How To Lose Weight

Manuel García, Jr.
2 March 2013

Too many people in the industrialized nations have come to realize they are "fat." (1) Often, they eat processed foods that may be "convenient" and "fast." Their perception of being overweight may range from a somewhat severe self-assessment corresponding to being a few pounds (a kilogram or two) above the physiological ideal for their height, to finally being a breakthrough admission to having a serious problem with obesity.

Beyond the psychological factor of anxiety about appearance because of excess body fat, an overweight or obese person might suffer from consequent related health risks and maladies, such as: artery wall thickening by fat accumulation along the interior surfaces (atherosclerosis), elevated blood pressure (hypertension), type 2 diabetes (or its possibility because of a chronic excess of glucose in the blood), difficulties breathing and sleeping (sleep apnea), back and knee pain (arthritis), and perhaps ultimately strokes, heart attacks and cancers.

The mechanisms thought to explain the association of excessive body fat with the increased risk of cancer involve changes to hormone production and immune responses, and some influence by the chronic state of low-level inflammation resulting from obesity. The National Cancer Institute summarizes the link between obesity and cancer as follows: "Obesity is associated with increased risks of cancers of the esophagus, breast (postmenopausal), endometrium (the lining of the uterus), colon and rectum, kidney, pancreas, thyroid, gallbladder, and possibly other cancer types." (2)

Another cancer risk is that animals can accumulate chemical toxins (e.g., mercury) and carcinogens (e.g., polychlorinated biphenyl compounds, PCBs) from polluted environments into their fat, and that subsequently accumulate in the fat of the humans who consume them.

Given an epiphany that one is carrying excess body fat, the immediate next thought is: how do I lose the weight? This article describes my answer to that question. Since human variety is so diverse, I cannot possibly assume that my answer will work for you, so I make no claims for what follows beyond that it is what I am doing, and it has helped me.

Attitude

Losing weight and then keeping yourself from regaining it requires a determined attitude based on three ideas: everything in my life that contributes to weight gain must change, there are no shortcuts or excuses, my commitment is permanent.

Goals

Setting clear goals helps you remain firm in your resolve to maintain (forever) the regime of diet and exercise -- let us call it the *Personal Routine For Metabolic Management* (PRFMM, or PeRForMM) -- to be established. Our four goals are:

to maintain blood pressure within the *desired* ranges of 90-119 systolic pressure (mmHg) and 60–79 diastolic pressure (mmHg), or to lower hypertension as much as possible with the PRFMM so that even if hypertension-reducing medications are needed the doses can be minimized;

to eliminate a chronic excess of sugar (glucose) in the blood and thereafter prevent its buildup (to end the risk of developing type 2 diabetes), or to lower blood glucose levels as much as possible with the PRFMM so that even if glucose-removing medications are needed the doses can be minimized;

to maintain body mass (weight) within the range designated as *normal* for one's height by the physiological measure known as the *Body Mass Index* or BMI (to be described just below), or to reduce excess weight as much as possible with the PRFMM;

to improve physical endurance with the aerobic exercise component of the PRFMM, to maintain strength with the anaerobic exercise component, to improve flexibility and muscle tone by stretching, and to slow the inevitable rates of decrease of endurance and strength due to aging.

Body Mass Index

BMI is a physical quantity based on body mass and height, which has been found to correlate with the percentage of body fat. BMI is the ratio of body mass, in kilograms, divided by the square of the height in meters. The units of BMI are kilograms per square meter. The ideal body mass for a given height has been found to correspond to a BMI of 25.

Actually, there is a range of body mass (called *normal*) that corresponds to physiologically ideal conditions. The various ranges of the full BMI scale are characterized as follows, for BMI: under 15, *very severely underweight;* between 15 and 16, *severely underweight;* between 16 and 18.5, *underweight;* between 18.5 and 25, *normal;* between 25 and 30, *overweight;* between 30 and 35, *moderately obese;* between 35 and 40, *severely obese;* over 40, *very severely obese.*

To find BMI (in kilograms per square meter) using body mass measured in pounds, and body height measured in inches, divide the pounds by the square of the height in inches, and then multiply that result by 703.

