sustain healthy life.

CALORIES AND WEIGHT

Total intake is measured in calories. Scientifically speaking, a calorie is "the amount of heat required to raise the temperature of one kilogram of water one degree centigrade." Nutritionally speaking, calories are the currency one must take in and save to gain weight, or avoid and spend to lose it.

A pound of body weight contains about 3500 calories of energy. To gain a pound, one must take in and store that much. To lose a pound, the reverse is true—get rid of what is stored.

All activities burn up calories. Even sitting in a rocking chair reading the newspaper uses them at the rate of about a quarter of a calorie per pound per hour. Moderate exercise, such as working in the garden, uses about a half-calorie per pound per hour. "Severe" exercise, one physiology textbook says, consumes one full calorie per pound per hour—or more.

Running is even more "severe" than this textbook indicates. Researchers have found that a long distance runner uses calories at the rate of perhaps 1000 an hour (more than five per pound). Sprinters burn 10 times that much, but only for brief periods. While they're exercising, then, runners are among the biggest calorie consumers. But still, on running alone, it takes as much as 35 miles of running to lose a single pound.

All carbohydrate, fat and protein foods contain calories; water, minerals and vitamins do not. For moderately active mature adults, the recommended caloric intake is about 18 per pound per day for men, and about 16 for women. This totals about 2700 per day for a 150-pound man, and 2000 a day for a 125-pound woman.

Obviously, though, daily calorie intake can't be reduced to a formula that applies to everyone. Each individual has to make himself what Dr. George Sheehan calls "an experiment of one." Determine your own needs.

Weight is the best guide. Decide the weight at which you run best, then try to get up or down to it, then maintain it. It's as simple as balancing caloric intake with energy expenditure. It's simple *on paper*, that is. In practice, this isn't so easy.

Low weight is unquestionably an advantage in running. Eating isn't like filling a grocery bag. The excess food we put in ourselves doesn't fall out on the ground. It stays in storage to be carried along as an extra load. The general populace eats and weighs too much. Surprisingly, within the context of their exercise, many runners eat and weigh too much, too.

Dr. Irwin Stillman, author of *The Doctor's Quick Weight Loss Diet*, has devised the best formula yet for figuring weight. Runners can use it to check

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Men use 110 pounds and five feet as a base; for each inch over five feet, add 5½ pounds. This gives an "average" weight for a man's height. Stillman says the "ideal" figure would be about 10% less. For instance, an average 6'0" man would weigh 170 pounds; his ideal weight would be 151-152. For women, the base figures are 100 pounds and five feet; add *five* pounds for each additional inch. The rest of the calculations are the same.

Runners in the sprints tend to be somewhere between the "average" and "ideal" levels, and the middle and long distance athletes usually are even lighter than the ideal. If weight is above average, some caloric balancing apparently needs to be done. (More on this in a later chapter.)

Proper eating is more subtle, however, than simply shoveling in the food at hand until you can hold no more. There are a number of other factors to consider. Total food intake is one among many.

RECOMMENDED DAILY ALLOWANCES (RDA)

Nutrition is a relatively new science, still in a shifting state. This much is evident from looking at the US national dietary recommendations.

Before 1943, there weren't any recognized ones. Then that year the Food and Nutrition Board of the National Academy of Sciences began publishing its "recommended daily allowances" for calories, proteins, vitamins and minerals.

The present recommendations don't much resemble the original ones. That's because the RDAs have been reviewed constantly since 1943, with revisions to the list published every five years. In theory, each revision is an improvement.

The 1968 figures are the latest ones released by the Food and Nutrition Board. See the accompanying chart. The recommendations are not minimums, maximums, or absolutes. They are merely guidelines or averages, which if followed provide adequate nutrition—and then some.

According to the Board, they "afford a margin sufficiently above average physiological requirements to cover variations among practically all individuals in the general population. The allowances provide a buffer against increased needs during common stresses and permit full realization of growth and productive potential. But they are not necessarily adequate to meet the additional requirements of persons depleted by disease, traumatic stress or prior dietary inadequacies."

In other words, these are educated guesses based on an elusive "average, healthy" person. What about the runner, who is somewhat abnormal in his activity and may at one time be both unhealthy and super-healthy? The answer here isn't so clear, and is the source of much of the controversy surrounding the feeding of athletes.

The question of whether or not athletes need special diets because of their special stresses hasn't been fully explored scientifically, and so as yet is far from fully answered. We have some clues later in the booklet.

For now, here are the conventional recommendations. (See next page.) Runners won't stray far from them.

(Three substances—two vitamins and a mineral—aren't listed on the chart, but have established RDAs. Through age 22, the RDA for Vitamin D is 400 milligrams; no amount is listed for higher ages. The folic acid or folacin re-

RECOMMENDED DAILY ALLOWANCES

MEN'S CHART

Ages	Calories (no.)	Protein (gms.)	Vit. A (I.U.)	Vit. E (I.U.)	Vit. C (mg.)	Niacin (mg.)	R'flavin (mg.)	Thiamin (mg.)	Vit. B6 (mg.)	Vit. B12 (mg.)	Calcium (mg.)	Phos. (mg.)	Iron (mg.)	Mag. (mg.)
6-8	2000	35	3500	15	40	13	1.1	1.0	1.0	4	900	10		
6-8	2000	35	3500	15	40	13	1.1	1.0	1.0	4	900	900	10	250
8-10	2200	40	3500	15	40	15	1.2	1.1	1.2	5	1000	1000	10	250
10-12	2500	45	4500	20	40	17	1.3	1.3	1.4	5	1200	1200	10	300
12-14	2700	50	5000	20	45	18	1.4	1.4	1.6	5	1400	1400	18	350
14-18	3000	60	5000	25	55	20	1.5	1.5	1.8	5	1400	1400	18	400
18-22	2800	60	5000	30	60	18	1.6	1.4	2.0	5	800	800	10	400
22-35	2800	65	5000	30	60	18	1.7	1.4	2.0	5	800	800	10	350
35-55	2600	65	5000	30	60	17	1.7	1.3	2.0	5	800	800	10	350
55-75+	2400	65	5000	30	60	14	1.7	1.2	2.0	6	800	800	10	350

WOMEN'S CHART

Ages	Calories (no.)	Protein (gms.)	Vit. A (I.U.)	Vit. E (I.U.)	Vit. C (mg.)	Niacin (mg.)	R'flavin (mg.)	Thiamin (mg.)	Vit. B6 (mg.)	Vit. B12 (mg.)	Calcium (mg.)	Phos. (mg.)	Iron (mg.)	Mag. (mg.)
6-8	2000	35	3500	15	40	13	1.1	1.0	1.0	4	900	900	10	250
8-10	2200	40	3500	15	40	15	1.2	1.1	1.2	5	1000	1000	10	250
10-12	2500	50	4500	20	40	15	1.3	1.1	1.4	5	1200	1200	18	300
12-14	2300	50	5000	20	45	15	1.4	1.2	1.6	5	1300	1300	18	350
14-16	2400	55	5000	25	50	16	1.4	1.2	1.8	5	1300	1300	18	350
16-18	2300	55	5000	25	50	15	1.5	1,2	2.0	5	1300	1300	18	350
18-22	2000	55	5000	25	55	13	1.5	1.0	2.0	5	800	800	18	350
22-35	2000	55	5000	25	55	13	1.5	1.0	2.0	5	800	800	18	300
35-55	1850	55	5000	25	55	13	1.5	1.0	2.0	5	800	800	18	300
55-75+	1700	55	5000	25	55	13	1.5	1.0	2.0	6	800	800	10	300

quirement is about 0.4 milligrams per day. The iodine recommendation varies with age from 80 to 150 milligrams.)

ESSENTIAL NUTRIENTS

To review, the six main elements of the diet are carbohydrates, fats, proteins, minerals, vitamins and water. They're present, in varying degrees and combinations, in foods and drinks. Here we'll talk briefly about what they do and where they're found.

Carbohydrates—These are the high-energy foods, primarily the sugars and starches. Their energy characteristics give them utmost importance in the running context. In relatively short, fast bursts of energy, carbohydrate products are the main fuel because they can be used quickly and efficiently. When carbohydrates break down they wind up as glycogen—a substance stored in limited amounts in the liver and muscles. Glycogen burns vigorously during exercise, but since the supply is limited it may run out before the run does. Loading the diet with carbohydrates can increase the glycogen supply to a certain extent. Almost all foods have proportionately more carbohydrates than fats or proteins. Sugars and cereal grains are the most common sources.

Fats—Because of the connection with obesity, fats have gotten a bad name. In fact, they're the best source of energy that the body has, being more concentrated than carbohydrates. However, during heavy exercise fats break down slower than the carbohydrates. In high stress situations, fats simply aren't as efficient. Animal fats and vegetable oils are the richest sources of this essential nutrient.

Proteins—They are the body-builders, helping bones and tissues grow and repair themselves. The body needs a considerable amount of protein to keep operating well. According to the Food and Nutrition Board, an adult needs 0.9 gram a day per kilogram of body weight (this translates to 0.33 gram per pound). These complex substances are available in a number of forms. The most obvious is meat, which contains high quality, concentrated protein. The best meats are beef, chicken, haddock, pork chops, liver and salmon. However, protein needs can be met entirely without eating meats (as a number of vegetarians illustrate later in this booklet). Eggs, dairy products, nuts, beans and peas, grains and cereals, are good protein sources.

Minerals—To the runner, the most important ones are those which strongly influence his muscular action and his oxygen consumption. The muscle-related ones are calcium, phosphorus, sodium, potassium and magnesium. Iron is invaluable in oxygen transport.

Calcium—working together with phosphorus—promotes normal action of the heart muscle and helps it maintain a rhythmic beat. Dairy products, oranges and eggs are rich in calcium.

Phosphorus becomes a chemical compound that helps the body release energy. It is found in dairy products, lean meats and fish, eggs and whole-grain cereals.

Sodium and *potassium* have the overlapping functions of maintaining the body's fluid balance and transmitting muscle impulses. Most foods contain sodium naturally. Citrus fruits are rich in potassium.

Magnesium acts as a transmitter of nerve impulses and as a trigger for muscle contractions. Without it, there are muscle tremors and cramps. Vegetables, cereal grains and nuts are good sources.

Iron is important to the red blood cells, which carry oxygen; when iron supplies are short, anemia (with a generalized feeling of weakness) results. Organ meats (such as liver), dried fruits, dark green vegetables and eggs provide iron.

Vitamins—The ones that interest runners the most are E (which influences heart action and endurance), C (which builds resistance and speeds healing) and the B-complex (which promote energy metabolism). Others with established daily recommendations are A (important to eyesight, growth and resistance) and D (valuable to the bone structure).

Vitamin E is found naturally in vegetable oils like wheat germ oil.

Vitamin C (also called ascorbic acid) is present in citrus fruits, broccoli, and selected other fruits and vegetables.

Of the B-complex, *thiamin* (a catalyst in the oxidation of glucose) comes in greatest supply from pork chops, ham, peas, beans, liver rice and oatmeal; *riboflavin* (involved in both protein and energy metabolism)—liver, meats, milk and whole grains; *niacin* (mental and physical resistance)—milk, eggs, meats, nuts.

Yellow and greenvegetables provide *Vitamin A.*

Fish liver oils and fortified milk give adequate *Vitamin D.*

Water—Since the body is mostly water, it needs a considerable fresh supply each day just to maintain its essential balance and to carry on its functions normally. With water, unlike food, there is little danger of taking too much. Excess food is stored in the form of fat. The kidneys simply flush out excess water.

DIET BALANCING

The Recommended Daily Allowances, taken as a group, make such a mass of figures that it almost takes a slide rule to be sure of meeting all the needs. There's a simpler way to do it, however, than counting every gram, milligram and international unit.

The simplified method is the "Basic Four" chart that children learn in school and promptly forget. If followed carefully, it should fill most of the needs.

The Basic Four chart lumps foods into groups: (1) milk group; (2) meat group; (3) vegetable-fruit group; (4) bread-cereals group. The daily recommendations below are based on standard US eating habits.

- **Milk Group**—2-3 glasses of milk for children under 9; children 9-12—three or more glasses; teenagers—four or more glasses; adults—two or more glasses. (Cheese, ice cream and other milk-made foods can supply part of the milk.)

- **Meat Group**—two or three three-ounce servings (eggs, cheese, beans, peas, lentils, nuts may be substituted).

- **Vegetable-Fruit Group**—four or more half-cup servings; group includes dark green or deep yellow vegetables; citrus fruits, potatoes, other fruits and vegetables.

- **Bread-Cereals Group**—four or more servings, preferably whole grains.

Fats, sweets and flavorings may be added within the limits of individual calorie needs and tastes. However, it is preferable to fill all needs from the basic four.

These four provide every essential nutrient. If these foods are eaten regularly, in proper amounts and following proper preparation, there is no need for anything more. Manufactured vitamin and mineral supplements offer nothing that isn't available naturally in foods. And natural foods are the most pleasant way to get your nutrition–if not the cheapest and most effective.

RUNNERS' SPECIAL NEEDS

The runner works harder than the average person, and he does his work in fairly violent bursts lasting from a few seconds to a few hours. While he's working this way, the demands on his muscular, energy and fluid systems are quite high–higher than normal, anyway. To meet these demands, runners need diets that strike three delicate balances:

- Maintaining energy for a higher than normal output...without so much food that excess is stored as fat.

- Maintaining the muscle bulk and strength needed for the higher-than-normal muscular work of the event...without sacrificing instant energy.

- Maintaining enough liquid to preserve the body's fluid balance...and replacing lost liquids with minerals as well as water.

Performance *can* be improved–often dramatically–with dietary control. We have the scientific studies and personal experiences here to prove it. The three main ways are (1) by adjusting the ratio between carbohydrate and fatty foods vs. proteins; (2) by drinking mineral-loaded liquids immediately before, during and after hard runs; and (3) by taking heavy doses of certain vitamins.

1. Recent scientific evidence shows two things: (a) Heavy carbohydrate intake (with a corresponding reduction in fats and proteins) before competition greatly improves distance running performance; simply stated, that's because carbohydrates are most rapidly converted to usable energy. (b) Runners apparently need no more protein than do non-runners. Some researchers suggest that they need *less* than the customary amount. (The latest Recommended Daily Allowances call for 25% less protein than previously listed.)

2. Minerals play a key part in warding off muscle fatigue and cramping. Recognizing this fact, manufacturers have produced a number of "electrolyte replacement drinks" in recent years. They generally contain sodium chloride, calcium and potassium. Recent research points out that sodium chloride (ordinary table salt) may be less important than previously imagined, and that potassium and magnesium losses are the most crucial to the runner. At any rate, runners report significant improvements in distance times after taking water-electrolyte-sugar drinks during races. The drink that best synthesizes the runner's sweat seems to produce the best results.

3. The so-called "mega-vitamins" approach to athletic diet is still subject to a great deal of controversy. This is the habit of gobbling vitamin tablets at rates 10 or more times above the Recommended Daily Allowances. The value and wisdom of this practice are still in the speculative stages. But there is a certain amount of test data suggesting that big doses of Vitamin E and Vitamin C are worthwhile. Vitamin E is said to affect the heart function and en-

durance. Vitamin C apparently provides protection against illness and injury, and speeds recovery.

The claims that added carbohydrates, minerals and vitamins benefit the runner have some truth to them. The danger, though, is taking the attitude that "if X amount is good for me, double-X must then be twice as good." That kind of logic doesn't stand up. The task of the exercise physiologist—as well as the exercising runner—is to find out just what that perfect X is.

TOO MUCH OF NOTHING

BY OTTO BRUCKER, M. D.
(Reprinted from "Condition" Magazine of West Germany)

Anyone who enters athletics announces indirectly that he is not interested in neglecting his body. The athlete is attempting to maximize performance, and he realizes that any disturbance in the physical system will hinder him. His body's complicated metabolic system has to operate at best efficiency, and a basic condition for this is fulfilling nutritional needs.

However, the growing number of nutritionally caused diseases and the high percentage of people afflicted indicates that the basic nutritional needs of the society are not being adequately met.

What is especially dangerous for the athlete is the wide-spread concept that he can prevent these diseases simply by exercising. This is not to say exercise is not important in the maintenance of health. But the athlete should keep the following firmly in mind: A man can stay healthy with proper nutrition but without sufficient movement; he *cannot* remain healthy on any amount of exercise if essential nutritional elements are lacking.

The ravishes of modern nutrition cannot be prevented or softened by any kind of athletic activity. Despite the obvious physical benefits of exercise, it is clear that this activity cannot make up for the lack of essential metabolic substances. The reverse is more often the case. The more intense the physical movement, the more necessary is a sufficient supply of vital substances.

Just what constitutes a "sufficient supply of vital substances" is still open to some question. But a new body of nutritional research is currently replacing (or at least modifying) conventional medical thinking on this subject. Since these new findings have long since passed the stage of theory and have the test of practical application behind them, it seems negligent to continue quoting older nutritional theses. The most important matters in this "new nutrition" only become clear when contrasted with old theories (which, though outdated, still influence thinking today).

Old nutritional theory assumed that a supply of the three basic nutritional elements—protein, fat and carbohydrates—along with certain minerals was sufficient for health. These were supposed to give 2000-4000 calories a day. This measurement in terms of the caloric content of the three basic elements is a mark of old nutrition. Not even the discovery of vitamins changed anything important in this basic principle. Vitamins merely were added to the existing list of recommendations.

New nutritionists have discovered, however, that the three basic substances, certain minerals,and the classic vitamins are in no way enough to maintain health and performance capacity. Countless other substances are required. They call them "vital substances." These include not only the generally recognized vitamins and minerals, but also minerals present in the tiniest amounts (called "trace elements"), a large group of enzymes, polyunsaturated fatty acids and aromatic substances. Some of these are necessary for good health; others must be present for life itself to go on.