An individual of 81 kilograms (178.6 lb) at 1.8 meters (70.9 in.) has BMI equal

to:

BMI (using kg and m) = 81/(1.8x1.8) = 25,

BMI (using lb and in.) = [178.6/(70.9x70.9)]x703 = 0.03553x703 = 24.98, which is obviously equivalent to 25 for our purposes.

Given your height, H, in meters, then your weight at BMI equal to 25 can be called your *ideal weight,* and is given in kilograms from the product 25xHxH. For example, an individual 1.8 meters tall would calculate an *ideal weight* of 25x1.8x1.8 = 81 kilograms.

To calculate the *ideal weight* in pounds for a given height H measured in inches, one uses the formula (25xHxH)/703. The calculated *ideal weight* in pounds for an individual 70.9 inches tall is (25x70.9x70.9)/703 = 125,670/703 = 178.8 pounds. A weight of 178.8 pounds is equivalent to 81.1 kilograms (note that had we used BMI equal to 24.98 in this calculation, the resulting *ideal weight* would be 178.6 pounds, which corresponds to 81 kilograms).

If you multiply your BMI by 4 you can interpret that number as a percentage for your weight in comparison to your *ideal weight,* 4xBMI = % of *ideal weight.* For example, a person with a BMI of 30 has a body mass that is 120% of the ideal for his or her height.

The following conversions are listed here for convenience: 1 kilogram = 2.20462 pounds; 1 centimeter = 0.393701 inch; 1 pound = 0.453592 kilogram; 1 inch = 2.54 centimeters; 1 meter = 100 centimeters; 1 meter = 39.371 inches.

What is your BMI?

Initial Change Of Diet

Immediately stop the consumption of "convenience," "fast," "snack" and processed (packaged) foods, and all desserts, sweets and "treats" (solid and liquid). Essentially, stop eating: sugar (sucrose and high fructose corn syrup), refined carbohydrates (food items made with flour), fats (as in meats, dairy, shellfish, eggs, margarine, vegetable oils and fried foods), added salt and salty food items, and starchy foods (like white rice and potatoes). Also, reduce alcohol consumption as much as possible (ideally to zero).

Immediately begin a diet based primarily on leafy vegetables eaten raw (salads, which can be dressed with olive oil, vinegar, lemon juice and pepper), steamed vegetables (like broccoli, green beans, asparagus, brussels sprouts, sea weed), and fresh fruit.

Supplement this vegetable diet with fresh fish, ideally high in omega-3 fatty acids (which are nutrients essential to metabolism and which the body cannot produce)

and low in accumulated heavy metals (e.g., mercury) and fat-soluble pollutants (e.g., PCBs and dioxins), like wild-born wild-caught salmon.

Omega-3 fatty acids originate abundantly in the algae eaten by the little fish that the carnivorous salmon gobble up in the wild. Aquaculture (captive) salmon are usually fed a combination of fish meal, wheat byproducts, soy meal and processed poultry feathers (steam pressure cooked, dried, and ground into meal), and would be deficient in omega-3 fatty acids if their feed were insufficiently rich in fish meal (which is why more than 50 percent of the world fish oil production is fed to farmed salmon). Because a number of major hatcheries release young salmon into the wild to forage and fatten up, much wild-caught salmon is now really ocean-ranched salmon.

In a situation similar to that of feedlot cattle, farm raised salmon spend their lives in confined aquatic spaces near shore with high concentrations of their own wastes along with related and coincident industrial pollutants, and they are dosed with antibiotics and pesticides to ward off the epidemics of diseases and parasites that arise under such conditions. The salmon you find in your local markets is most likely farm raised. Other commonly farmed fish include tilapia, catfish, sea bass, bream and trout. (3)

Because "the levels of chlorinated pesticides, dioxins, PCBs and other contaminants are up to 10 times greater in farm-raised salmon than in wild Pacific salmon," and the salmon usually available to you will most likely have been farm raised, it is best for children, young people and pregnant women to limit their consumption of salmon to only a few times a year. However, if one is middle-aged or older and is most immediately concerned about cardiovascular health (which benefits from consuming omega-3 fatty acids) instead of fearing the more distant risk of accumulating carcinogenic pollutants from fish meat, then eating salmon more often is a good choice. (4)

In addition to eating fresh fish, supplement the basic diet of greens with: beans, whole grains (like brown rice), and occasionally meat (100% pasture raised, not grain-fed and injected with growth hormones and antibiotics).

Get a copy (borrowed from your local public library, or purchased) of Michael Pollan's book *In Defense Of Food*. From this, learn how to distinguish *real foods* (which are raw "whole foods" prepared or cooked as "slow food") from processed foods. Apply this knowledge to guide in developing your food buying and preparation and social eating strategies, and to expand and refine your new diet regime as you reduce body mass, invigorate, and refine your PRFMM.

Metabolic Rate

A *calorie* (cal) is the amount of energy required to raise the temperature of one gram of water (at sea level pressure) by one degree Celsius. In this report *calorie* will refer specifically to the *thermochemical calorie,* which is equal to 4.184 joules

(J) of energy.

An amount of energy equal to 1000 calories is called a *kilocalorie* (kcal). On a daily basis, the human metabolism expends somewhere in the range of 200,000 to 4 million thermochemical calories. Thus, it is more convenient to quantify human metabolic rates in units of *kilocalories* (per unit of time). As a result, in dietary literature the physical chemist's *kilocalorie* is referred to variously as the: *large calorie, nutritionist's calorie, dietary calorie, food calorie,* or most confusingly as the *Calorie* with a capital C and abbreviated as Cal. In this report *calorie* (cal) and *kilocalorie* (kcal) will be used exactly and explicitly. To repeat, "food calorie" is *kilocalorie* (kcal).

Power is the rate at which energy is used, and is measured in units called *watts* (W). A *watt* is equal to the application or transfer of one joule per second (J/s), 1 W = 1 J/s.

A summary of energy and power units, and conversions, is listed here for convenience: 1000 cal = 1 kcal; 1 cal = 4.184 J; 1 kcal = 4.184 kJ; 1 J = 0.239 cal; 1 kJ = 239 cal; 1 W = 1 J/s; 1kW = 1000 J/s = 1 kJ/s; 1 W = 0.239 cal/s; 1 kW = 239 cal/s = 0.239 kcal/s; 1 kcal/s = 4.184 kW.

An older and less precise unit of power is the *horsepower* (hp), which we can equate to 746 W. Thus, 1 hp = 0.746 kW = 178.3 cal/s = 0.1783 kcal/s. Inversions of these are: 1 kW = 1.34 hp; 1 kcal/s = 5.61 hp.

The human metabolism operates at a continuous rate *of the order* of 0.1 hp (74.6 W) just to keep us alive. The total energy used in this way during a 24 hour period is 1541 kcal (in this specific example of 0.1 hp). This continuous use of energy keeps our hearts and lungs pumping, our brains and nervous systems alive and warm, and the many organic processes of our bodies in operation. This particular metabolic rate of 0.1 hp is equivalent to the "burning" of 0.018 kcal per second, or 1.07 kcal per minute, or 64.2 kcal per hour. We call this necessary and minimal metabolic rate the *basal metabolic rate* (BMR).

As humanity is diverse in individual size, age, condition and intrinsic rhythm, the range of BMR is wide. A woman of 90 years, 90 lb (40.8 kg), and 60 inches (1.52 m) has a BMI of 17.6 (underweight), and a BMR of 868 kcal per day (kcal/d). A lad of 20 years, 260 lb (118 kg), and 82 inches (2.08 m) has a BMI of 27.2 (overweight), and a BMR of 2551 kcal per day (kcal/d). There are probably human lives with BMR as low as 200 kcal/d, and as high as 4000 kcal/d.