The common cause of performance lags and nutritionally associated diseases of civilization lies in the incorrect concepts of older nutritional theory. This is expressed as an over-emphasis on nutritional concentrates (isolated elements in the diet) and underestimation of total nutritional needs.

Injury to health comes mainly from manufactured nutritional products. These are marked by a lack of vital substances that are essential to health. The more concentrated the substance is, the fewer vital elements it will contain and the more harmful it will be to health.

In old nutritional theory, the worth of a diet was measured by its caloric content. In the new order of things, nutrition is based on the diet's vitality. The more food is left to nature, the more alive it is; the less natural, the less life-like. The scale extends from completely lifeless industrial preparations such as white sugar, to conserved and heated nutrients, to foods in their natural state.

Nutritional researcher Kollath set up a scientifically exact order of preference in his book *The Order of Our Nutrition.* In descending order of vitality: (1) completely natural; (2) fermentatively altered; (3) mechanically altered; (4) heated; (5) conserved; (6) prepared (artificially concentrated nutrients).

The two main representatives of isolated nutritional concentrates with insufficient vital substances are (1) *white sugar,* and (2) *refined flours.* Their danger is considerably greater than is generally recognized, and is based on the following three points:

- *They are practically void of vital substances.*
- *They are eaten daily in large amounts by modern man.*
- *Their harmfulness is still unknown by most people.*

The growing number of industrially altered fats also is contributing to ill health. These include margarines and oil products produced by chemical processes. Other manufactured dietary items play smaller roles because of their low consumption.

Nutrients that contain no vital substances can be called "dead foods." In this sense, Kollath distinguishes between food and nutritional "preparations." He says these preparations can no longer be considered food because they lack certain essential elements necessary to support life and health. Food is alive because it contains all substances necessary for life and health.

The "industrial" sugars cause a chain reaction of harm, Not only do they lack vital substances; they also act as vitamin thieves because they require vitamins (particularly B-vitamins) for their digestion. In addition, these sugars interefre with some enzmye activity.

It is misleading to say that eating isolated sugars increases energy. In fact, it *requires* great energy just to assimilate these products. Eating these sugars drains away vital substances while adding none, it disturbs enzyme functions, and in the end increases strength and energy levels not at all.

Eating isolated sugars is damaging in yet another way—because of their quick assimilation. Pure sugar, especially dextrose (glucose), passes quickly through the intestinal walls into the bloodstream. This is dangerously protrayed as advantageous and desirable, based on old nutritional theory. In truth, it has a negative effect. The immediate rise in blood-sugar level is followed by a dramatic drop to levels below the norm. (This is called a "hypoglycemia" state.) If the athlete tries to boost this back up with further sugar intake, he creates an even greater imbalance in his blood-sugar level.

Athletes should keep in mind that proper metabolism can take place *only* when all the necessary vital substances are delivered, in balanced relationships. This is true of sugar consumption, and also in eating grain products.

Kollath was one of those responsible for the discovery of vital substances. He first succeeded in causing diseases in animals by witholding certain of these nutrients.

Czech scientist Bernasek has gone further with Kollath's experiments. Bernasek has shown that a still larger number of unidentified vitamins exist. He fed rats a purely synthetic diet that contained all previously known vital substances necessary for maintaining life and heatlh. Diseases nevertheless occurred.

The most remarkable part of these experiments was that pathological changes in organs were found in the first generation only to a limited degree. But they appeared more and more acutely from generation to generation. Beyond the fifth generation, there was no further reproduction.

An equally important result of these tests was that all the damage was preventable by feeding whole grains.

These observations have a further striking parallel in human beings, who are now in the third and fourth generation of *not* eating whole grain products. The diets resemble those of the rat insofar as carbohydrates consist predominately of pure starch and sugar preparations; fats are made up of margarines and chemically extracted oils, and proteins are denatured by heating processes. The "inexplicable" degenerative phenomena in man—especially in the nervous system—have a striking similarity to the pathological findings in rats during Bernasek's experiments.

New Nutritionists have uncovered a number of other important facts of great practical significance. The two leading ones are:

- *Vegetable proteins are just as valuable as animal proteins.*
- *Heating contributes to the destruction of proteins.*

Researchers Kollath and Bernasek also made key discoveries in the protein area. When protein substances were heated to a maximum of 34 degrees (C), the laboratory rats lived normally. But when the heat was doubled, they died.

By purely chemical analysis, the proteins still appeared to have the same properties. Yet in biological tests, the heated substance would no longer support life. The conclusion was that man couldn't obtain optimal protein supply from thoroughly-cooked muscle meats—as was previously taught—but that uncooked vegetable nutrients supplemented with whole grains and cereals can do this. (Milk proteins likewise suffer decisive damage from cooking and pasteurization processes.)

To summarize, it is clear that there is no important difference between the diet necessary for optimal health and the diet necessary for best performance in athletics. Although it is not possible in this short article to give details of a modern full-value diet, I can list general guidelines.

- The diet should consist, as much as possible, only of full-valued foods.

I advise complete avoidance of manufactured nutrients. This means renouncing refined flour and sugar, and chemically-extracted fats.

- Take fruits and vegetables in raw form. The greater the share of raw products, the greater will be a person's performance capacity.
- Fill the protein needs with nuts, soy beans, whole grains and cereals, without relying on muscle meats.
- Drink only raw (unpasteurized) milk.
- Use only butter, cream and cold-pressed oils to fill fat needs.

It is important to recognize that health and performance capacity rest on several pillars. No single one contributes sufficiently without the others. Mastery of life's problems through harmony in the mental-spiritual realm is just as meaningful as whole-value, natural nutrition, sufficient physical movement and abstention from enjoyable poisons. Only by a meaningful union of all factors can a person truly live.

THE RETURN TO NATURE

Nutritional theory seems to be moving backwards. Which is another way of saying, "The more things change, the more they become the same."

"New" nutritional thinking–all the talk about natural foods–isn't new at all. For only a heartbeat in the span of time has man been eating prepared and preserved, refined and rejuvenated foods. Only a few decades of this kind of eating has convinced many nutritionists that this is the wrong way to go–that man must get back to simpler, fresher food sources or pay a high penalty.

Food dies. Every step it moves up the preparation ladder, away from its fresh and raw roots, it surrenders a bit of its life–giving value until finally it is empty and dead. Eating empty, dead food is worse than useless, according to new nutritionists such as Dr. Brucker.

Brucker basically reflects the thinking of Are Waerland, a Swede of Finnish birth who popularized the Waerland dietary system in Europe. His methods center on eating foods as close to their natural state as possible. (See Ian Jackson's article in details on the Waerland system.)

European runners follow the Waerland program in fairly large numbers. Some have had notable success, particularly in being able to run well year after year–in the best of physical health.

Erik Ostbye, a Swede, is now over 50 years old. He still runs the marathon under 2:30, and is one of his country's leading runners a dozen years after winning his first national championship. In 1943, Ostbye was suffering from a severe intestinal disorder. A switch to the Waerland diet cured him. He has stayed with this dietary plan–with a few individual variations–to this day. Diet is the decisive factor in his running, he says. He doesn't think a person on a "normal" diet could accomplish the things he does after more than two decades of hard training.

The case of John Systad, a Norwegian, is similar. Though Systad was never as good a marathoner as Ostbye, he labored against greater handicaps. Systad suffered with asthma as a child. When he was 12 years old, a severe inflammation in both lungs and an extremely high fever threatened his life. He pulled through, but with a drastically reduced breathing capacity that weakened him generally.

Systad's mother switched him to a raw-foods diet. As he got stronger, he added long hikes, sun baths and fasting to his health building routine.

By the time he was 18, Systad was strong enough to compete in 30-kilometer walks. Then, after World War II, he switched to distance running. He was already 34 years old when he started. Systad eventually won eight Norwegian championships–five in the marathon. The last victory came at age 43.

Systad became convinced that since fruit gave him great energy, it must be possible to live almost exclusively on fruit. He followed this basic diet:

Early morning–pure orange or grapefruit juice.

Breakfast–herb tea and sometimes an apple.

Mid-morning–fruit.

Evening–only "meal" of the day, consisting of many onions, a raw and a cooked potato and two slices of whole grain bread.

The Dutch marathon record holder, Aad Steylen, follows the same sort of diet—though less severe than Systad's. Steylen ran a 2:19 marathon several years ago, at the age of 33. "I am convinced," he says, "that through a particular kind of diet, combined with optimal training, one does remain in top form for many years longer without exhausting the body."

Steylen recalls his own dietary experience: "In 1961, I began to change my nutrition to a natural diet with raw vegetables, salads, rice, whole cereals, fruit. Then in 1963 I became a vegetarian. I now nourish myself with whole cereals, rice, raw vegetables, salads, fruit, potatoes, whole wheat, millet, various herbs, whole grain bread, curds, sour milk, nuts herb teas and cold-pressed vegetable oils (such as wheat germ oil, which I consider important for its vitamin E content).

"On the basis of this diet, combined with my training, I have been able to attain the best successes. My experiences showed me that one has a more consistent performance development through the season with this natural nutrition, and is protected against colds and related troubles. Since beginning this diet, I have had hardly any infectious diseases, tendon, cartilage, joint or muscle injuries. I trace this back to my natural diet, which provides the body with the necessary nutritional and building substances. Nutrients are supposed to give vital energy. They are just as important as training, and can be the foundation of health."

NEXT PAGE: Distance racers attempt to maintain an inner balance by taking liquids on the run. (Steve Sutton photo)


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INTERNAL DISTURBANCES

In the hair-splitting world of running, where good and bad performances are divided by seconds and tenth-seconds, the effects of sound nutrition are subtle. The worth of a beneficial diet can't be measured strictly by the stop-watch.

A runner can have an ideal diet and still not notice dramatic improvements in time. The body works that way. When it's working best, it's noticed least. It's said you don't really appreciate the water until the well runs dry. And you don't appreciate how important nutrition is until something goes wrong inside. The effects are dramatic. These you *can* measure.

The first two parts of this chapter centered on sound general nutrition. These factors have a rather indirect role in performance. By promoting good overall health, they create an environment in which runners can train to their maximum. But no matter how good their eating habits are, runners progress little without the training. The quantity and quality of running makes the differences of seconds and tenths.

Here, we're talking about the direct influence of diet. Unfortunately, it's usually a negative one. No matter how well the training has gone, dietary miscalculations can spoil everything.

Runners operate under physical and sometimes emotional stress. Dr. George Sheehan calls the runner "man at his maximum." Stress situations make runners peculiarly susceptible to diet-related irregulariteis that don't often strike people who operate on a lower plane.

Trouble pops up at the worst possible time. This is when stress is highest, which usually means when there's a race to run. The common symptoms are internal upsets which cause vomiting and/or diarrhea, and stomach or intestinal pains that mess up running rhythm.

There appear to be two main causes of severe internal distress:

- *Eating too much too soon before running.* Pre-race diet is such a ritual that it prompted Arthur Lydiard to observe, "The way runners eat before races, you'd think they were worried about dying of malnutrition after 50 meters." Dr. Ernst van Aaken, a German scientist and coach, says runners are wise not to eat *anything* before competition. According to him, the body is perfectly capable of "living off its own resources" during the race, and every ounce of food increases the system's burden. The system is already busy enough, van Aaken says, and extra food only increases the chance of trouble.

- *Eating the wrong foods at the wrong times.* Certain stomachs can't tolerate certain food groups, and they react violently to them—particularly in tense situations. Dr. Sheehan listed these foods in his booklet *Encyclopedia of Athletic Medicine.* Surprisingly, he started his list with two "perfect" foods: milk and bread (or more correctly, all grain products containing the substance gluten).

Other suspect foods are (1) the highly allergenic ones (chocolate, shellfish, strawberries, pork, melon, nuts, citrus fruits, egg white), which "cause stomach pains, diarrhea, bloating, rash, itching, headaches, nasal stuffiness, migrane headaches, etc." (2) Excessive roughage (raw fruit, raw vegetables, nuts, corn, beer, baked beans, cabbage, etc.); "cause gas, bloating, pain, thincigar-like stools in runners with spastic colons." (3) Coffee—"causes hyperacidity and stomach spasm in some people."

The problem with milk is that some people can't stand it—literally. Their bodies aren't equipped to handle it. Dr. Sheehan has written, "Milk, after the second decade of life is something most Greek Cypriots, Arabs, Ashkenazi Jews and American Negreos should shun. These people from traditional non-milking areas (and this includes among others the Bantu, Chinese, Thai, Greenland Eskimo and Peruvian Indian) can have bloating, gas and stomach pains, along with loud noises, after even the small amounts of milk used in cooking."

Dr. Theodore Bayless of Johns Hopkins University, an expert on the milk intolerance problem, says about 8% of Caucasians also have trouble handling milk. He says this is because they have a deficiency in the enzyme that digests lactose, a sugar in milk.

Sheehan adds that "most people with milk allergy do not drink milk anyway through some body intuition. If you have never been much of a milk drinker, I think you should accept this 'body wisdom' and seek the necessary protein, calcium and vitamins A and D in some other foods or supplements."

Bread and most other grain-based foods also present problems for some runners. Sheehan says, "Many men it appears cannot live by bread *at all,* much less alone." He gives the case study of one of his patients, a distance runner named Gary Berthiaume.

"Every time he entered a long, tough race," Dr. Sheehan writes, "he came down with severe stomach pain. Sometimes he would have diarrhea and blood as well. When not running and at all other times, he had little or no bowel complaints."

When Gary sought help from another doctor, he was told nothing was abnormal and that his difficulties stemmed from "too much stress during the race and too much nervousness anticipating it." Berthiaume already knew that. But telling a distance runner to avoid stress is like telling a swimmer not to get wet.

"Stress obviously played a part," Sheehan goes on. "He only developed symptoms after a hard run. But he was peculiarly susceptible to these abdominal complaints, and no one knew why... He had no known allergies, and even varying his pre-race meal didn't help. He continued to experience pain severe enough to double him up soon after the race was over. He finally reduced his pre-race feeding to bread and milk, but he still had trouble. There, as it turned out, lay the answer.

"Bread, or more specifically gluten—protein found in all grains except corn and rice—was his difficulty. In its full-blown state the inability to handle gluten is called 'sprue,' meaning chronic diarrhea. It now appears that some of us may have sprue. Most don't, but many, when placed under stress, can become symptomatic. When the rat-race pushes us too fast or too far, our bowels will let us know. Gluten is always there in our diet, in the bread and baked goods, in the cereals and cereal products, and hidden in soups and gravies, ice cream, wheat germ, mayonnaise and even beer and ale."

The ironic thing in this, Sheehan points out, is that milk and bread—long considered the perfect foods for stomach disorders—have turned out to be major causes of the ailments they were supposed to cure.

Chapter Three

The Body's Fuel

Photo by Jeff Johnson

TWO SOURCES OF ENERGY

BY M. E. HOUSTON

To run continuously at a fast pace, a runner requires oxygen and fuel as the essential components of the performance. The cardio-respiratory system, which is improved by training, transports the oxygen to the working muscles. Efficient delivery of the oxygen is a prime requirement for distance running success. However, the fuel with which the oxygen combines is also very important.

There are three fuels available to all cells: protein, carbohydrate and fat. It is a well established fact that protein is not used as a fuel to any significant extent when the caloric content of the diet is adequate. Hence, fat and carbohydrate are the chief substances employed in daily energy production cycles.

If we look solely at energy content, fat is a better fuel than carbohydrate. Each gram of fat yields 9.3 calories; each gram of carbohydrate produces 4.1 calories. All of us contain stored energy sufficient to run tremendous distances. However, our speed of running is limited by how rapidly we convey the oxygen to the working muscles.

It is important, therefore, to focus attention on fuel *efficiency.* That is, which produces more energy per given amount of oxygen, carbohydrate or fat? Each gram of fat produces 4.5 calories of energy for every liter of oxygen, whereas carbohydrate produces 5.0 calories per liter of oxygen. Thus, if we are limited by the amount of oxygen at the muscle cell level, it would be better to burn carbohydrate than fat as a fuel.

Each of us, even the leanest runner, has enough stored fat to run at least 100 miles were we able to get it to the working muscle cells. But carbohydrate is not stored to any large extent in the body.

There are three areas where carbohydrate is stored: (1) in the blood stream as *blood glucose;* (2) in the liver as *liver glycogen,* and (3) *muscle glycogen.*

Blood glucose is controlled in the body so that a certain minimum level is always present. The liver (the organ that stores the glucose as glycogen) maintains the blood glucose levels at the minimum concentration. Since the blood glucose concentration is so essential and since the liver acts as a reservoir for glucose, then the muscle glycogen depots are filled only when blood and liver stores are adequate. Furthermore, studies have revealed that blood glucose is not employed to any appreciable extent as a fuel by the muscles during work. This underscores the need for adequate muscle glycogen stores.

A peculiar situation exists in the body. Fat may be produced from carbohydrate, excess protein and dietary fat. However, neither fat nor protein can produce carbohydrate to any appreciable extent. Hence, only dietary carbohydrate may act as the source of muscle glycogen.

It has been discovered that endurance athletes have larger than normal muscle glycogen depots in the muscles employed by the activity. Thus, a marathoner has more glycogen stored in his leg muscles than a non-runner of the same size. However, they might have the same amount in the shoulder muscles since these are not the essential working muscles for a distance runner.

There are rather large differences in muscle glycogen concentration throughout the body. But unlike stores of many other substances, glycogen cannot be moved from muscle to muscle. It is, in essence, locked into the particular muscle where it was formed.

During the past five years, some remarkable studies have been performed on the working muscles of man. Many of these studies have shown a definite relationship between the ability to perform long endurance work and the stores of muscle glycogen. That is, subjects were able to work much longer at a high work load if their muscle glycogen depots were filled than if these depots were only partially filled. Furthermore, when the glycogen in the muscles was depleted, the subjects were exhausted. Further work was possible only if the workload was decreased.