Of course, most humans do more than simply sleep all day, so our additional motions and activities expend energy and increase our *daily metabolic rate* (MR). If we lead sedentary lives then our *daily metabolic rate* might be 120% of BMR, and if we are engaged in rigorous physical activity for much of the day, we might increase our *daily metabolic rate* to 190% of BMR. For example, the age 90 woman with a BMR of 868 kcal/d might lead a quiet life of careful activity, at

120% of BMR, expending 1042 kcal per day; the age 20 professional footballer with a BMR of 2551 kcal/d, and activity at 190% of BMR, would expend 4847 kcal/d.

It is interesting to consider how much power a human being can produce bodily in short bursts. Human power at the rate of 1.2 hp delivers 0.21 kcal per second, 12.8 kcal per minute, and 770 kcal per hour. If the age 90 woman could operate at this rate, perhaps in an emergency, she would have less than 14 minutes (expending 174 kcal) before reaching exhaustion for the day (a total of 1042 kcal). The age 20 footballer might be able to operate at this rate for nearly 3 hours (expending 2296 kcal), before reaching exhaustion (a total of 4847 kcal) for the day. (In these examples, we assume that daily metabolic needs are met exactly by the caloric content of consumed food, and we are not considering the metabolization -- burning -- of stored body fat to extend the performance times.)

Human power at the rate of 2.5 hp delivers 0.45 kcal per second, 26.7 kcal per minute, and 1605 kcal per hour. This rate of human power is really only achieved in short bursts by highly trained athletes. If by some miracle the age 90 woman could operate at this rate, she would exhaust herself in less than 7 minutes (expending the 174 kcal that usually powers all her daily activities beyond her BMR). The age 20 footballer might be able to operate for 86 minutes (1 game?) at this rate, before going to the showers.

In 1919, James Arthur Harris (1880-1930) and Francis Gano Benedict (1870-1957) published a study on human metabolism, which included formulas (for men and women) for calculating *basal metabolic rate* based on the weight, height and age of the individual. These formulas were revised in 1984 by A.M. Roza and H.M. Shizgal. (5)

Let W, H, and A represent weight, height, and age, respectively. Simplified forms of the Harris-Benedict equations will first be stated (for men and women) with W in kilograms, H in centimeters, and A in years. Then they will be shown for W in pounds, H in inches, and A in years.

Simplified H-B equations (kg, cm, years):

BMR (men) = 88.4 + (13.40 x W) + (4.80 x H) - (5.68 x A)

BMR (women) = 447.6 + (9.25 x W) + (3.10 x H) - (4.33 x A)

Simplified H-B equations (pounds, inches, years):

BMR (men) = 88.4 + (6.08 x W) + (12.19 x H) - (5.68 x A)

BMR (women) = 447.6 + (4.19 x W) + (7.87 x H) - (4.33 x A)

What is your BMR?

The Metabolic Energy Balance

The power we expend as our *daily metabolic rate,* MR (in units of kcal per day), must be supplied by the caloric (heat energy) content of the food we eat, and any bodily stored energy that we burn. If we ingest an oversupply of food on a daily basis, then the excess energy must be stored in the body as sugar and fat. If we ingest a deficit of food, then that deficit must be made up by burning stored energy. The metabolic energy balance is:

energy intake = internal heat produced + external work + energy stored. (6)

Energy intake is the caloric content of the food consumed daily.

The *internal heat produced* is largely the BMR (an energy expended per day), with a small additional amount of energy needed daily to metabolize the food ingested (equal to about 10% of the energy intake).

The *external work* is the energy powering the sum of activities during the day.

The *energy stored* is in the form of glycogen (stored sugar) in the muscles and the liver, and body fat. When bodily stored energy is burned (weight loss) instead of accumulated (weight gain), we call it *negative energy stored,* or *stored energy burned.*

The following six cases are identified from the energy balance, and they are listed in order of decreasing *energy intake,* or from gluttony to starvation.

If the *energy intake* is greater than *internal heat + external work,* then energy is stored bodily and weight is gained.

If *energy intake* is equal to *internal heat + external work,* then no storage occurs and weight is unchanged.

If *energy intake* is less than *internal heat + external work,* then stored energy is burned and weight is reduced.

If *energy intake* is equal to only the *internal heat,* then the *stored energy burned* is equal to the *external work,* and weight loss is optimized.

If the *energy intake* is less than the *internal heat,* then the *stored energy burned* includes loss of muscle. This is the situation of a *starvation response.* If the *external work* were reduced to zero in this case, the burning of stored energy would still be necessary to maintain that portion of the *internal heat* not supplied by food energy. The body must partially consume itself to maintain vital functions.

If the *energy intake* is zero (no food), then *stored energy burned* is equal to *internal heat + external work.* This life is drawing energy entirely from bodily reserves. As muscle is consumed in this process, activity will diminish. When activity, *external work,* becomes negligible, then the *stored energy burned* is reduced to just supplying the *internal heat* (now entirely BMR), a condition of total self consumption.

Clearly, the best strategy for weight loss is to increase MR significantly above BMR with an exercise routine, and to eat just enough food that your caloric intake is a bit more than the BMR.

An equivalence that is part of dietetics lore is that 3500 kcal of effort is required to burn off 1 pound of body fat (7716 kcal/kilogram). Since the anticipated loss rate of stored energy with the optimum strategy is (MR - BMR) *kilocalories per day*, we could estimate a *weight loss rate* (WLR) as:

WLR(lb/d) = (MR - BMR)/3500

WLR(kg/d) = (MR - BMR)/7716

where the first form shown is in units of pounds per day, and the second form shown is in units of kilograms per day.

For example, if MR - BMR = 1050 kcal/d, then WLR = 0.3 lb/d (0.136 kg/d). This WLR corresponds to a healthy body mass reduction rate of 2 pounds a week, 3 pounds every 10 days, 9 pounds a month (0.9 kg/week, 1.36 kg every 10 days, 4.08 kg/month).

For "Joe Typical" (male) with a BMR of 1750 kcal/d, daily activity of 1050 kcal would raise his MR to 2800 kcal/d, and represent an *activity level* (AL), or multiplier to BMR of 2800/1750 = 160%. This level of activity is moderately heavy, being about halfway between *sedentary* (120%, an MR of 2100 kcal/d for Joe) and *very heavy exercise* activity (190%, an MR of 3325 kcal/d for Joe).

We now have all the theoretical results needed to characterize our physiological state (BMI, BMR), to know how much to eat during a program of optimized weight loss (just over BMR), and how to estimate our anticipated rate of weight loss (WLR) given an assumption (or data) about the activity level (AL) we will (or now) maintain so as to elevate our *daily metabolic rate* (MR). It is time to put theory into practice.

Devising An Exercise Routine

An ideal daily exercise routine is efficient with respect to: time, space, money and necessary equipment. My specifications for these four parameters were: 20 minutes, a rectangle no larger than 11 feet x 6 feet (3.35 m x 1.83 m), $0 and carpeted floor.

The ideal routine can be done at home. If it does not require special locations, travel time is eliminated. A 20 minute period of exercise is enough to stretch and perform calisthenic motions to raise MR, and it is a sufficiently modest portion of the day that the routine can always (with rare exceptions) be performed.

What is needed is enough clear floorspace to stretch and do repetitive body-motion exercises lying, prone, sitting, standing, jumping, bending, twisting, swinging arms, and in which you may slide lengthwise toward walls when lying.

To become master of your own metabolic management, do not let others commercially exploit it. Look at cats, how beautifully they stay in shape (unless you confine and overfeed them) without needing a membership to a "health club." Along with self-directed exercise, purging your body of the unhealthy residues of commercially processed food, and preventing their reintroduction, is the dietary part of a complete plan (PRFMM) for the care and feeding of your metabolism.