Since the carbohydrate content of the diet profoundly influences the amount of muscle glycogen, it appears that a high carbohydrate diet is necessary in sporting events where large quantities of glycogen are employed. Such a situation occurs in distance running, cross-country skiing and long distance bicycle racing.

A high carbohydrate diet plus endurance training results in larger than average glycogen depots in athletes. Furthermore, there is a special diet that can increase muscle glycogen levels to super values. This special diet requires one week, and is therefore suited for the *big* race. One week before the race, the glycogen supplies in the working muscles are depleted by a long run—about the same distance as the event itself, though slower. For the next three days, a diet devoid of carbohydrate is consumed. This means that the food eaten will be fat and protein (meat, eggs, fish, cottage cheese, cabbage, celery, lettuce, tomatoes, cheeses). As a result, the glycogen in muscles, depleted by the practice distance, is kept low. Training will be more difficult here since fat primarily will be the training fuel. (But training before big events generally is reduced, anyway.)

The last three days before the race, a high carbohydrate diet is eaten. This means supplementing the regular diet with carbohydrate-rich foods: bread, potatoes, vegetables (beans, peas, sweet potatoes), spaghetti, etc. It should be emphasized that gorging is not the idea; one is merely shifting the food balance to those foods supplying carbohydrate. On race day, nothing special need be eaten. As usual, the runner should eat lightly beforehand, and only those foods that agree with him.

This pre-race diet has been verified by Swedish physiologist Bengt Saltin. Two groups of fit students ran two 30-kilometer races, three weeks apart. For each race, either the special diet or a normal mixed meal was eaten. The results: Performances averaged eight minutes faster when the experimental subjects ate the special diet. This should have tremendous significance to the seasoned runner, where seconds alone can separate the top finishers and can result in personal records.

It is evident from these findings that carbohydrates are quite important in the diet of distance runners—not only before races but while in heavy training. Runners should be careful to maintain high carbohydrate intake at a time when the percentage of this element in the American diet is decreasing.

PRE-RACE EATING PLAN

If any one man could claim credit for turning runners away from steak and eggs and turning them onto spaghetti and cookies, it is Per-Olof Astrand.

Astrand, a Swedish medical doctor, is an avid skier—a cross-country skier. His sport is much like distance running, so he has more than an academic interest in the diet and performance of endurance athletes. Astrand has experimented extensively, and his work has been well publicized.

Several years ago, Astrand wrote a long article for the magazine *Nutrition Today*. It summarized his then revolutionary findings. He made two claims which, at the time, were startling. Now they are common knowledge.

- *That protein foods play no immediate part in the energy production of exercising athletes.*

- *That energy comes from a judicious mixture of carbohydrates and fats. Proper dosage can increase stamina by 300%.*

Astrand had the facts to back up his statements. First, the matter of protein. "In 1866," says Astrand, "two German scientists, Pettenkofer and Voit, showed that combustion of protein was no higher during heavy exercise than during rest. Since these century-old studies, these findings have been frequently confirmed... In one experiment, we compared cross-country skiers who raced 20-50 miles in one day with resting athletes used as controls. There was no noticeable difference in the amount of protein used."

Astrand concludes, "There seems no doubt that it is proper to exclude protein from consideration as a fuel for working muscle cells." Carbohydrates and fats are the workers, he says. He has learned that fat is the main fuel supply in mild exercise. He takes an example from his own distance skiing experience.

"We participated in a ski tour in the mountains," he says. "During three days, we covered a distance of about 65 kilometers (39 miles). The calculated caloric ouput was a total of some 18,000 calories. Only 1000 calories were supplied. These came almost exclusively in the form of carbohydrate. Some 14,000-15,000 calories were probably derived from fat (stored in the body). With the few calories in the form of sugar taken at appropriate intervals and by avoiding peak loads, the three days of heavy work could be completed. We experienced the symptoms of hypoglycemia (low blood-sugar) on only a few occasions during the test."

As exercise becomes more intense, however, carbohydrate assumes prime importance. According to Astrand, "The utilization of carbohydrate depends on the oxygen supplied to the working muscles. The more inadequate the oxygen supply, the higher the carbohydrate utilization." This would be the case in most running events, which are relatively short and fast, and have a degree of oxygen debt involved.

So the obvious way to increase available energy for running is to increase the amount of carbohydrate in the diet. It is a physiological fact, though, that carbohydrate—converted to glycogen—is in relatively short supply in the body. It can't be stored easily and increased indefinitely. There are limits. And to reach even these, Astrand says, requires careful dietary control. But with the kind of control he recommends, the results can be astounding.

Here's how he says to go about building available energy reserves:

"The proper preparation for a competition in any endurance event exceeding 30-60 minutes would be to exercise to exhaustion the same muscles that will be used in the event. This should be done about one week in advance to exhaust glycogen stores. Then the diet should be almost exclusively fat and protein for about three days. This keeps the glycogen content of the exercising muscles low. As the big day nears, the athlete should add large quantities of carbohydrate. *Add* is the word, because the intake of fats and protein should be continued. This regimen is recommended for anyone preparing himself for prolonged, severe exercise. We have found it works."

The Swedish doctor offers laboratory evidence that it works. Several of his colleagues tested 20 subjects, who rode to exhaustion on a stationary bicycle. Before their rides, the athletes were checked for muscle glycogen content in their upper legs (the hardest working muscles in this test).

They followed a normal "mixed" diet. The average glycogen count was 1.6 grams per 100 grams of muscle. The exhausted riders stopped after 90 minutes. The glycogen level had dropped to 0.1g/100g. "With the glycogen depots emptied," Astrand says, "the work has to cease, or the subject has to reduce the rate of work."

Astrand's own tests supported these findings. He tested nine subjects, who worked on the bicycle at about the same intensity as those above. Astrand, however, took his subjects through four different rides—each on a different dietary routine.

- **First, a "mixed" diet** (for three days before test). The starting glycogen content was 1.75 grams per 100 grams of muscle. The average ride was 114 minutes.

- **Second, an all-protein and fat diet** (three days). Initial muscle glycogen level was only 0.63 grams per 100—or about a third the mixed diet amount. The riders could only go half as far as before—or 57 minutes.

- **Third, a carbohydrate-rich diet** (three days). Starting glycogen levels climbed to 3.51 grams—twice as high as with the mixed diet. The subjects lasted 167 minutes on the bicycle—or about 50% more than they had on a mixed diet.

- **Fourth, a "seven-day-diet-plan."** Astrand says, "The most pronounced effect was obtained if the glycogen content was first emptied by heavy prolonged exercise and a diet very rich in carbohydrates given for (the last) three days. With this procedure, the glycogen content could exceed 4.0 grams per 100 grams wet muscle, and the heavy work tolerated for prolonged periods—sometimes more than four hours (240 minutes)."

Riding at a steady rate, the test subjects increased their "distances" by 200-400%—simply by changing what they ate. This study tells what dietary adjustment can do for pure endurance, which is the ability to hold a fixed pace longer before getting exhausted. What isn't so clear is just what the adjustment means to people trying for speed; those wanting to run a fixed distance *faster.*

GOING BEYOND THEORY

Laboratory studies are valuable. They have control and preciseness not found on the tracks and roads. Yet there is an air of unreality about them. Both the methods and the results can go over an unscientific runner's head, and leave him with little understanding of the practical significance of the lab work.

Scientifically, perhaps timed running tests are less accurate than those in the laboratory. But no doubt they hit a more responsive note with everyday runners. Swedish physiologists J. Karlsson and B. Saltin have made such a dietary study that runners can really get their teeth into. The results say exactly what carbohydrate-loading can mean in terms of time improvement.

Karlsson and Saltin tested 10 trained distance runners. They ran two 30-kilometer races, with three weeks of recovery in between. Running conditions for the two tests were as identical as it was possible to make them. However, the difference was in what the runners ate the week before each event.

Before the first 30-kilometer test, half of the subjects ate a normal mixed diet while the other half overloaded with carbohydrates. In the second test, the two groups were reversed. The pre-run program involved at least a two-hour run one week before the test, followed by three days of low-carbohydrate regimen while continuing training, then high carbohydrate intake for three days with no heavy work.

The results of the two tests were combined. The "normal-diet" runners averaged 2:23:00 for the 30-kilometer runs. The "carbohydrate-loaded" individuals ran 2:15:18 on the average. In other words, the per-man improvement amounted to over 7½ minutes, 5½%, or 25 seconds per mile. Any way you look at it, the effect of adjusted food intake was startling in this case.

The 10 runners were tested for muscle glycogen levels before and after each runner. On high-carbohydrate diets, the runners had about twice the stored glycogen that they had on normal mixed diets. The pre-run figures were 3.52 grams per 100 grams of tissue for the former and 1.77 for the latter.

During the runs, the subjects lost more glycogen after a carbohydrate-loading diet than after a normal one—but they had much more to lose. The post-run figures were 1.90 grams/100 in the first case and 0.52 in the second. Even after the high-carbohydrate run, glycogen levels were higher than normal.

The significance of this is that glycogen supplies energy for the working muscles. As long as glycogen levels stay high, muscles can keep working at a steady pace. When glycogen is depleted, work must slow or stop.

In this test, Karlsson and Saltin recorded split times at several points in the 30-kilometer runs. They found that runners on the high-carbohydrate routine maintained a higher pace in the last two-thirds of the run than when they were on mixed diets. Times for the first third of the run are about equal, regardless of what they ate. However, on mixed diets severe glycogen depletion set in after 10 kilometers. To the man, the runners lost time from then on—in some cases more than 15 minutes compared with their carbohydrate-loaded performances.

DIET IN DISTANCE RUNS

BY DR. ENRICO ARCELLI

(Reprinted from "Leichtathletik" Magazine of West Germany)

In perhaps no other athletic event can fundamental knowledge of physiology be of such great practical value as in a long distance run such as the marathon. Athletes who are aware of the physical demands of distance running are better able to prevent crises in competition. These include dehydration, hyperthermy (excessive body heat), hypoglycemia (low blood sugar) and exhaustion of the glycogen stores in muscle tissues. All are related to nutrition, and I'll deal with them here. The material is subdivided for quick reference purposes, but in fact many of the subjects are interrelated.

• **The Caloric Cost of Running:** For every kilometer run at race tempo, the marathon runner uses about 0.9 calories per kilogram of body weight. A well-conditioned athlete may get by on less (e.g., 0.8 calorie) while a person not accustomed to running may supply about 1.0 calorie. For the entire marathon distance (42.2 kilometers), an athlete weighing 60 kilograms and running at a cost of 0.9 cal./kg. x km. will have to expend about 2280 calories. He uses about 55 calories per kilometer.

For the same well-trained runner, the per-mile caloric cost converts to about 88. He uses 0.66 calories per pound for every mile at racing pace. The cost per pound for each kilometer is 0.4.

• **Dehydration and Salt Deficit:** During a marathon run in mild weather, the runner loses an average of two to three liters of sweat (about four to six pounds). In great heat, some runners lose five or more liters, and in extreme cases even 10% of their body weight. A loss of this magnitude can put a runner in a dehydration crisis state. It is therefore important that the runner go to the starting line well-hydrated, and that he replace at least part of the water lost in sweat during the race. Above all, it is advisable for the runner under conditions of great heat to drink at least enough to still his thirst.

It must also be pointed out that perspiration contains 0.2 to 0.5% salt. When the organism is in such a state of salt deficiency, perspiration can become difficult. Some authorities take the view that one should add salt to the drinks taken during the run. The salt balance is thus maintained, and also the time the drink spends in the stomach is decreased.

• **Water of Hydration and Water of Oxidation:** During the marathon run, 2.7 grams of water are freed for every gram of burned glycogen—which is bound to the water as "water of hydration." An athlete following the preparatory diet (described below) uses about 375 grams of glycogen during the marathon; about 1000 grams of water are freed during the process. After a mixed diet, the glycogen use drops to about 280 grams, bound with 750 grams of water. After a fat-protein diet, the glycogen consumption amounts to only about 185 grams = 500 grams of water.

Aside from this, about 300 grams of "water of oxidation" are freed during the burning of glycogen and fatty acids. In all, between 800 and 1300 grams of water of hydration and oxidation can be removed from the body in the form of sweat—without the blood or other tissues having to give it up. This is one of the reasons why marathon runners may lose more than 8% of their body weight as sweat during the run yet show no symptoms of dehydration—at least not to the extent that would be seen in someone who loses the same amount of sweat without muscular work.

The significance of this profuse sweating is that it acts as a coolant during the race. Dietary control can influence the sweating rate.

• **Glycogen and Fatty Acids:** Glycogen and fatty acids are the fuels from which the energy for the muscles comes. Glycogen is already in the muscles in tiny mass particles. Fatty acids, on the other hand, come from the stores of fat and arrive at the muscles via the blood. The total amount of glycogen in the muscles is about 100 grams in a marathoner before the start. (At the finish, this amount is severely reduced.) Fatty acids stored in fat deposits are about 2-3% of the body weight (about 1.5 kilograms in a runner weighing 60 kilograms).

• **Significance of a Carbohydrate-Rich Diet:** In 1939, Christiansen and Hansen found that physical work of a given intensity can be continued for an average of four hours when an athlete has eaten predominantly carbohydrates; two hours with a mixed diet; and less than 1½ hours with a fat-protein diet. Recently, other Scandinavians determined that a carbohydrate-rich diet increases the glycogen content of the muscles, and that this high glycogen content permits a longer stress of given intensity (or, if one speaks of a race at a fixed distance such as the marathon, that less time is needed to run the distance).

• **Maximum Glycogen Content of the Muscles:** In an athlete eating a mixed diet, the glycogen content of the muscles is about 1.5 grams per 100 grams of muscle. After a longer-than-normal period of stress in training, this glycogen content sinks significantly.

If the athlete then eats predominantly carbohydrate-rich meals, the glycogen content of the muscles rises sharply after only a few meals. By the third day, values of over three grams per 100 grams of muscle can be attained. This is twice the normal glycogen content.

If, on the other hand, a pure fat-protein diet is maintained after decreasing the glycogen content by training—and no carbohydrates are eaten—only a very small amount of glycogen is maintained in the muscles. Such a diet has no immediate usefulness, but is important in creating a "sugar-hunger" in the muscles. If the athlete then eats carbohydrates exclusively for the next three days, the glycogen content of the muscles reaches about *four* grams per 100 grams of muscle (and in certain cases even over *five* grams—or more than three times the normal value).

Therefore, if the marathon runner wants to go to the start with a high glycogen content in his muscles, he should—beginning six days before the competition—(1) take a long training session; (2) maintain a fat-protein diet for three days; (3) then follow a high carbohydrate diet for the final three days.

• **Training During the "Preparatory Diet":** Suppose that the marathon will be on Sunday. The last long training run takes place on the previous Sunday. From then until Wednesday, the athlete stays on a fat-protein diet and trains over very limited distances. The lack of glycogen will make training very tiring. Thursday, Friday and Saturday, there should be little or no training, in order to promote the storing of glycogen. On race day, the athlete will eat lightly, if at all—depending on the starting time of the race. If there is a long time between the last meal and competition, he may take sugar in solid or dissolved form 15-30 minutes before the start.

If a runner cannot follow the preparatory diet completely, he should nevertheless do this partially—even though the advantage is not as great. Above all, the last four to six meals should consist solely of carbohydrates. This diet should begin after a lengthy training session, and there should be very little training during the dietary period.

• **Weight Gain from "Preparatory Diet"**: The athlete following a preparatory diet will go to the starting line weighing several hundred grams more than one who has been on a mixed diet. If this weight increase is one kilogram (2.2 pounds), the runner will have to use about 1.6% more energy during the first stage of the race. However, this runner will also lose weight faster than one who has been eating a mixed diet during the week before the race. There is also less need to drink.

The increase in weight is attributable less to storage of glycogen than to the fact that this occurs in hydrated form. Each gram of glucose corresponds to about 2.7 grams of water of hydration.

• **Advantages of "Preparatory Diet"**: The athlete has a better "breathing quotient." In other words, he can produce 4.92 calories of energy for every liter of oxygen after a carbohydrate-rich diet—compared to 4.86 calories after a mixed diet, and 4.80 calories after a fat-rich diet. Compared with a mixed diet, then, the energy advantage of an "excess glucose" diet amounts to about 1.2%. However, we also saw that weight gain amounts to 1.6% or more. The disadvantage due to additional weight seems to neutralize the benefit of extra energy.

In reality, though, one must also consider the following: (1) The athlete who has followed the preparatory diet loses added weight quickly. (2) Runners on a preparatory diet will not run the risk of glycogen deficiency crisis; glycogen will still be present in sufficient amounts during the last kilometers of the marathon. (3) Athletes store greater amounts of water during a preparatory diet, and run less risk of dehydration or heat-crisis. (4) The glycogen stores of the liver also increase; since the liver regulates the glucose content of the blood, a hypoglycemia crisis is easily avoided in this way.

• **Sugar Eaten During Competition**: Going to the starting line with muscles heavily enriched with glycogen undoubtedly is an advantage for the marathoner. Can one achieve the same advantage by eating sugar during the run? The answer is clearly no. Aside from the difficulty of eating the same amount of sugar during a run as we spoke of concerning the preparatory diet, physiological factors speak unequivocally against this. Normally, sugar (and all carbohydrates) are converted to monosacharides during digestion and are carried into the circulatory system. These are transferred to the cells with the help of a hormone—insulin. During physical exertion, the insulin level sinks, and the monosacharides can no longer be transferred to the muscles. Sugar intake is somewhat useful during the run—but less as a source of glycogen for muscles than to maintain the blood sugar balance.