The only equipment required in a routine of *stretching* and *calisthenics* is padding on the floor, for comfort. We want an indoor space (at home) for all-season, all-weather MR-raising activity.

An exercise routine that meets the above four criteria will be easy to perform in many other places, it is portable. You should be able to perform it while away on travel by finding appropriate indoor spaces (e.g., your hotel room), and even outdoors on soft ground in good weather.

Exercises are of two types: static, where the body is held in a pose while muscular effort is exerted, and dynamic, where the body moves briskly. In the first sessions of a new exercise regimen, you may wish to only do stretching so as to familiarize yourself with your body's initial limits as regards your extent of bend, reach, twist, and range of motion in various poses.

NEVER STRAIN (never "push," "jerk," or "pull" yourself into pain, which can have the sensations of "tearing" or "pins and needles"). NEVER LOCK OR TWIST THE KNEES. Remember, healthy exercise and weight loss are PAINLESS, *and* a good deal of work requiring iron discipline.

As you "loosen up" with subsequent sessions, you will soon want to spend more of your daily conditioning period doing dynamic exercises whose motions repeat about once a second (a frequency of 1 hertz), and whose action sweeps through your range of motion for that maneuver. Some of the movement exercises you choose to do may suggest themselves as animated analogs of your stretching moves. Over time, try to increase the fraction of your exercise period devoted to movement until that fraction is over half (or to your level of comfort).

A good routine is efficient: time not spend in dynamic exercise (*calisthenics*) is

spent in static exercise, specifically *stretching* and *isometrics.*

Stretching improves your body's flexibility. For each stretch, the pull in the muscles being extended is held for at least a half minute at the current safe limit of your reach or range of motion in that pose.

Isometrics are static exercises for maintaining and building strength. They are performed by exerting muscle power to support your body's weight against gravity, or to push against rigid structures like floors, walls and doorways.

The stretching and isometric poses that you choose for your exercise routine could be some of the asanas of Hatha Yoga, which is an ancient system of rhythmic breathing coordinated with stretching, isometrics, relaxation and meditation. However, you would not want to include the asanas for breathing exercises, relaxation and meditation in your routine to raise metabolic rate. You can certainly perform these relaxing forms of Yoga *in addition to* your daily exercise routine, to enjoy their benefits in calming and refreshing the mind.

As your condition improves, you can periodically increase the number of repetitions of any of your calisthenic moves. I use the rule that once I increase the number of a particular move, I can never thereafter do less.

Go to your comfortable floorspace, sit, and see if you can bend forward to touch your toes without straining your lower back (NEVER STRAIN YOUR LOWER BACK). Whatever your reach, hold it and breath slowly, and on exhalations try to inch gently forward just a mite more. Hold that. Eventually you arrive at your safe limit for the day, and you feel the tension of stretching along the backs of your legs, body warmth, and are possibly flushed (heart is pumping oxygen enriched blood), and even breaking out into a slight dew of perspiration. Do it again tomorrow, and you will be more flexible and stronger, and so starts a lifetime in a discipline of self-renewal.

The Formula For Optimized Weight Loss Rate

Consider the situation of an individual whose lifestyle is sedentary with the exception of a daily exercise routine. This particular individual wishes to lose weight at an optimum rate and so maintains a diet that supplies food calories at a rate very slightly above their BMR. What *weight loss rate,* WLR, can this person anticipate given a particular exercise routine, which is characterized by its *total number of calisthenic moves at 1 Hz,* EXm, and the *total time in minutes of the exercise session,* Tt (and static exercises fill the time intervals between the calisthenic series)?

Note that if one does five different sets of calisthenic exercises in a session, each set separated by a period of static exercise, and the number of repetitions within each set were equal to the numbers represented by N1, N2, N3, N4 and N5, respectively, then EXm would equal the sum N1 + N2 + N3 + N4 + N5. Also, the

total time in minutes spent in calisthenic motion is equal to EXm/60.