• **Blood Glucose Content:** Normally, 100 grams of blood contains about one gram of glucose (1 g%). If this amount sinks to 0.8 g% or less, we have hypoglycemia (a deficiency of glucose). A glucose deficiency leads to severe disturbances and—if the glucose falls to less than 0.5 g%, even unconsciousness.

The glucose content of the blood is usually maintained at a normal value by glucose present in the liver—in the form of glycogen. If the glycogen stores in the liver of a marathon runner at the start are insufficient, the runner risks a hypoglycemia crisis during the run. As mentioned in the previous section, eating sugar during the run can help the runner somewhat—but not nearly as much as if he had followed the full preparatory diet.

We have found that marathon runners who prepared in the way outlined here arrived fresher at the finish line, and confirmed that they had suffered less than in runs without this preparation. The usefulness of the preparatory diet is therefore beyond doubt, even aside from its time advantages.

VITAL ROLE OF GLUCOSE

BY M. H. M. ARNOLD

(Reprinted from "Athletics Weekly" Magazine of Great Britain)

One of the most remarkable things about the human body-machine is its flexibility of performance. The same person—the same body—can dash for 100 yards, run a marathon, or walk the length of England. Although much the same muscles are used in all three cases, the rate at which work is done and the duration of effort vary enormously.

The long distance walker will consume energy at the rate of 350 calories an hour intermittently for around 200 hours. The marathon runner uses about 900 calories an hour for over two hours. The sprinter burns energy at the rate of about 10,000 calories an hour, but only for a few seconds. (A high jumper will work at the fantastic rate of 100,000 calories an hour, for a fraction of a second.)

No other machine can approach this range of performance. Because the range is so broad, it is reasonable to suspect that different energy supply mechanisms are involved. This is in fact the case.

The "single-effort" athlete—jumper or thrower—obtains his burst of energy from the almost explosive breakdown of a substance called adenosine triphosphate within the muscles. Skill in these activities depends largely on triggering this supply of energy at just the right moment. (The performer also builds up an extra energy supply in the form of momentum from a run or a spin.)

The sprinter simply runs as fast as his legs will carry him. He gets his energy from the glycogen in his muscles. His body demands six liters of oxygen during a 10-second dash. This he cannot get, because the most his heart and lungs can supply in that short time is a liter. The body goes into debt for oxygen, obtaining energy by converting glycogen into lactic acid without the use of oxygen. In fact, during a sprint the lungs have little to do, and a sprinter can run 100 yards while holding his breath. When the race is over, the sprinter pants. He is repaying the debt by converting lactic acid back into glycogen.

The oxygen debt process is extravagant. In 10 seconds, about a half-pound of glycogen is used up. True, all but about a quarter of an ounce is paid back later, but the whole half-pound must be there to start with. The glycogen stocks of the body must be fully adequate to meet the demand.

There is a limit to the oxygen debt that can be built up. This is set by the increasing muscular discomfort as lactic acid levels build up in the blood. The longest distance that can be run at full speed is about 300 yards. At longer distances, a runner must take care not to get into oxygen debt too soon. However, beyond the mile oxygen debt declines progressively in significance and is replaced by the factor of energy supply.

The maximum rate at which oxygen can be supplied continuously for prolonged periods (without incurring oxygen debt) is about 2.5 liters per minute. This is the so-called "steady state" at which energy is being used up at the rate of about 800 calories per hour. This corresponds to a speed of 6-7 m.p.h., and to a glycogen usage of around 200 grams (about a half-pound) per hour.

The total stock of glycogen in the body will not greatly exceed 600 grams, and can well be as little as little as a quarter of that figure. is used up, exhaustion sets in. Beyond this point, activity can proceed only at the low rate determined by mobilization and conversion of fat—corresponding to an oxygen supply of no more than a liter per minute, energy dissipation of around 300 calories an hour, and a speed of 3-4 m.p.h. In other words, any reasonably well-fed person can walk all day and every day without getting out of breath or feeling unduly tired. It is only when he speeds up that he runs into trouble. This is our concern here.

Two points stand out clearly.

- *Performance could be improved at distances below the mile by removing lactic acid.*

- *Performance could be improved over the longer distances by increasing glycogen supply.*

The best way to dispose of an acid is to neutralize it. Many attempts have been made to increase the maximum oxygen debt by feeding athletes alkaline materials before the race. These experiments without exception have been failures, partly because the body has powerful controls built in to resist attempts to change its acid/alkaline balance; partly because it is almost certainly not lactic acid *as an acid* that causes trouble, and partly because it is no use neutralizing an athlete nicely if he then feels too sick to run.

The maintenance and increase of glycogen, on the other hand, is both simple and effective. Glucose—often called "dextrose"—is a natural sugar. It is the form in which energy is transmitted inside the body. Carbohydrate foods are converted into glucose, which is carried in the blood to form glycogen in liver and muscle. Glycogen can be regarded as an insoluble form of glucose; the two are inconvertible and used interchangeably for energy production.

It would therefore seem obvious that the glycogen stock of the body could be conserved and exhaustion warded off by eating glucose. This is in fact so. Dogs can run for 24 hours and more without apparent fatigue if given glucose every hour. Without glucose, they collapse exhausted—however well nourished—after a few hours.

Thus, before any athletic event, whether sprint or distance, care should be taken (1) to build up glycogen stores with carbohydrate-rich diet for a few days before the event and (2) where appropriate, to maintain those stores by eating glucose at appropriate intervals.

It may be asked: "Why, if all food is convertible into glucose, do you insist on glucose?" The great merit of it is that it is absorbed rapidly and directly into the blood stream and is available for muscular use the moment it gets there. All other substances must undergo digestion, are absorbed more slowly, or must be converted into glucose after entering the blood stream.

Glucose is the fastest-acting nutrient. Even so, one could wish it were faster still, for a snack of glucose takes about 30 minutes to produce its full effect. Its effect is shown by an increase in blood-sugar of 50% or more. No harm will come from an occasional excess, for the kidneys automatically excrete into the bladder any amount more than twice the normal level.

Although the body controls the minimum blood sugar value until all glycogen is gone, there is everything to be said for maintaining a higher level. In fact, the response of the body to exertion or stress is to mobilize glycogen and raise blood-sugar. This is quite likely related to the fact that the effects of a slight deficiency in oxygen supply to the brain (as happens when the body goes into oxygen debt) are minimized by high blood-sugar. This is again linked to the fact that there is a mental element in all fatigue, and that even purely mental fatigue is alleviated by glucose.

Therefore, although from the strictly energetic aspect no benefit is to be expected from eating glucose before events of less than two miles, there can be a real neuro-physiological benefit even at the shortest distances. (Any effect in "single-effort" events will be purely psychological.) It must always be remembered that there will be a time lag of up to 30 minutes after eating. The amount needed is small—only a few grams (one or two tablets, if taken in tablet form).

For long distances, glucose is essential. It can be taken shortly before starting and then perhaps every half-hour, according to personal taste and availability. The desirable amounts are fairly substantial. (Since it is less sweet than cane sugar, quite large amounts are easy to swallow.) Anything much less than an ounce is not likely to be worth the trouble. The choice as to whether the glucose should be taken in liquid or tablet form is up to the individual. Perhaps the most practical means of taking glucose is in on-the-run drinks.

Suppose now that a second event is to follow the next day? It is not possible to restore glycogen stocks overnight—or even in two nights. And all athletes know what can result if one middle or long distance event follows another at too short an interval. The problem was, until very recently, insoluble in practical terms. But now a substance known as fructose has become available at a price which allows it to be eaten and not just used for medical purposes.

Fructose—often called "fruit sugar" because it occurs commonly in fruit—looks just like glucose but is about three times as sweet. Like glucose, fructose is absorbed rapidly and completely into the blood stream when it is eaten. But, unlike glucose, there is no question of its being immediately available for muscular use. Its destiny is quite different than glucose. Fructose is rapidly and completely converted into glycogen. The speed of conversion is startling.

So the obvious way to build up glycogen stocks rapidly is to eat fructose. The body's stock of 1½ pounds of glycogen would need 1½ pounds of fructose—and that's a lot of sugar to eat in an evening. But in fact glucose derived from the rest of the diet will play a substantial part in forming glycogen, as will body fat. So fructose should be taken for "topping up" glycogen stocks rather than as a major supply item. (Fructose also has the unusual property of increasing the speed at which *glucose* is converted into glycogen—thus giving a kind of bonus.)

How should fructose be taken? Any way you like, for it can replace ordinary sugar in nearly all foods. But, to keep things simple, fructose can be taken in beverages or on cereals—or perhaps best of all for sweetening fruit.

BLOOD SUGAR SUPPLIES

BY GEORGE SHEEHAN, M. D.

The fuel content of an ordinary 150-pound human being is approximately 166,200 calories—1200 in carbohydrate, 25,000 in protein and 140,000 in fat. Yet this 150-pounder, fortified by extra calories at breakfast, must have a coffee break two to three hours later or get the vapours.

Why? The answer is low blood sugar. Most of us suffer from it because we eat the wrong breakfast—or, if you go along with veteran marathoner Aldo Scandurra, from eating breakfast at all.

"When I get up the day of the Boston marathon," Scandurra once told me, "I don't eat at all. I take a large glass of hot water, have a bowel movement, and I'm ready for that race at noon." And what about energy for that long 26 miles? "I have enough already stored up," he replied. "There's no sense upsetting my system with more."

Scandurra is physiologically correct. In the fasting person, the blood sugar stays in a straight line well within the normal range. Only after a meal does it rise, thereby calling for an outpouring of insulin (a hormone of energy storage). When the insulin accomplishes this task, the sugar level drops and you usually know it.

How? Well, you feel as if you need a coffee break. More specifically, that could range from fatigue and yawning or actual drowsiness on the one hand, or a feeling of jitteryness or a light sweat on the other.

The treatment is usually coffee and a Danish. Other therapies include all those quick-energy foods and candies and drinks we see advertised in the press and on TV. The effect is almost immediate. Zing goes the blood sugar—back up and even past normal. This again calls on the insulin to deposit the extra calories. And thus we go on and on depositing high-octane fuel in an already full tank, depositing fat on top of fat when all we had to do was call on the energy we already had stored for use.

Can this be done? Can low blood sugar be cured without diet or treated without jelly sandwiches, candy bars and fruit juice? Can we raise our blood sugar any time we want to?

Why not? Children and athletes do. What do grammar school students do at 10:30 in the morning when they get the same feeling that sends grown men and housewives to the kitchen or the snack bar? They have recess. They get out and raise a sweat, and in the process elevate their blood sugar. They then come back to the classroom renewed and intelligent, becoming more docile, more teachable. The transformation is a physiological one.

And what of the athlete? He has the same meal. He has been advised to have a relatively high carbohydrate meal before his event. If nothing else, it is more easily digested. Then he waits the two to three hours. Insulin, the hormone of energy storage, is doing its work. His blood sugar starts down. He begins to yawn (spectators mistakenly marvel at how casually he seems to be taking the race), or gets into a light, clammy perspiration. Does he then look around for food, something to raise his blood sugar? Of course not. He knows he is ready to release this power he has crammed into his muscles and liver. This is what these feelings mean to an athlete.

So he does the only appropriate thing, the natural thing for the human animal. He goes into physical action. That action, for reasons we did not know until recently, has to be intense enough to cause sweating and prolonged enough to call on what has been described as that "miraculous refreshment and renewal of vigor"—the second wind.

We now read that there is a good scientific reason for all of this. The pancreas which produces insulin, a hormone of energy storage, also produces glucagon, a hormone of energy release. Further, when the athlete exercises he stimulates the production of glucagon, with the result that all the fuel he has stashed away in the last meal—and the past week and past year, if necessary—begins to pour out into the blood. *Voila,* the blood sugar rises.

There is a time, the Bible says, for everything. There is a time for low blood sugar. There is a time for high blood sugar. There is a time for insulin. There is a time for glucagon. There is a time for meat, a time for bread, and a time for nothing at all. The problem is finding the right time.

ON FOODS AND FASTING

Athletes as a group subscribe wholeheartedly to the "you-are-what-you-eat" school of thinking. Reasoning runs like this: Exercise burns up calories. Therefore, the exercising athlete must eat more than the average person so he'll have more calories available for energy. And since muscles are doing the work, plenty of muscle-food (meat protein) is needed to keep them working.

This sounds logical enough. Three square meals every day, heavy on calories and meats, represents the conventional means of feeding athletes. But scientific evidence to the contrary is mounting. In several significant ways, the athlete is what he *doesn't* eat, the studies are indicating.

Skipping meals (fasting) and skipping meats (vegetarianism) generally are still regarded as food fads, with no place in athletic diet. Not eating certain "essential" foods, or not eating *at all,* for extended periods are self-defeating. Even some so-called authorities say that. At best, these practices have no measurable effect on athletic performance, others say.

However, a number of diet-endurance tests performed in Europe say otherwise. The conclusions have practical value to runners—particularly distance runners. Swiss doctor Ralph Bircher reviewed three studies on fasting and protein consumption for the German magazine *Leichtathletik.* The research isn't new. Two of the experiments are 30 years old, and the other occurred nearly a decade ago. But until recently they were buried in technical journals and were lost to most of the people who needed this information.

• *The first deals with fasting.* In 1964, a group of 19 Swedes took a walk from Kalmar to Stockholm—a distance of over 300 miles which they covered at the rate of 30 miles a day. Most of the men, ages 18 to 53, were sedentary workers. They had no background as endurance athletes. They ate no food at all during the 10 day walk.

"Insane, foolish, impossible, we are inclined to say," Bircher notes, "because we live for the most part in the belief that our daily need for food must be constantly stilled—even when one is doing nothing, not to mention during such a long walk. We are convinced that otherwise we would soon fold up."

Though their average weight loss was about 15 pounds, all the walkers completed the test. "The happy, natural appearance and obvious liveliness of the walkers at the finish, and a minute examination both showed that they were all in the best of health."

In this case, the walkers proved one of Ernst Van Aaken's contentions: that the body is perfectly capable of "living off its own resources" for extended periods, and in fact even thrives on it.

• *The second test involves a sudden shift from cooked and processed foods to raw, fresh ones.* This was done back in 1933, with three young sports students as subjects. The test lasted six weeks. During the first two weeks, the athletes ate their normal mixed diet (which included approximately 100 grams of protein, 150 grams of fat, 230 grams of carbohydrate and 14½ grams of salt daily). They trained to the point of best performance. Then they made an abrupt shift in diet. They changed to raw foods (fruits, vegetables, nuts—with very small amounts of milk and eggs). Protein consumption was cut in half, and salt intake by almost 90%.

Following the shift to this unaccustomed diet, there were more tests (rowing, diving, long distance running, gymnastics). "The results surpassed all expectations," Bircher says. "In the three weeks of pure fresh foods, there was no decrease whatsoever in athletic performances. Metabolism was in continuous balance, no digestive difficulties at all, increased sensation of well-being. We see that demanding physical performance can continue unreduced even after sudden–almost grotesque–inversion of the diet. We also see that with minimal protein (50 grams), best performances can still be possible."

- *The third test centers on protein consumption.* Does the working runner need more than normal amounts to keep his muscles operating effectively? Another 1933 study says no–just the opposite. Heavy protein intake may in fact *impede* performance.

For one thing, Bircher says, "the caloric need grows by one-fourth when one adds protein to the extent customary in sports." This is apparently because more energy is required to assimilate protein than to break down other food substances.

One of the protein researchers who made this discovery was a mountain climber. In one high-mountain experiment, he limited his protein consumption to whole wheat (7-8% protein)–and took in no cheese, eggs or meat.

Bircher says, "In this way, the large, heavy man's caloric intake dropped from 3000-3600 per day to 2400, and thirst and perspiration largely disappeared. His muscular performance increased by 20-30% as tested, and the need for oxygen sank by 10%, which at great altitudes naturally proved quite useful. Performance was optimal, and above all an extraordinary increase in endurance and recovery ability appeared. The rest days, previously unavoidable after days-long strenuous high altitude effort, could be omitted, as a night's rest sufficed and shorter pauses were able to replace longer rest periods."

Lower total calories means lower weight–which is usually a plus factor for runners. If a runner can lose weight and at the same time increase energy, oxygen intake, recovery rate and well-being (these tests strongly indicate one can), certain foods are worth skipping.

EATING ON YOGA TERMS

BY GEORGE BEINHORN

I started running in 1969, two years after becoming a vegetarian. This makes it hard for me to say that vegetarian diet has had this or that effect on my running. I do, however, have the strong feeling that natural foods are the most efficient way to get the right nutrients to the cells, and that a pure-foods diet keeps the organs of assimilation, crystallization and elimination in the best health. But one thing at a time, and from the beginning.

It takes great interest to change your diet. You eat the same things for X number of years, and are "bound" by very strong habits. No one can talk you into being a vegetarian or fruitarian, or not eating white flour, etc. It takes a keen personal sense of the reasons why this is the best thing to do. Why, indeed, do we make any changes in our lives? Because we expect, rightly or not, that they will make us happier. Well, this is why I began to change my diet.

I was miserable, emotionally drained by chaotic human relationships; physically a mess from two major surgeries and irrational, destructive habits; mentally stale and tired from too much booking and a crash effort in finishing my master's thesis. After graduation and an extended rest period, I began to do research again, on the most efficient and sure-fire means of having a deeply meaningful, if not overtly "happy" life. This led me, inevitably, to a system of physical, mental and spiritual culture that has been tested for over 5000 known years: yoga. All systems are interrelated in yoga; the physical side has its mental and spiritual effects, etc.

The yoga diet is simplicity itself. That is why it is rather difficult to follow, as we are not often used to reducing our behavior to simplicity. The Bhagavad-Gita says that there are three qualities universally present in various mixtures everywhere in this world: (1) the negative or destructive; (2) the activating, and (3) the soothing or spiritual. Foods can be classified according to these qualities.

- In rotten foods such as stinky cheeses and thousand-year-old eggs, or even stale vegetables, we easily see the negative, degenerative quality. The yogis say that these foods tend to create certain corresponding qualities of the mind: a lazy, sullen, sadistic, destructive disposition. Let me qualify right now—the effect of food is by no means stated to override and dominate well-developed personal qualities. We all know wonderfully cheerful, positive people who eat "tamasic" foods, as they are called. This class of food extends also to many of the items currently under fire by "inner ecologists," such as white flour, overcooked vegetables and meats.

- The stimulating, or "rajasic" category includes foods that taste sharp, acid, bitter, sour. These are said to produce a nervous, jumpy mind and disposition. Some examples are salt, which is known to cause hypertension and acts as a thyroid stimulant. Try to give up salt. You'll find out that it is a strongly addictive stimulant. Others are hot peppers, vinegar and mustard. Again, not eating these foods won't make you calm and peaceful, nor will eating them necessarily make you jumpy and irritable if you have a strong habit of calmness. The Bhagavad-Gita only gives this advice for those who want to put their body systems in a state which will not interfere with the cultivation of mental states that conduce to happiness.

• The third, spiritual or "sattwic" type of food is easily identified. These are the foods that appeal most to our senses of smell, sight and taste, discounting the unnatural appeal to stimulation and gluttony of the other two categories. Fruit, fresh vegetables, nuts and grains. Think of a hamburger with plenty of mustard and relish, then a bowl of fresh, sliced peaches with honey, or blueberries, or watermelon. Which seems more soothing, pleasing to the eye, easily digested?

There are two additional tests that tell what kind of food is most natural for man: (1) the ratio of the length of the intestinal tract to the distance between the mouth and the anus, and (2) the tooth structure. Without elaborating, these are specific to each animal, including human beings, according to the kind of food on which the animal thrives. The teeth, of course, have to be a certain shape in order to chew and tear the characteristic food. And the intestinal tract must not be too long, or the food will begin to rot before it leaves the animal's body, becoming a festering ground for disease bacteria. By these tests, man is a fruit-and-nut eater.

To return to my own case, after struggling with the initial change I began to feel much more energy. My body felt "magnetized." There isn't a better word. I much less frequently got tired. When I did start running I had no problems related to nutrition. It was a struggle to work up to easy three-mile runs, as it is for everyone, but I never felt a lack of energy that kept me from recovering from one day to the next, working eight hours as usual, and gradually lengthening my runs.

My specific diet is as follows. I don't find it monotonous at all, because I have by five-year habit returned to natural tastes in food. Things that a meat-and-spice-eating person wouldn't look twice at are delicious to me. Oranges, for instance, and most other fruits are the most delicious dessert items I can imagine.

Breakfast: (heaviest meal of the day) two handfuls of nuts; four or five large tablespoons of seasame seed mixed with wheat germ and honey; six to eight dates or prunes (unsulphured); an orange; maybe a lemon or some pineapple.

Lunch: a handful of a different kind of nuts than were eaten at breakfast; pineapple if I hadn't eaten any at breakfast; fruit juice (usually grapefruit or apple); another orange.

After-work snack: a pint to a quart of raw skim milk; fruit; maybe an orange; a small glass of apple juice or more if it's hot. A carrot or two.

Dinner: A big salad made of a base of romaine lettuce and raw spinach leaves, plus whatever else my creative impulses decide (alfalfa sprouts, tomato, etc.); I use a homemade dressing of soy oil, garlic, herbs, and vinegar (the vinegar will soon be switched to lemon juice, as I think it's hard on the kidneys).

I don't want anyone else to follow this diet. I doubt that anyone would. The point I will make is that I get along on this, with no meat and potatoes, and run with good energy. I run eight to 10 miles four days a week, take two easy days of two-three miles, and go out in the hills for a run of 17-22 miles on a Saturday or Sunday. I intend to use the van Aaken run-walk system to learn to go more than 25 miles on a weekend run, as I think that most of the trouble at 20 miles is due to the body's never having been forced to learn to switch over to conversion of stored fats after it runs out of glycogen. I vary the basic diet radically after a long run, especially on a hot day. Then there is no question about heading for the nearest store to get some fruit. I've found berries to be the most refreshing post-run food, especially strawberries and blueberries. Raw milk also seems to be a good recovery drink. I have no scientific evidence of this, just personal experience repeated many times.

Ideally, I fast one day a week, and three days once a month. Recently I have been fasting until noon with good results. I believe fasting is necessary to clean out the body from time to time. During a fast I drink a lot of orange juice, and take a herbal laxative. The effects are predominantly mental for me, but there are good effects on my running. I feel more energy during the first run while fasting. The digestive organs do a lot of work to push food through 30 feet of tubing, and I think when I stop eating this energy is freed for running. I've also fasted on the day of a race, getting my best time for five miles. My longest fast while continuing to run was four days, and the last run was a real flop. I see no need to keep on training through a long fast, except as an experiment, never pushing it beyond what feels tolerable in order to preserve energy for the body's inner cleansing work.

For about three months I loaded up on vitamin E pills, magnesium and potassium. I noticed no change at all, and therefore guess I am getting enough of these in the nuts I eat.

One serious mistake I made as a vegetarian was in not getting enough of the right kind of protein. I cut out milk completely, as well as wheat and any soy bean products. I don't want to generalize my experience as I have read about contradictory experiences, but after a year and a half without milk, etc., I began to have poor concentration and a kind of lightheadedness which I was told were symptoms of protein deficiency. Sure enough, when I started getting more milk I recovered within about three weeks. I now get along very well on about 70 grams of protein a day, but I'm careful to include two or more foods in my daily diet that will give me at least the basic 10 amino acids—from which the body is able to manufacture the rest.

Since I've been a vegetarian trying to control by food intake, my weight has not varied more than five pounds up or down.

The high carbohydrate race preparation formula has produced good results for me on one occasion, and wretched runs on two others. I believe that in the two unhappy cases I overdid it, eating so much carbohydrate food that my heartbeat and breathing rates increased, making sleep shallow and unrestful, and sapping the energy I would have used to race.

My experiences have convinced me there must be moderation, even in this kind of radical diet.

Chapter Four

The Body's Regulators

Photo by Stan Pantovic

LET'S DRINK TO THAT

Immediately before, during and just after running, the runner's drinking habits should concern him more than what he eats. Calories only burn up at the rate of about 100 per mile in a distance run; this means it takes 35 miles to lose a pound of flesh. On the other hand, a pound of fluid may drain away in as little as two miles; on hot days, the pace may be faster yet.

David Costill is perhaps the leading American exercise physiologist studying runners. Dr. Costill has tested fluid losses in distance men, both in his laboratory at Ball State University and in actual races.

Costill says, "When a man loses 2% or more of his body weight by sweating, his ability to perform prolonged exhaustive exercise is drastically impaired. During our laboratory test, we recorded weight losses of nearly 7% of the runners' body weight."

Fluid loss (we use the word "fluid" here because it isn't simply pure water that the runner is losing; the water contains many dissolved minerals) hits athletes two ways.

- *They get thirsty, obviously.* This indicates that the liquid supply is running low and needs to be replaced. If thirst isn't at least partially quenched, performance will suffer.

- *Internal temperatures rise.* When they get too high, performance suffers this way, too. In extreme cases, heat exhaustion or heat stroke can result.

Costill found in his testing that thirst isn't an accurate guide to fluid needs. He also discovered that a runner can't possibly fill his needs while the run or race is on.

In a *Distance Running News* article, Costill wrote, "At the 1968 US Olympic marathon trial, we recorded weight losses as large as 13.5 pounds. The average weight loss of the top 10 finishers was 9.3 pounds. We were amazed at the small amount of fluid drunk in the course of 2½ to three hours of running. The average volume of fluid taken at each of the feeding stations was 1.5 ounces. That means that these men were only replacing about 0.5 of the 9.3 pounds that they were losing."

The runners, he says, were only drinking enough to quiet their immediate thirst. This doesn't come close to matching the body's true demand. Costill says, too, that the placement of drinking stations in long distance races is a problem. According to the physiologist, by the time a man gets his first drink, he may already have lost more than three pounds. In the laboratory, the subjects took 3.5 ounces every five minutes during their runs—and came through their runs with less weight loss and fewer dehydration symptoms.

Acute dehydration, occurring during a run, hurts performance in that run. However, losses are usually repaid soon afterwards. Costill's bigger concern is with *chronic* dehydration.

"Large body water losses incurred on consecutive days may cause an accumulated weight and fluid loss," he says. "Man generally relies on his thirst to control body fluid balance. Unfortunately, this mechanism is far from accurate. In laboratory rests that required about eight pounds of sweat loss, we found that thirst was temporarily satisfied by as little as one pound of water. Total replacement of body weight may take several days unless the runner forces himself to drink more than is desired.

"Chronic dehydration can drastically damage a runner's endurance capacity by lowering his tolerance to fatigue, reducing his ability to sweat, elevating his rectal temperature and increasing the stress on his circulatory system."

Costill mentions here that a daily weight check is a better indicator of dehydration than is thirst. "If you note a two- or three-pound decrease in body weight from morning to morning, efforts should be made to increase your fluid intake. You need not worry about drinking too much fluid, because your kidneys will unload the excess water in a matter of a few hours."

Another of Costill's tests determined (1) amount of fluid absorbed by the body *during* exercise, and (2) the effect of liquid intake on internal temperatures. Four test subjects—all national class middle and long distance runners—went through a series of three treadmill runs. They went the equivalent of six-minute mile pace, meaning that each run was a hard 20-miler.

During each test run, the athletes gulped 4.5 pounds of water or Gatorade (which contains sodium chloride, potassium, phosphorus and glucose). They drank at five-minute intervals for most of each run. "To add to the pain of the situation," Costill says, "the runners' stomachs were aspirated

(pumped) immediately after each test to determine how much fluid remained in the stomach."

He found that "only about 81% of the 0.54 gallons ingested had actually been absorbed from the stomach. We have estimated that a runner will lose about 3.7 pounds per hour, but he can only remove about 1.8 pounds of water from his stomach in the same period. That means that regardless of how much a runner drinks, it will be impossible for him to keep up with the weight being lost by sweating."

Still, the conclusion was that during a run such as this—a simulated 20-mile—drinking fluids will "significantly benefit" a runner. That's because it lowers internal temperatures.

Costill says, "Rectal temperatures were two degrees (F) lower when the runners drank fluids than when they did not. Amby Burfoot's internal temperature reached 105.5 degrees when he ran without fluids, but leveled off at 103.6 degrees when he drank either of the two fluids (water of Gatorade). Since a body temperature above 104.5 can cause extreme distress and possible collapse, this cooling quality of ingested fluids could be of paramount value on a warm day."

Summarizing Costill's findings: He strongly recommends drinking during long runs and races—as much to reduce body heat as to ward off thirst. The physiologist would do away with restrictions on distance race drinking stations, letting runners take in all they want—*and more*. After and between hard runs, he thinks the best way to avoid dehydration is to watch one's weight; sudden losses mean trouble, and corrective action should be taken.

Costill adds that fluids are retained and/or replaced more effectively with electrolyte solutions (such as Gatorade) than with plain water.

DO RUNNERS NEED SALT?

Common table salt—sodium chloride, in chemical terminology—is the subject of controversy. Does it help or hurt running performances?

Conventional wisdom goes like this: sweat is salty, so heavily sweating individuals need extra salt to replace what is lost; if they don't get it, they risk fatigue symptoms, muscle cramping and even heat exhaustion or stroke.

In the previous article, Dr. David Costill said, "Attempts should be made to drink fluids that will be retained by the body. After acute dehydration, drinking water will only produce a partial rehydration. The ingredient needed to improve the retention of water is sodium chloride."

There isn't total agreement in the scientific community on this claim. Other researchers are saying that salt isn't the complete answer—and, in fact, that it may not be as essential a supplement to the athlete's diet as once believed.

Dr. Kenneth Cooper, originator and popularizer of the "aerobics" program, tested three-quarters of a million volunteers while doing his research. He has at hand the largest single body of data on running physiology. Several of his tests have centered on the loss and replacement of fluid electrolytes—which include not only sodium chloride, but also potassium, calcium and magnesium.

Cooper has concluded tentatively that sodium chloride may be the least important of the four, and that *magnesium* is most critical. His test of marathoners showed no significant sodium chloride loss during races, but a heavy drain on magnesium supplies. (Further details on his magnesium studies later in this chapter.)

Cooper conducted much of his research in the hot and steamy Texas summer. One could reasonably expect runners to need extra salt under these conditions—perhaps in the form of salt tablets. Cooper says no.

"One of the greatest factors leading to heat stress problems," he notes, "is inadequate fluid replacement, particularly in a heat acclimatized subject. Salt tablets alone may do more harm than good if taken without adequate fluids. As a means of preventing heat stress, I always encourage adequate fluid replacement *first* and salt intake second.

"Most runners can compensate for the salt loss, once they are heat acclimatized, by merely adding extra salt to their food. In fact, most of our noon runners in San Antonio did not find it necessary to take salt tablets, even though three- to five-mile runs were quite common in high temperature, high humidity conditions so prevalent during the summer. On no occasion did one of our runners suffer a heat stress syndrome."

Two other American researchers did their studies in hot weather areas, where salt intake should be most important. Physicians James Schamadan and W. D. Snively tested teenagers working in the scorching fields of Israel and Arizona. Temperatures frequently were above 100 degrees.

Schamadan's and Snively's subjects, who were doing longer but less intense work than found in running, developed serious *potassium* deficits even though they were eating adequately and were getting supplementary salt. The potassium deficiency disappeared when they switched to high-potassium foods and stopped taking salt tablets.

The two doctors concluded that high salt intake accelerates sweating, and in the process "washes out" other essential electrolytes besides salt. They say some of the confusion about high salt intake may have developed because the substance "probably relieves heat exhaustion at the onset, but then as the body's potassium reserves drop it (salt) exerts the opposite effect."

Dr. George Sheehan says one effect of adapting to heat is that the salt content of the sweat drops almost to insignificance. He claims that at best the extra salt may be wasted, noting, "The body quickly throws off excess." This "throwing off" process, in turn, could contribute to the situation Schamadan and Snively were talking about.

Dr. Sheehan, a world-record veteran distance runner himself, says, "I have been on a low-salt, high potassium diet for years, and have been satisfied with my performances. How I would do on salt I'm not sure, and frankly I'm not about to try."

VICTORIES OVER HEAT

In 1965, Tom Osler went off the salt shaker. He was then, he admits, "a terrible hot day runner." But he decided that salt deficiency wasn't the reason. He says he finished his runs looking like a pillar of salt, having it caked on his face, neck, arms and shoes.

Tom's experience told him his diet was too high in salt. He read a physiology textbook and it concurred. It said the average American diet is "unnaturally high" in salt, and that the body's needs can be met from natural sources—without turning to the salt shaker.

Osler figured he had an unnecessary addiction, so he stopped. There were immediate results.

- *Body weight dropped several pounds.*
- *He worked more efficiently in heat.*
- *He sweated less, and the sweat was less salty.*

The real test of his low-salt diet ("low by American standards; natural by God's standard") came two years later. Tom ran the National AAU marathon championship, which incorporated the Pan-American Games Trial. The race came to be known as the "Holyoke Massacre" because so many runners fell to the 97-degree noonday heat and humidity near 100%. It was so hot, he says, that his shoes made a clicking sound as they stuck to the melting asphalt.

Osler finished fourth in that race, while most of the big names dropped out. He said this convinced him that he'd gone from one of the worst hot weather runners to one of the best, simply by cutting out table salt.

"After the race," Osler says, "I took my friend Ted Corbitt aside and with great eagerness announced my amazing discovery. Ted, in his usual quiet, reserved manner, grinned and told me that he had known this for many years—and had himself been an advocate of low salt diets."

Corbitt is the US record holder at 50 and 100 miles, both set when he was past 40 years old. Not coincidentally, Ted is known as one of the country's most effective hot weather runners.

Fred Grace's salt-free experience goes back ever farther. Grace is well past 70, yet he still eases through marathons under four hours. He claims he hasn't had so much as a headache since he was 13, and he attributes this to his combined exercise-diet program.

"I haven't used salt for over 30 years," Grace says. "Why haven't I died? Because everything we eat and drink contains salt. And added salt contains strokes."

Osler warns, however, that suddenly eliminating excess salt can temporarily cause trouble. The body has become dependent on these large doses and has to be weaned away carefully. He says men working in extreme heat may initially experience muscle cramps, dizzyness and nausea. According to Osler, the best time to cut down on salt is during the cool weather months. Then, when summer comes again, the runner will be adjusted. He'll surprise himself at how well he copes with heat and humidity.

ANALYSIS OF DRINKS

The salt controversy aside, this much seems clear. Neither salt alone nor water alone is enough to put down dehydration symptoms resulting from hard running. They have to be taken in combination with minerals.

A number of companies, working from this principle, have developed "exercise drinks." The best-known is Gatorade, a Stokely-Van Camp product invented at the University of Florida. Other leading brands are Sportade (Becton, Dickinson Company) and Bike Half-Time Punch (Kendall Company).

Though the drinks differ in makeup, they have three things in common. They're designed to replace (1) lost fluid; (2) lost electrolytes; (3) lost glycogen. They are all mostly water, obviously. But they also contain salt and potassium, and sugars to accomplish the last two steps.

The magazine *Medical Times* has tested these three commercial drinks, comparing their chemical compositions. Besides salt, the article identified potassium as the key electrolyte in the solutions. "The need for potassium," it said, "is especially applicable when salt is being given, for it has been found in hot climates that increased salt intake enhances potassium excretion. Also, a large series of heat stroke cases reviewed has shown that potassium depletion in the serum was present in a majority of cases."