It takes energy to convert food mass into glucose. We must sip, masticate and swallow, then digest (chemically process) the food to produce the actual fuel our body uses to power its metabolism. This process of conversion may represent an overhead of 1% of the caloric content of vegetables, and perhaps 10% for harder to digest foods like animal protein. So, to supply metabolized food calories at a rate matching BMR will require a slightly higher rate of food energy intake. This is called the *thermic effect of food*. (7)

As shown earlier, the *daily metabolic rate* MR is related to the *basal metabolic rate* BMR by a proportionality called the *activity level* AL, hence MR = AL x BMR.

We consider AL values above 1.2 (that of sedentary life), and for convenience ignore the *thermic effect of food* (which we could not do if we were considering the metabolic energy balance of essentially static human life, such as of bedridden individuals). So, in the following model of optimized weight loss we will assume that food calories consumed per day are equal to BMR.

Replacing MR by (AL x BMR) in the previous formulas given for WLR (*optimized weight loss rate*), we arrive at:

WLR(lb/d) = (BMR/3500) x [AL - 1]

WLR(kg/d) = (BMR/7716) x [AL - 1]

Based on a study of my own metabolic history for several months, I arrived at the following model of the dependence of AL on the duration of each of the dynamic (*calisthenic*) and static (*stretching* and *isometric*) parts of a daily exercise routine.

AL = 1.2 + [EXm/8.57 + Tt]/240

The *optimized weight loss rate* (in lb/d and kg/d forms, respectively) is:

WLR(lb/d) = (BMR/3500) x {0.2 + [EXm/8.57 + Tt]/240}

WLR(kg/d) = (BMR/7716) x {0.2 + [EXm/8.57 + Tt]/240}

Consider the following three examples for Joe Typical with BMR = 1750 kcal/d, and for Jane Typical with BMR = 1155 kcal/d.

Example 1, *Moderately Heavy Exercise,*
EXm = 750 moves at 1 Hz (12.5 minutes), Tt = 23 minutes,
AL = 1.66,
Joe, WLR = 0.33 lb/d (0.15 kg/d),
Jane, WLR = 0.22 lb/d (0.10 kg/d).

Example 2, *Moderate Exercise,*
EXm = 350 moves at 1 Hz (5.8 minutes), Tt = 30 minutes,
AL = 1.50,
Joe, WLR = 0.25 lb/d (0.11 kg/d),
Jane, WLR = 0.16 lb/d (0.07 kg/d).

Example 3, *Light Exercise,*
EXm = 0 moves at 1 Hz (0 minutes), Tt = 30 minutes (all static exercise),
AL = 1.33,
Joe, WLR = 0.16 lb/d (0.07 kg/d),
Jane, WLR = 0.11 lb/d (0.05 kg/d).

With *moderately heavy exercise* (and caloric intake at essentially BMR) Joe can lose 1 pound in 3 days, 1 kilogram in a week, 30 pounds in 3 months and 15 kilograms in 100 days. Jane can lose 1 pound every 5 days, 1 kilogram every 10 days, 20 pounds in 3 months, and 10 kilograms in 100 days.

With *moderate exercise* (and caloric intake at essentially BMR) Joe can lose 1 pound every 4 days, 1 kilogram every 10 days, and 45 pounds (20 kg) in 6 months. Jane can lose 1 pound a week, 2 kilograms a month, and 24 pounds (11 kg) in 5 months.

With *light exercise* (and caloric intake at essentially BMR) Joe can lose 1 pound a week, 2 kilograms a month, and 24 pounds (11 kg) in 5 months. Jane can lose 1 pound every 10 days, 1 kilogram every 3 weeks, 30 pounds in 9 months, 15 kilograms in 10 months.