Sweeteners go into the drinks for reasons of "sweetness, palatability and caloric replacement. Some investigators have also shown that glycogen depletion and lowered blood sugar appear related to fatigue and impaired performance during long severe exercise. By using both quick-acting and immediate-acting sugars like glucose and sucrose, one can obtain both sweetness and slight differences in their availability to the blood stream, which is desirable."

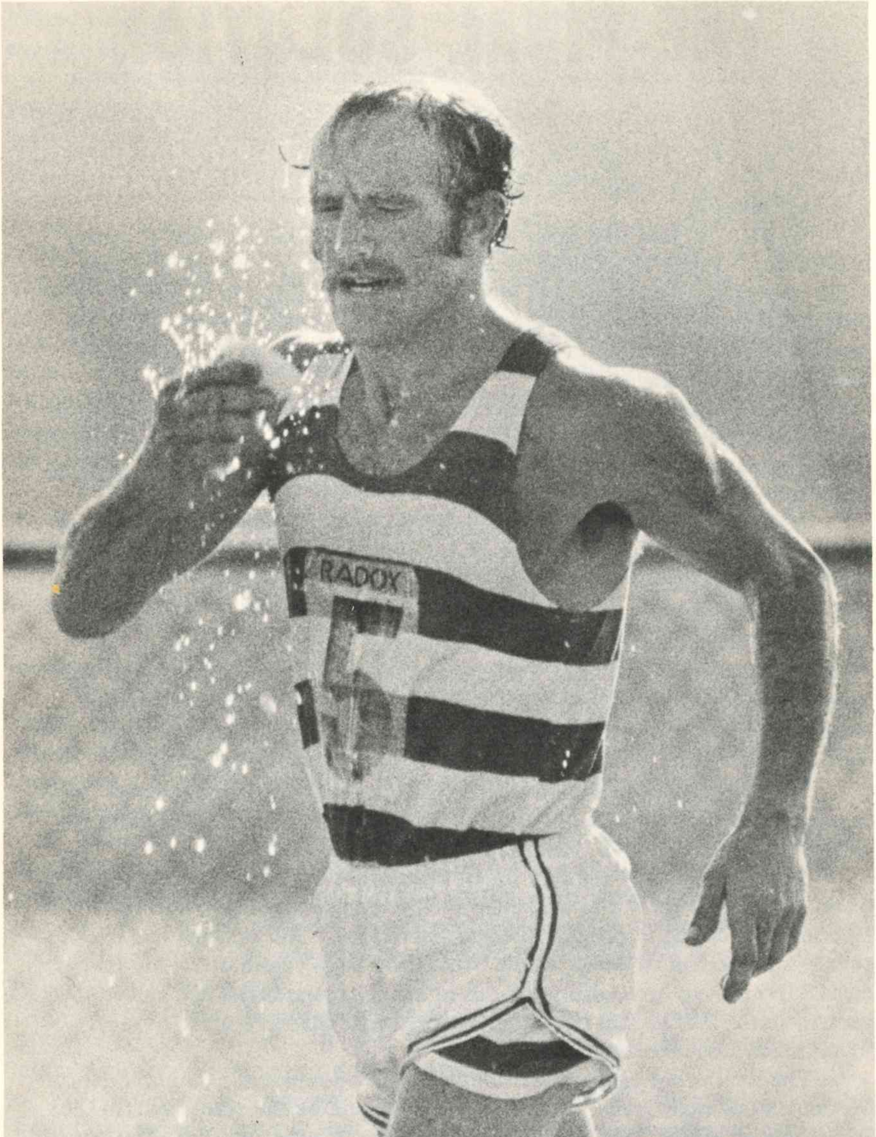
- All three drinks had similar *sodium* content, which was about the same as what's found naturally in a glass of whole milk.

- *Potassium* measured highest in Sportade. It had five to 10 times as much as Gatorade and Half-Time Punch. Yet Sportade has only about half the potassium of whole milk or orange juice. Gatorade and Half-Time Punch have less than a can of beer!

- *Calories and carbohydrates* (indicators of sugar levels) in all three drinks are lower than those of orange juice. Sportade and Half-Time Punch however, have nearly twice the carbohydrates and calories of Gatorade.

Using the *Medical Times'* criteria for an effective athletic drink (sodium-potassium-sugar combination), Dr. George Sheehan analyzed the findings of the magazine's study. He said in these respects Sportade is best, Half-Time Punch second and Gatorade a distant third. Of the "natural" drinks, orange juice is best though it lacks sodium. Milk has sodium and potassium, but is relatively low in carbohydrates and calories.

"Gatorade has very little potassium," Sheehan says. "Orange juice and slices are good sources of this mineral. Sportade seems to be the best commercially available drink, though ERG ('Gookinaid')—a new preparation—may be even better. Orange juice with a weak salt solution can be a good homemade solution."



A drink of water and a splash of it on the head and upper body cools the runner—inside and out. But in the distances he has to take care that he replaces lost minerals, too. (Ed Lacey photo)

THE FINAL SOLUTION

Bill Gookin was 39 years old before he satisfied himself that he'd found his answer. His experimenting started 17 years earlier. After his first marathon, in 1954, Bill began tinkering with running drinks for the best of reasons —to help himself.

Gookin ran that first marathon in 3:18. After that, he tried drinking plain water. It didn't rest easily in his stomach. He tried various mixtures of sugar or honey, orange juice and salt. Not only did these fail to prevent cramping and late-race fatigue, but the side effects of the drinks were awful. He gave up on these solutions. (Bill learned much later that he was allergic to both honey and oranges.)

Years later, before the current wave of exercise drinks flooded the market, Gookin was still experimenting. As both a trained chemist (he's a science teacher in San Diego) and a practicing distance runner, he was in a unique position for testing.

Bill tentatively settled on a formula of water, lemonade, salt and sugar. He used this combination in the 1967 Culver City marathon, and ran his best time (then and still) of 2:29:21. He wasn't completely satisfied, either with the time or the drink.

Then along came Gatorade. Gookin tried it for the first time in the 1968 Olympic marathon trial. "It sounded just like what I wanted," he says. He drank it during the race and got sick. "I ran the last 10 miles bent over double with stomach cramps. But still I thought that what I needed was Gatorade's contents without the artificial sweeteners and flavoring."

Bill kept testing new mixtures—variations on the Gatorade theme. Within a year of the Olympic Trials disaster, he found one which suited him. He tested it in the 1969 AAU marathon championship.

"I didn't take any until 15 miles, after dropping from ninth to 13th," he recalls. "Weaving and feeling miserable, I chug-a-lugged between 10 and 12 ounces, thinking to myself 'this is going to hurt.' But nothing bad happened—and I began to sweat, which I realized I hadn't been doing for several miles." He moved up to third, ran out of energy towards the end and slipped back to sixth. But he still felt good enough about the experience to say, "That made a believer out of me."

The final proof came in the fall of 1971. Gookin was trying to qualify for the US Olympic Trials. If he made it, he would be the oldest man in the Trials field at age 39. The day wasn't conducive to good running. The temperature was in the mid-70s. But it was a good day for testing the formula which had come to be known, inevitably, as "Gookinaid."

Bill had used the drink since 1969, but other factors such as illness, injury, training letdowns and unavailability of his favorite product had kept him from conducting a fair test. "Santa Barbara was the first marathon where everything was right—training, health and getting the Gookinaid."

Gookin drank his customary half-glass at the start. He began cautiously and let the field get away from him. Every 3-5 miles, he took a drink. The first 10 miles took slightly less than an hour (2:36 pace). The pace for the next 10 was five minutes faster. At 20 miles, Gookin was still several minutes behind the leaders. He was getting his regular cupful of Gookinaid from a squeeze bottle and was feeling good. The pace stayed strong, despite the heat.

Coming up a long hill three miles from the finish, Gookin caught the younger leaders. "When I came up on them," he says, "I noticed they were both covered with dried sweat." Bill wasn't. He was perspiring freely. He gained a half-mile on the others from that point and finished in 2:29:33.

The late-race strength and good heat tolerance sound like the answer to a distance runner's prayer. Gookin says they aren't accidents but are predictable reactions. That's because the drink is replacing roughly the same things that normally would be lost for the rest of the run through sweating.

Gookin's drink might be called "synthetic sweat" because he developed it by analyzing his own liquid losses and then approximating them in his formula. The advantage of his drink over others on the market is that it is based on the sweat of distance runners. Athletes in other activities don't lose the same things, he found. Perhaps that was the reason runners had little success with other drinks.

All fluid-replacement solutions need three properties: (1) water; (2) essential minerals; (3) sugar. All the commercial drinks have these. But the balance of them is the crucial factor.

In an article for *Runner's World*, Tom Sturak told of the chemical analysis that led to the discovery of "Gookinaid." (The actual name of the product, now that it is on the market, is *ERG,* which means "electrolyte replacement with glucose." The name explains the physical action of the drink.)

Sturak said Gookin started by analyzing Gatorade chemically, attempting to identify its elements and to duplicate its formula. "At the same time," Sturak wrote, "he began analysis of physiological saline (salt) solutions for humans and other primates: e.g., those used in hospitals for heat exhaustion victims and in zoos and medical research facilities.

"The goal of these investigations was to develop a sugar (glucose) solution that was isotonic... An isotonic solution makes possible quick and painless absorption of electrolytes and fluid. If too sweet, such a sugar solution will draw fluid from the blood into the stomach, causing cramps. If too dilute (or if plain water), then electrolytes are pulled from the blood, which can result in muscle cramping."

Gookin found through hard practical experience that Gatorade didn't work for him. He found chemically that it "did not match the makeup of either plasma or sweat—in particular, his own."

So much for his experience. What about others? Bill took sweat samples from three other athletes—a shot putter, an overweight novice jogger and a football player. Sturak noted, "He discovered significant differences; most particularly between the sweat of the overweight jogger and that of a conditioned distance runner. The latter's sweat is more dilute (the sweat glands work more efficiently, and the body seems to conserve electrolytes), and the proportions of sodium and potassium ions are very much the same (whereas the fat man loses about three times as much sodium as potassium).

"Literature supported Gookin's conclusions about the critical importance of sodium and (particularly) potassium losses during marathons, as did common empiricism (e.g., the craving after a race for fruits and leafy vegetables, both rich in potassium)."

The exact formula of Gookin's final version of ERG is a guarded secret. However, Bill does say it has balanced proportions of sodium and potassium, and that the mixture includes vitamin C and "buffers." Vitamin C, which is lost in sweat, is vital to the metabolism of glucose. The buffers assure "the right pH (acid-alkaline balance) for absorption"; real sweat, he says, is too acid to be absorbed.

ERG doesn't contain magnesium, which has been identified as another valuable electrolyte in distance running. Sturak reported on Gookin's test of the substance: "Adding magnesium salts to ERG taken on a marathon training run, he experienced no noticeable effects—except laxative. Because the magnesium ion is 'bound up' (much like iron in hemoglobin), it is difficult to assimilate. But since it is undoubtedly critical in muscular fatigue and nerve functioning, Gookin feels it should be regularly provided in the everyday diet (nuts, leafy greens, etc.)."

Gookin never intended his drink to suit anyone but him, and it wasn't designed as a commercial venture. He developed it on the basis of his sweat, for his own use. Word of it spread quickly in 1971 and '72, however, and he soon had a thriving family industry. He got the formula patented, and now makes ERG available to other runners at a reasonable price.

ERG comes in powder form, with each 35-cent package making a half-gallon of the liquid. It is yellowish in color (food coloring was added so it wouldn't be confused with water at race pit-stops). It has a bland taste, slightly sweat-like but not unpleasant.

Gookin himself mixes the power and his three children help him package and mail it. Their names are Debi, Mark and Karin. They semi-seriously call their company the DMK Corporation, and sell the product from their home at 5946 Wenrich Dr., San Diego, Calif. 92120. Or just send 75 cents to Starting Line Sports, 1142 Chestnut, Menlo Park, Calif. 94025 for a sample 100-gm package which makes one half gallon.

Demand is exceeding supply to such an extent that Gookin sometimes wonders what kind of monster he has created. He has less time for running now that he's so busy making the stuff for other people. And when he gets to races, he sees them drinking away the advantage he had for a short time. There are fewer salt-caked runners caught weaving through the last miles.

DRINKING LEGISLATION

"A competitor taking refreshments at a place other than the refreshment points appointed by the organizers renders himself liable to disqualification."

That's the rule in long distance races. It generally is ignored in all but the biggest national and international competitions, but it is still the rule. Officials at all races have the power to enforce it, whether or not they use it.

This is what it says in the International Amateur Athletic Federation handbook—rule 165, section five:

"Refreshments shall be provided by organizers of the race at approximately 11 kilometers or seven miles, and thereafter at approximately every five kilometers or three miles." The rule further states that "no refreshment may be carried or taken by a competitor other than that provided or approved by the organizers."

The runner is put in the position of (1) suffering because of an apparently arbitrary rule, or (2) breaking the rule for the sake of his performance and health. This is particularly true on warm days.

David Costill's tests indicate that neither subjective feelings of thirst nor the international rule takes into account the body's true fluid needs. He says that by the time the runner feels thirsty and can drink, it may be too late to do much good.

According to Costill, "We have been led to conclude that international rules and the feeding habits during marathon races make the practice of drinking fluids totally ineffective. That is to say that the current methods of taking fluids during a marathon race do little more than satisfy the runner's thirst temporarily."

Costill's test subjects had the most success when they drank 3½ ounces of liquid every five minutes of their runs—starting in the first five minutes and continuing to drink until the last half-hour.

"While this technique appears to be the most ideal method for replacing fluids during a race," he says, "current international marathon rules prohibit feedings before 11 kilometers. It is therefore possible that by the time a runner is able to begin replacing his fluid losses, he may have already lost more than three pounds."

As mentioned in an earlier article, running drinks have three purposes: replacing water, electrolytes and energy. These things don't happen immediately. There is a certain time-lag while the body processes the fluids. Experts on the subject say it takes 30 minutes or more to get the full effect from a water-mineral-glucose drink. This fact makes two important points to runners:

- The drinks do little or no physiological good in races shorter than six miles, even if they're taken in the first minute of the run.

- If you follow the rules and take the first drink at seven miles, you don't get full benefit from it until you've gone perhaps 12 miles. By then, as Costill says, you're already in severe fluid debt.

One way to get around both of these things and be well-watered in short races or the early miles of long ones is to drink *before* the run. Remember the half-hour time lag, and plan the drink for maximum good later on.

Bill Gookin, the inventor of "Gookinaid" or "ERG" (discussed in the following article), follows this practice in his own races. Even before the shortest races, he drinks a half-cup of his product "to take the dryness out of my mouth." He reports nothing but good effects.

Dr. George Sheehan adds a warning: "Pre-race drinks (sodium chloride-potassium-sugar mixture) may be helpful. But the body quickly throws off excess, so don't rely on this completely.

A better answer is to change the drinking rule which apparently has no scientific basis—or failing that, to subvert it. The long distance bicyclists carry their own drinks as they ride, and swig from their bottles whenever they want. This isn't practical for runners. But the idea is sound. Drinks should be available when runners need them—before they *think* they need them, and these needs don't follow any pattern that can be set down in a rule book.

THE MAGNESIUM DRAIN

It wasn't the most inviting prospect before and after a hard marathon. Dr. Kenneth Cooper, the developer and popularizer of the "aerobics" program, asked for blood donors. He wanted to see what happened in the runner's blood during a marathon. Surprisingly he got the necessary number of volunteers, and the test produced potentially valuable results.

Cooper did his testing at the 1969 Boston Marathon. His eight volunteers all gave samples of their blood an hour before the start. Then they ran. The temperature during the race was mild (55-60 degrees), so heat didn't create unusual havoc with the runners' fluid levels. They drank less than a pint of liquid apiece while running, so liquid replacement was minimal.

As soon as they finished—and before they ate or drank—Cooper sampled their blood again. He checked for mineral changes in the blood serum. Sodium, potassium, calcium and magnesium were the electrolytes he was most interested in.

Running drinks contain combinations of the first three—sodium, potassium and calcium—but magnesium hasn't gotten much attention. Cooper's findings, however, indicate that magnesium should find a more important place for itself in the food and drink of long distance runners. He doesn't make any wild claims for the substance, but spells its role in cautious, scientific language.

"The data (from the test at Boston) show that all subjects exhibited a significant *rise* in serum sodium and potassium immediately after the marathon run. No significant change was noted in either serum chloride or serum calcium. There was a significant *fall* in serum magnesium after the run."

Cooper noted that it is unusual for potassium levels to rise while magnesium levels drop, since the activities of the two usually run parallel. He hinted that potassium may be rushing into the bloodstream from cellular storage to over compensate for the increased demand. Why the same thing doesn't happen with magnesium isn't made clear. Perhaps, he says, it is because the cells release potassium easier than magnesium, or magnesium flushes out of the system faster.

In any event, magnesium losses through sweating are quite high. Cooper says, "Sweating could possibly account for considerable loss of total body magnesium. It is of interest to note that after the marathon run some of the participants complained of nausea and muscle cramps. These symptoms may in part be due to the magnesium changes noted."

Cooper concludes: "In sweating, many electrolytes are lost from the body. Replacement solutions of various types have been advocated for athletic participants, but to our knowledge most of these solutions do not contain significant quantities of magnesium. From this study it would appear that magnesium is perhaps depleted to a greater extent after a marathon run than some of the other electrolytes, and that replacement solutions containing magnesium as well as other electrolytes should be evaluated to replace this deficit."

Cooper says he has talked with marathoners who supplement their diet with a commercial product called Dolomite which contains calcium and magnesium. Another possibility, suggested by physician-marathoner J. Karr Taylor, is Magnesium Plus. In natural form, magnesium is available from a number of food sources. (See accompanying chart.)

One big problem with magnesium is that it passes through the body - easily. Magnesium is lost through the feces, perhaps more than the sweat. When the mineral is taken in high doses, it tends to promote diarrhea. So the runner under stress taking extra magnesium and (already prone to diarrhea) may lose two ways.

Dr. Taylor did an informal test with distance runners. "Each runner ran at varying distances and saved stool for a week at each distance," he says. In almost every case, there was a rather remarkable step-wise increase in the loss of magnesium via the stool—not the sweat. It seems at least possible that the stool is the major avenue of magnesium loss in long distance runners, and the actual presence of intraluminal magnesium may well explain the observed absence of constipative difficulties in distance runners."

Taylor adds that daily fecal losses of magnesium average 138 milligrams, but "in the distance runner this loss may increase by from 50 to 100%." He

The following foods have the highest magnesium content listed in milligrams per pound of the edible portion. The Recommended Daily Allowance of the mineral is 400 for a man in his early 20s. The average daily loss through the feces is 138 milligrams, but a runner may lose 50-100% more, as well as losing it through sweating.

Spinach, dehydrated	4327	Curry powder	1288
Cottonseed flour	2948	Parsley, dried	1284
Wheat bran, crude	2223	Soybean flour, high-fat	1234
Coffee, instant powder	2068	Almonds, dried	1225
Cocoa, dry powder	1905	Cashew nuts	1211
Wheat bran, cereal	1095	Soybeans, dry seeds	1202
Tea, instant powder	1792	Molasses, blackstrap	1170
Peanut flour, defatted	1633	Soybean flour, full fat	1120
Wheat germ	1524	Yeast, brewers	1048
Soybean flour, defatted	1406	Cowpease, dry seeds	1043
Mustard, dried	1343	Buckwheat, whole grain	1039
Chocolate, bitter	1325	Brazil nuts	1021
Soybean flour, low-fat	1311	Peanuts, raw	934

says Magnesium Plus seems to produce less diarrhea than does Dolomite, and that magnesium taken in natural-foods form has less effect yet.

Long before the magnesium question came up in the running area, Adelle Davis had mentioned it in her book *Let's Eat Right to Keep Fit.* She says it has to be taken in correct combination with calcium to do much good. Miss Davis notes, "The correct proportion appears to be approximately twice as much calcium as magnesium, or 500 milligrams of magnesium for each 1000 milligrams of calcium." (The Recommended Daily Allowances for the two minerals are about 400 magnesium and 800 calcium.)

Miss Davis adds that eating magnesium compounds without the needed calcium can produce symptoms of "muscular weakness, listlessness, lethargy, drowsiness, lack of coordination, speech difficulties, slow heartbeat, nausea and vomiting"—or worse. Runners are unlikely to get the "or worse," but the others are serious enough to warrant attention.

EXTRA IRON FOR WOMEN

"Women have nearly twice the iron requirement of men." The line comes from an advertisement for an iron supplement, but it's more than a selling gimmick. The Food and Nutrition Board says the same thing. Women from puberty through menopause (about age 13 through late 40s) should get 18 milligrams of iron a day, while men need only 10 milligrams.

Iron is one of the most important substances in the body, appearing in every red blood cell. In the form of hemoglobin, it transports oxygen. And of course keeps the runner running.

Writer and marathoner Janet Newman of Oregon has dug up facts linking iron deficiency with women's running capacities. She says research indicates that the average woman in the 20-30 age group has 15% less hemoglobin than a man per 100 milliliters of blood. This gives women a far smaller ability to carry oxygen.

Many women, she notes, are chronically anemic—or have a low red blood cell count. The result is physical weakness, which causes obvious problems in running. Janet herself has this problem. She writes:

"I might add my own experiences with low hemoglobin counts. I seem to be chronically anemic but can remedy the situation with daily iron supplements and an emphasis on iron/protein in my diet. I have found a direct correlation between my running performances and my hemoglobin count. While doing about the same amount of training, all my best performances came when my hemoglobin was normal. When the hemoglobin count dropped to 48%, my running times slowed markedly—up to a minute per mile in races a mile to 13 miles long. Returning to iron pills, in one week the hemoglobin count rose 10% and I could feel a pronounced difference. My legs in particular lost their feeling of heaviness."

She advises other women who suspect they have anemia to take iron supplements and have regular blood tests. "Symptoms to watch for would be a general tired feeling, an unaccountable drop in performance, 'dead' legs and pale complexion," Janet says.

Men can suffer from anemia, too, but women—because of their menstrual cycle—are much more susceptible. Individuals with anemic symptoms can take any number of iron pills or tonics available commercially. Geritol is one.

The following foods are naturally rich in iron. They're listed here with the milligram count per average serving.

Beef liver (2 oz.)	5.0 mg.	Chicken (½ breast)	1.3 mg.
Dried beans (¾ cup)	3.5 mg.	Eggs (1 medium)	1.1 mg.
Beef pot roast (2 oz.)	2.9 mg.	Rice (¾ cup)	1.1 mg.
Pork chops (1 chop)	2.2 mg.	Tomato juice (4 oz.)	1.1 mg.
Spinach (½ cup)	2.0 mg.	Haddock (1 fillet)	1.0 mg.
Ham (2 oz.)	1.6 mg.	Macaroni (¾ cup)	1.0 mg.
Apricots (½ cup)	1.5 mg.	Bologna (2 slices)	1.0 mg.
Green peas (½ cup)	1.5 mg.	Sweet potatoes (1 med.)	1.0 mg.
Dried prunes (5 prunes)	1.5 mg.		

VITAMINS TO RUN ON

BY LUDVIG PROKOP, M. D.

(Reprinted from "Der Leichtathlet" Magazine of East Germany)

Vitamin balance and physical—especially athletic—performance capacity are closely related. In all clinical cases of vitamin deficiency, the first symptom to appear is reduction of physical capacity. And in hard work the need for various vitamins increases markedly, so that even with so-called "normal" doses a deficiency can result.

This means too that vitamins only produce a demonstrable, and likewise subjectively noticeable, influence on performance when errors are made in composition and amounts in the diet. With full-valued diet, if one adds even high amounts of additional vitamins, he can expect little positive effect.

There are great differences in the importance of individual vitamins for physical performance, and in optimal individual doses. And in many aspects of vitamin effects we still lack legitimate, performance specific, comparable and placebo-tested results. We often must draw our conclusions from clinical studies.

With that introduction, I'll move on to discuss individual vitamins and their role in athletics. Vitamins A, the B-complex, C, E and P appear to be the most important in endurance sports such as running, while vitamins D and K have no known effects on endurance capacity.

Vitamin A: Relatively little is known about a specific influence of vitamin A *(axerophtol)* on physical performance. It plays an important role in certain aging processes in connective tissue. A deficiency can provoke disturbances in sexual hormone metabolism and atrophy of the adrenal cortex. This has meaning for the mastery of performance demands because of the central position of the adrenals in the stress system. In highest performance conditions, athletes should increase the intake of vitamin A to double the normal dose—i.e., 3-4 milligrams per day.

Vitamin B-Complex: Of the vitamin B group, vitamins B1, B2, Niacin and B12 seem performance-specific. In all vitamins of the B group, a decrease in spontaneous initiative and activity is one of the first deficiency symptoms.

Vitamin B1 (thiamine) is, in its physiologically effective form, necessary for the reduction of grape sugar (*glucose* or *dextrose*). Therefore, it is necessary for any increase in caloric use in all kinds of endurance performance. The daily requirement is 6-8 milligrams according to calories burned.

Vitamin B2 (lactoflavin, riboflavin) is also pertinent to endurance activity because of its importance in the formation of yellow respiratory enzyme. A normal daily requirement of 2-4 milligrams is indicated for high performance.

Niacin (the PP factor) is indispensable for the building and reduction of carbohydrates, as well as fats and proteins. For endurance performance, 40 milligrams—or double the normal requirement—is indicated.

Vitamin B12 has an anti-anemic effect, plus specific effects on the metabolism of amino acids and the nervous system. Again, higher than normal doses are recommended, particularly for athletes performing at high altitude.

Vitamin C: This vitamin (also called *ascorbic acid*) undoubtedly occupies a central position in connection with performance ability. This ubiquitous substance is partially responsible for the economy of almost all metabolic processes in the body. Ascorbic acid deficiency reduces physical performance capacity, and during physical exertion the underbalance of it is intensified. The vitamin C requirement of athletes and hard laborers is therefore significantly above the common norms. It may amount to 500 milligrams daily. This is especially true for endurance performance and during simultaneous severe weather.

However, vitamin C intake is often irrationally exaggerated. During the Austrian bicycle tour, we found a daily elimination of vitamin C amounting to as much as four grams in the urine.

My own extensive investigations also have proved that vitamin C in the *natural* form (for example, in fruit juices) is clearly superior to synthetic ascorbic acid. We were able to objectify this in experiments with standardized stresses. The tests showed a decrease in oxygen debt and lowering of pulse and blood pressure. The reason for this increased effectiveness lies in the stabilization of vitamin C in fruit juices by the Vitamin P group and other substances.

Vitamin E: Vitamin E *(topopherols)* assumes great importance for muscular performance capacity through an influence on circulation and capillarization, which improve utilization of oxygen. This gives E special significance in endurance performance.

As with vitamin C, a certain superiority of natural vitamin E (for example, in wheat germ oil) exists in contrast to equal dosage of synthetic vitamins.

Because of limited storage by the body, a continuous supply of perhaps 10-30 milligrams per day is necessary.

Vitamin P: The vitamin P-complex (*rutin, citrin, hesperidin*), used in relatively large amounts by the body, has a certain indirect influence on performance because of its stabilizing effect on vitamin C—as well as possibly other water-soluble vitamins.

The following chart summarizes average vitamin requirements for an athlete weighing 70 kilograms (154 pounds).

		SPEED/STRENGTH		ENDURANCE	
Vitamin	**non-athlete**	**training (mg.)**	**racing (mg.)**	**training (mg.)**	**racing (mg.)**
A	1.5	2	2-3	3	3-6
B1	1.5	2-4	2-4	3-5	4-8
B2	2	3	3	3-4	3-4
Niacin	20	30	30-40	30-40	40
C	70	100-140	140-200	140-200	200-240
E	7-10	14-20	24-30	20-30	30-50

Endurance capacity is often not so much a question of taking vitamins in high dosages, but assuring the simultaneous working of various vitamins in a physiologically balanced bouquet—the way they are commonly found in nature. This is above all true of vitamins A, B1, B2, C and E. An overdose of these vitamins, perhaps with the exception of vitamin E, can easily disturb the balance and thereby *decrease* performance capacity.

Therefore, multi-vitamin preparations as so-called "means of building oneself up" during strenuous training and before competition seem more favorable than high dosages of individual vitamins.

The hubbub over vitamins has helped spread the opinion that one hardly needs to be concerned with real vitamin deficiencies any longer, and that the demand for an increase in vitamin values of food is exaggerated. However, there are alarming researches—even from economically well-situated countries —which contradict such optimistic views.

For example, an investigation of US teenagers concerning their intake of vitamin C showed only 10.3% of the boys and 52.4% of the girls reaching the standard recommendations of the Food and Nutrition Board. This is a result on the one hand of overeating carbohydrates, and on the other of increasing consumption of "practical" canned foods.

It is obvious that during athletic stresses real inadequacies must result. The vitamin balance of the athlete for the present continues to demand special attention.

Chapter Five

The Body's Weight

Photo by Stan Pantovic

GETTING MORE FROM LESS

In 1925, a young German runner read Paavo Nurmi's statement, "All people eat too much and are therefore incapable of good performances." Ernst van Aaken never forgot what the Finnish runner said.

Van Aaken, now in his 70s, has made a lifelong study of running methods and nutrition (he talks about the two as one). His combined role of medical doctor and running coach has given him a unique perspective on these subjects.

Van Aaken is a forceful, opinionated man. His ideas on training and eating are unorthodox, and acceptance of his thinking has come slowly—even in West Germany. His ideas rest on two principles:

- *Running slowly to increase heart volume and oxygen intake.*
- *Eating lightly to reduce body weight.*

The two are complementary, because the long slow running he recommends also cuts the weight load and lower body weight boosts heart efficiency. Van Aaken says the entire system operates better when it's lighter.

By "lighter" he means considerably below normal weight. "One should eat so little," van Aaken says, "that he stays 10 to 20% under so-called normal weights." (See clarification of "normal" or "average" weights in articles that follow.)

Van Aaken can march out a number of scientific reasons for his low-weight theory and can offer a mound of test data. But none of his reasons are as compelling to the runner-reader as actual experience on the track.

Here, van Aaken points to one of his students—Harald Norpoth. Norpoth has competed in the last three Olympic Games and has held a number of European middle distance records. He is 6'1" tall, and weighs just over 130. He obviously inherited a tendency toward thinness, but van Aaken's training and eating regimen no doubt pushed him down lower than he normally would be. Lower, in fact, than many people would consider safe or healthy.

Norpoth is van Aaken's idea of a classic runner: carrying strong motor inside a light frame. The idea, the doctor says, is to develop a powerful cardiovascular system capable of sucking in and using huge amounts of oxygen. The bigger a runner's heart volume is in relation to his body size, the more endurance he will have.

He explains: "The normal adult man has a heart volume of about 600 cubic centimeters. Sprinters have for the most part also only 600cc. Middle distance runners have a heart volume of 750-900 cc., the long distance men have volumes of 900-1200 cc., and many professional bicycle racers have heart volumes in excess of 1200cc. The largest hearts were found in professional cyclists, long distance rowers and marathon runners."

This is related to body weight. "If one divides the heart volume, expressed in cubic centimeters, by the body weight, stated in kilograms, the result is what I have termed the 'endurance quotient.' I have found that the best long distance runners in the world show a quotient of 17, while very good—not the top—distance runners have at the very least a quotient between 12 and 14.

"The astonishing thing, though, is that children 5-14 years of age whom I have examined have had much higher endurance quotients (often in the 12-

14 range) on the average than untrained adults. The reason for this is that in relation to their body weight children have a greater heart capacity, especially if they are lively children. To use a technical expression derived from the automobile, they have a strong 'heart motor' and a light 'car body.' "

Ideally, van Aaken thinks, all endurance runners should cultivate this combination—high fuel supply and lowest possible cargo.

"Breathing," he says, "is more important than eating. Without breathing, man perishes within a few minutes, whereas he would be able to work 40 days consuming nothing but fruit juice and vegetable juice."

Breathing is easier, van Aaken claims, when weight is light, while extra weights puts an unneeded burden on the oxygen system. This is why he recommends reducing to at least 10% below average wieght, and ideally 20% below. He says a runner needs 2000 liters of oxygen to burn away one kilogram (2.2 pounds) of weight, estimating that this requires about 100 kilometers of

Runners who are light at the start, van Aaken says, can get by on less training mileage. According to him, the greatest value of big mileage is as a weight-reducer. "Their (the extra-long runs) main effect on heavily-built Peter Snell was to get his weight down. They should not be used to excess for slim runners like Norpoth and Bodo Tummler (bronze medalist in the 1968 Olympic 1500-meters)."

Van Aaken thinks light eating is a better way to lose weight than long running. He recommends minimal caloric intake and periodic fasting.

He says, "If you eat little and train down to a low body weight, you will save oxygen—something our theoretical dieticians have apparently not thought about. Expressed in calories, a marathon runner must very often undercut the basic 1600 to 1700 calorie level—regardless of training and occupation—because the organism is able to get along on a minimum.

"It is not eating that makes the master, nor a particular diet. Rather, it is eating very little of the diet, and running on an empty stomach, running on 'trained' reserves of many kinds."

Here's where fasting comes in. He has found that occasional fasts teach the body to live on its own built-in resources. (It has the additional benefit of cutting weight.) "The middle and long distance runner of the future," he says, "must learn how to fast, the best thing being to run with a certain feeling of hunger. Digestion shortly before or during a race wastes energy.

Predictably, van Aaken comes out strongly against such practices as pre-race carbohydrate "loading" and eating on the run.

"Scientists recommend eating during the marathon, when it has been proven in practice that the best endurance results are achieved when one completely shuts off digestion during athletic activities and lives off reserves built up over a long time in training. It is therefore necessary to have fasted very often for a least 14 hours, in order to train the full distance with a completely empty stomach, so that carbohydrates are built up in the liver from reserves already present in the organism. Endurance activity can be carried on for days with almost no food, as was shown in a 500-kilometer walk in France in 1971."

When not fasting, van Aaken says,"a runner may eat anything he likes and what is customarily offered in his social surroundings. But he should not go beyond 2000 calories per day." He adds, "Only the athlete who runs daily, lives modestly and eats little but well will ever become a good runner."

Almost 50 years later, the Paavo Nurmi influence is still there.

FINDING IDEAL WEIGHT

Finding best body weight isn't easy. One way is to labor through a long trial-and-error process, checking results at different levels. This takes time. Another is to check a medical weight chart. This almost invariably will be too high. Another is to have a doctor measure your fat percentage. This is expensive.

There is no simple way to determine one's best weight—the level representing maximum strength with minimum extra baggage. Ideal weight is unique to the individual, based on his body makeup and the physical work he's trying to accomplish. A heavily-muscled, thick-boned man is naturally going to have a higher ideal weight than a light-bodied ectomorph. A sprinter, taking powerful bursts of effort, needs more muscle bulk than a distance runner gliding his miles. No single weight chart can suit them all.

At best, any formula is a generalization requiring individual interpretation. There are formulas, however, which give ideal weights with fair accuracy.

One formula, published in *Runner's World,* is not particularly accurate. That one indicates that the best weight for a distance runner is twice his height in inches. For instance, if a runner is 5'7" (or 67 inches) tall, he should weigh 134 pounds. This is fine—if you happen to be 5'7" tall. Otherwise, the formula is a gross over simplification. The farther one gets from 5'7", the less accurate the formula is.

Jack Bacheler is 6'6 5/8" inches tall. Under the height-doubled system, Bacheler should weigh 157 pounds. One of Jack's training partners pointed out—correctly—that "if he weighed 157 pounds, you wouldn't be able to see him." Bacheler might end up in the hospital if he reduced that severely. On the other hand, a 5'5" runner has it too easy. He might actually be pudgy around the middle at 130 pounds.

We need a better formula than that one to quote—one that is fair to people at the extreme heights. Medical doctor and author Irwin Maxwell Stillman has one which may be the best available.

Dr. Stillman takes a somewhat unorthodox, yet apparently highly successful, approach to weight reduction. Besides treating thousands of overweight patients, he has written two books—*The Doctor's Quick Weight Loss Diet* and *The Inches-Off Diet.* We'll have some of his suggestions later in this chapter, but here the formula is the point.

Stillman tells how to figure "average" weight for an individual's weight and height.

- *Men start with 110 pounds and five feet. For every inch above that height, add 5½ pounds.* If a man is 6'0" tall, he adds 66 pounds (12 x 5½=66) to 110 pounds. His average weight is 176 pounds.

- *Women start with 100 pounds (not 110) and five feet. For every extra inch, add five (not 5½) pounds.* A 5'5" woman adds 25 pounds (5 x 5=25) to 100 pounds. Her average weight is 125 pounds.

This isn't the end of it, though. There are two more catches.

1. In theory, people quit growing in their early 20s. Stillman says no one should ever weigh more than they did at age 25. *People under 25 sub-*

tract one pound per year from their average weight, down to age 18. (If the 6'0" male is only 20 years old, his average drops to 171 pounds.) The formula doesn't apply to rapidly growing children under 18.

2. Average weights are just a starting point. Stillman writes, "I don't believe we should be guided by average weights. They are often too high because Americans are generally overweight." He says *the ideal weight is 10% below the average for one's height and age.* (The 20-year-old, 6'0" male's ideal weight, then, is 154 pounds.)

Dr. Stillman further recommends, "If you're an athlete it is best to weigh about five pounds less than the ideal weight listed."

This formula is more fair than the old height-doubled idea. With it, Jack Bacheler sees he's really 15 ponuds or so eblow his "ideal" weight. The smug short guy finally sees he isn't as skinny as he thought.

RUNNING WEIGHT CHARTS

To save all the figuring, here is Stillman's weight formula in chart form. First for men, using 110 pounds and five feet as a base and adding 5½ pounds for each additional inch. For women, use 100 pounds and five feet as base figures, and add five pounds for each additional inch. (Deduct one pound for each year under 25, down to age 18.)

These calculations give AVERAGE weight. Subtract 10% of that for Stillman's IDEAL weight; subtract 20% for the distance runner's ideal recommended by Ernst van Aaken. (Weights here are rounded to the nearest pound.)

MEN'S WEIGHTS

Height	Ave.	-10%	-20%	Height	Ave.	-10%	-20%
5'0" (60")	110	99	88	5'9" (69")	160	144	128
5'1" (61")	116	104	93	5'10"(70")	165	149	132
5'2" (62")	121	109	97	5'11"(71")	171	154	137
5'3" (63")	127	114	101	6'0" (72")	176	159	141
5'4" (64")	132	119	106	6'1" (73")	182	164	145
5'5" (65")	138	124	110	6'2"(74")	186	168	149
5'6" (66")	143	129	115	6'3"(75")	192	173	153
5'7" (67")	149	134	119	6'4" (76")	197	178	158
5'8" (68")	154	139	123	6'5" (77")	203	182	162

WOMEN'S WEIGHTS

Height	Ave.	-10%	-20%	Height	Ave.	-10%	-20%
5'0"(60")	100	90	80	5'6"(66")	130	117	104
5'1"(61")	105	95	84	5'7"(67")	135	122	108
5'2"(62")	110	99	88	5'8"(68")	140	126	112
5'3"(63")	115	104	92	5'9"(69")	145	131	116
5'4"(64")	120	108	96	5'10"(70")	150	135	120
5'5"(65")	125	113	100	5'1"(71")	155	140	124

LONGER AND LIGHTER

You don't see obese runners (not fit ones, anyway), and only rarely do you see any heavy-boned or heavy-muscled enough to push their weight up above the so-called "average" for their height. Average weight for the general population tends to be the upper limit for all, except for a few sprinters.

Earlier in this chapter, Dr. Stillman offered a workable formula for figuring average weights. He said that 10% below that average is "ideal." Dr. van Aaken said that a distance runner should reduce to *20%* below average.

We checked out these recommendations on the basis of what leading runners actually weigh, and the height-weight figures come out close to Stillman's and van Aaken's ideals.

The analysis involved about 300 of the top American male runners—the best 10-30 athletes in each of the running events for 1972. *Track & Field News* supplied the height-weight data. Stillman's weight formula (see preceding article) is the basis for the calculations.

Preliminary checks indicated that sprinters are heaviest and runners get progressively lighter as they go up in distance—marathoners being lightest. This fact is based on physiological principles: Faster, more explosive runs require greater muscle power and bulk, and require less total energy expenditure; longer runs use leaner endurance muscles, and continuous effort burns up more calories. Thin runners gravitate towards the longer distances, and the act of running long makes them leaner yet.

Let's go to the comparative figures and see if this is indeed how it works, and to what extent.

Heights for all runners, regardless of event, average about the same—about 5'11"...except for the hurdlers. Obviously, the best hurdlers need long legs. They are, as a group, about two inches taller than the runners. In weight:

- **Sprinters** (100-440 yards) are the heaviest of the runners—but they are still a bit lighter than the average man. The typical sprinter in this sample is 23 years old, 5'11" and 163 pounds. He's 2½% lighter than average for his height and age.

- **Hurdlers** (120-yard highs and 440-yard intermediates) are considerably lighter than sprinters running comparable distances. The typical 23-year-old, 6'1" hurdler weighs 168 pounds—or about 6% below average.

- **Middle distance runners** (880 to six miles) are lighter yet. As a group, they're well below Stillman's "ideal" with a combined percentage 12% under normal. Middle distance men's average is 23, height 5'10½", weight 147.

- **Long distance runners** (above the track distances) are the lightest of all. At 15% below normal, they're edging toward van Aaken's "ideal." The average marathoner is 25 years old, 5'10½" and 142 pounds.

- **Walkers** (20 and 50 kilometers) are somewhat heavier than their distance running counterparts. At age 30, 5'11" and 153 pounds, they average 10% below normal.

The accompanying chart breaks down the figures by event—100, 220, etc. The trend to lighter weight for longer distances is just as pronounced here.

Overall, the best weight for sprinters seems to be somewhere between the average for an individual's height and age to perhaps 10% below. In this study, an equal number of 100-yard sprinters are slightly *above* average and slightly below. A few of the "overweights" hang on in the 220, a smaller percentage yet appears in the 440 and hurdles, and only one above-average man showed up in the 880 and mile. From there up, there are none.

The heaviest concentration of sprinters and hurdlers are in the average to minus-10% category. This area accounts for about seven men in every 10.

At the 880, however, the emphasis shifts. This is the start of endurance running. Each step up from there, an increasing majority of runners carry weights 10 to 20% below average. A significant number of runners (one in five marathoners) are lighter than 20%.

The message is clear. Weight definitely is related to running performance —increasingly important as distance goes up. It is extremely rare in races above a half-mile to see a runner of even "average" weight. The normal man's average weight is the runner's obesity level. We have a lower set of weight standards because our performance standards are higher.

EVENT-BY-EVENT MEASUREMENTS

This chart is based on data from the leading US male runners during the 1972 season—about 300 athletes in all. The right-hand column is the most important one. It lists how far below average weight the runners in each event are. Only in the 100 are the weights average; the rest are well below.

EVENT	AGE	HEIGHT	WEIGHT	% BELOW
Sprints				
100	23.0	5'10.0"	163.3	–
220	22.7	5'10.7"	161.5	3.3%
440	23.1	5'11.6"	165.2	3.7%
Hurdles				
Highs	22.5	6'1.5"	174.6	3.8%
Intermediates	23.3	6'0.7"	163.4	8.5%
Middle-Distances				
880	22.5	6'0.3"	157.2	10.4%
Mile	22.7	5'11.0"	149.1	12.0%
3 miles	23.6	5'10.4"	146.0	12.3%
6 miles	24.6	5'10.1"	143.0	12.8%
Steeplechase	23.3	5'10.8"	143.7	14.2%
Long-Distance				
Marathon	25.6	5'10.3"	142.0	15.0%
Race Walks				
20 kilometers	30.4	5'11.2"	153.6	11.0%
50 kilometers	29.8	5'10.7"	152.3	10.0%

NEW WEIGHT-WATCHERS

Weight-watching is the great American pastime. Like the weather, everyone talks about weight but they don't do much to change it.

Runners can't afford just to talk about theirs, however, because weight is particularly critical to them. If it slips outside the narrow boundaries of the ideal range, performance shows it. They have to put weight where they think it belongs, then watch that it stays there.

In this sense, the runner's scales are as important to him as his stopwatch. A daily weight record is as valuable as a daily mileage tally.

Running weight-watching is tricky, for several reasons. Here are a number of points to keep in mind. Some are suggestions, some are warnings.

1. **Decide on ideal weight.** The Stillman-van Aaken formulas offer good starting points, but they have to be tempered by your personal situation. Listen to the lessons of your own experience. They'll tell what the personal ideal is.

2. **Get to that ideal weight.** If you're there not already, chances are you're on the high side. There are lots of ways to get down—all of which involve (a) work and/or (b) sacrifice; running more and/or eating less. Dr. Stillman advises, "Eat to satisfy your hunger, not to pamper your appetite... You're better off eating smaller meals six times a day than three bigger meals as is the general custom."

3. **Lose gradually.** The only successful diets are those which modify overall eating habits and are fairly easy to carry on for periods of months and years. Drastic, quick-loss schemes are often self-defeating because (a) they're hard to stick with, and (b) they may disrupt internal equilibrium and drag down performance.

4. **Keep a record.** Weigh every day, at the same time and under the same conditions. An easy system to follow is to weigh yourself first thing in the morning, after you've gone to the bathroom and before you've put on clothes, run or had breakfast. Write the weight alongside the record of everyday running.

5. **Don't be fooled by false losses.** "False" losses are liquid drains. A Runner can easily lose four or five pounds of sweat a day by running. In a year's time, he may sweat away a half-ton of weight. Obviously, this is a temporary loss, lasting only as long as it takes to do some heavy drinking. The liquid losses needn't concern you unless they show up the next morning in a 2-3 pound weight drop. Sudden drops like this are symptoms of chronic dehydration.

6. **Watch for creeping gains.** Weight doesn't usually accumulate overnight. These gains are easy enough to handle if they do occur. The hard ones to catch are the ones you hardly notice. A few extra calories a day may add no more than a few ounces a month, but over a year's time these ounces multiply into pounds. You wake up one morning five years later and realize you've gained 10 pounds. Here again daily weight-watching is invaluable. Dr. Stillman says, "Any time you see that scale mark three pounds more than your desired weight, consider it more serious than if your thermometer showed three degrees or more over your normal temperature."

7. Running isn't an invitation to gluttony. The runner doesn't inherit a license to eat. The sport burns up a hundred or so calories a mile; an hour's run uses around a thousand. It takes about 3500 calories to lose a pound, or the same to gain one. A milk shake can cancel out the weight-losing effect of an hour run.

8. Runners have efficient systems. As they get into better and better condition, the body "idles" at a lower rate than the average person's. The effect is that he burns a bundle of calories while running, but uses a lot fewer to survive the rest of the day. Therefore, he may not need gross amounts of food.

9. Stay out of the vicious cycle. This starts with thinking a higher-than-ideal weight is the best one. Running reduces it. You eat heavier to push it back up. The body works harder to get it back down. You eat; you strain. You eat, you strain. Van Aaken says one of the main reasons for super-long training is to reduce weight. If the weight is already low, you're already halfway there—without so much long, hard running.

10. This isn't kid's stuff. Little of the information in this chapter applies directly to growing children. They need plenty of food to grow on, and shouldn't be restricted unless they're obviously fat. Young children and teenagers who run probably are so light already that none of this need concern them. Dr. George Sheehan agrees with van Aaken that young children are the greatest natural runners.

Sheehan writes of a pre-teenager: "He is pound for pound the world's best endurance athlete. And he moves with the grace and elegance of the free animal. Strength and power he may not have, but fatigue is foreign to him. This is because he has the biggest heart volume for his weight that he will ever have unless he is an Olympic champion. He is therefore the nearest thing to perpetual motion in human form you will ever see, and yet at other times he is capable of the contented lethargy of a lion after a kill."

Both the perpetual motion and contented lethargy vanish gradually with age—and added weight. The point where he quits growing up and starts spreading out is the critical one. Stillman's weight calculations begin at age 18, and he says no one should gain another pound after age 25. Between 18 and 25 is when the gap between ideal and reality begins to show and spread.

FAST, FASTER, FASTEST

BY GARY CHILTON

In 1968, I took some positive action. I tossed out my cigarettes, began a weight-loss diet and started jogging. Today, four years later and 45 pounds lighter, I am the proud owner of a couple of sub-three-hour marathons. During my four-year journey from sickness to health, I have had experiences with diet and weight control which may be of value to other runners who have had to fight the battle of the bulge. As a result of my experience with training, special diets and fasting, I am convinced the greatest single limiting factor in successful long distance running is body weight.

This does not imply that training is unimportant. I am merely suggesting that optimum training and improvement can take place only when the runner is at his "ideal" weight. In other words, if a runner is carrying 10 or 15 pounds of excess baggage in the form of fatty tissue, and continues to consume enough calories to maintain this excess, then no amount of running training can bring about an optimum performance level. On the other hand, dramatic and almost instantaneous improvement in running performances can be noted even on reduced mileage when proper attention is given to diet and weight control.

I offer my own case history as an example. I began reducing from 185 pounds. The height/weight charts indicated an average weight of around 155 pounds for my 5'10" medium frame. With a balanced but reduced calorie diet and a daily four-mile jog, I was able to lose the indicated 30 pounds within a few months. According to my doctor, I was in excellent health and my weight was just right for my build. At the time, I had no reason to doubt the doctor's observation. At 155 pounds, I felt better than I had in years and my casual jogging had developed into competitive long distance running.

For almost three years, I trained and raced at 155 pounds. My training was almost exclusively slow continuous running–sometimes 80 and 100 miles a week. Improvement was slow. Also, I concluded that 3:20 marathons were about the best a 34-year-old ex-fat guy should expect on three years' training. I was beginning to think running wasn't worth the effort.

About that time, I read about Ernst van Aaken, who advocated–among other things–drastic weight reduction for long distance runners. According to Dr. van Aaken's recommendations, I should weigh between 130 and 140 pounds–a far cry from my comfortable 155 pounds. Dr. Van Aaken also recommended occasional days of strict fasting in order to teach the body to live on reserves. The recommendations seemed to make a lot of sense so I decided to experiment.

I started with a three-day fast during which I drank only small quantities of orange juice, vegetable juice and unsweetened tea. Training during this period was eight miles per day at about an eight-minute pace. This first attempt at fasting was unpleasant, to say the least. I was uncomfortable, hungry and my running was strained. In spite of the discomfort, the fast was effective in removing about six pounds.

For the next few weeks, I followed a program of fasting one day a week and restricting my intake to less than 2000 calories on the remaining days.

Within three weeks, I had lost about 15 pounds and I began to notice a dramatic improvement in training performances as well as an unusual sense of lightness, agility and overall well-being.

During this weight loss program, I maintained an average of about 60 miles per week of easy running. I was chopping minutes off my training loops with absolutely no increase in effort. A loop which had been difficult to run in less than 1:45 suddenly became an easy effort at 1:35. Another loop which had been a strain to cover in less than 1:22 suddenly became a relaxed 1:15 effort. A one-hour loop became a 50-minute loop. I was training at a pace between 30 seconds and a minute per mile faster than three short weeks before—and I was doing it with less effort!

The decrease in running effort was accompanied by other indications of increased capacity. Within a one-week period, a resting heart rate which had been 48 for two years fell to 42. An increased ability to withstand heat was noted as well as an increased capacity for running uphill. The weight loss alone was responsible for this increased training capacity since I had made no other changes in diet or routine.

Increased training performance has also been reflected in improved racing times. An eight-mile course which took 52:32 to cover two years ago I have recently covered in 46:47. A marathon course which took 3:33 two years ago has been improved to 2:57. I have only trained a short while at this new level of fitness and I am looking forward to continued improvement.

I attribute my improved training and racing performances to weight loss accomplished through strict fasting. The reduction in weight allows a greater level of training to be tolerated without an increase of effort. Maintaining a lower weight also allows a great degree of freshness to be retained while running "quality" workouts. Increased tolerance for heat reduces overall stress and makes workouts more enjoyable. Without the extra weight, I'm running less and enjoying it more.

If course, a lot of runners don't have a real weight problem, but I'm willing to bet that a good percentage are carrying more than they need for optimum performance. It's all too easy to tell ourselves that our running alone will keep us at the proper weight. This kind of reasoning is an automatic license to eat everything in sight.

Sometimes an illness or injury forces a layoff and we don't give proper attention to adjusting our intake. A person with the metabolism and appetite of a distance runner can blow up like the Goodyear Blimp with a few weeks of inactivity. Just a few pounds of fat can make a big difference in running performance. If your running has been at a standstill for awhile and you haven't been on the scale lately, maybe you have accumulated some excess baggage.

Check yourself. If you aren't 10-20% below what the standard height/weight charts recommend, maybe a weight reduction would give you that short in the arm you've been waiting for. Travel light. It makes a difference.

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