An individual intent to halt and reverse their accumulation of excess weight (as fat) would change the types of foods eaten to the healthy varieties already discussed, reduce their caloric intake to no less than their BMR, and begin a regimen of daily exercises, of any duration and type, to raise their daily metabolic rate. As their flexibility, endurance and strength improved, they could increase the intensity of their exercise routine to increase the rate of their weight loss. That the combination of diet and exercise is the key to healthy reliable weight loss and the maintenance of good physical condition has been known since before the days of Themistocles (8).

Keep a journal or log book of your daily exercises. Become a scientist taking data in the most important experiment of your life: YOU as a physical presence. Note the duration of your exercise sessions, and the number of repetitions of each of the calisthenic moves you perform. I estimate that 1 minute of calisthenics is equivalent (for the purposes of weight loss, or "fat burn") to 8 minutes of deep stretching or isometrics (holding positions of extension or strength). Also log your daily readings of body weight. Those who are mathematically inclined can plot weight over time and use such graphs to estimate future progress, or to just enjoy. Keeping a record of such data can help you correlate the intensity of your exercise routine with the coincident rate of weight loss (or lack of). Of course, in

real life weight loss is never a perfectly steady trend from day to day, but fluctuates for many reasons, some of which you will easily recognize, and others of which are the unfathomable mysteries of life.

To optimize weight loss, you set your daily caloric intake at slightly above your BMR. After you reach your target weight *and continue with your daily exercise routine* you will be able to increase your daily caloric intake to match the metabolic rate maintained by your activity level (MR). At this point you will want to expand the range of foods you eat, from those you limited yourself to during your period of weight loss. Having the flexibility to eat a wide variety of foods (including alcohol, red meat, cheese, bakery foods, desserts and confections, all in moderation) makes it possible for you to enjoy one of the great pleasures of life.

To do this with precision, you monitor your ongoing weight records for early detection of any upward trend that requires an immediate return to stricter dietary discipline (a reactive technique), and you estimate the caloric content of the foods and meals that you will encounter, so as to make reasonable choices (a predictive technique). So, the next step to refining your *Personal Routine For Metabolic Management* (PRFMM) is to improve your ability to estimate the caloric content of foods.

Food Calorie Accounting

To find data on the caloric content of food, read the labels displayed at fresh food markets and on the jars and packages of processed foods (which you will buy few of), and look on the Internet (search for "calories in food").

It can be very useful to keep a food journal (like your exercise and weight log) as a record of the foods you eat, in what amounts, and (if you are scientifically enthusiastic) with what caloric content. Given data on your ongoing "food history," you will be able to see how diet, exercise and weight correlate over time, and such insights will guide you in making whatever adjustments suit you (more or less exercise?, more and richer foods or less and leaner?).

As an illustrative example of food calorie accounting, consider the following meal plan, with a midday meal of Caesar Salad with grilled salmon, and an evening meal of fresh fruit. Food quantities are given below as ounces (oz), fluid ounces (fl oz), cups, tablespoons (tbsp), and teaspoons (tsp).

Caesar Salad With Salmon And Red Onions

6 cups chopped (from about 1.5) hearts of Romaine lettuce (40 kcal/cup) = 240 kcal

2 oz raw red onion (for flavor), slices or chopped (10 kcal/oz) = 20 kcal

1 oz croutons (93 kcal/oz) = 93 kcal
(0.8 oz bread at 54 kcal + 1 tsp or 0.2 oz olive oil at 39 kcal)

2 oz Caesar dressing (100 kcal/oz) = 200 kcal

1 oz Reggiano parmesan cheese, grated/shaved (120 kcal/oz) = 120 kcal

11 oz salmon steak grilled (65 kcal/oz)
+ 1 tsp olive oil brushed on for grilling (39 kcal)
+ white wine wash for finishing in broiler, adding 3 tsp or 0.6 oz (14 kcal)
= 715 kcal + 39 kcal + 14 kcal = 768 kcal

Caesar Dressing #1:
1 oz real mayonnaise
+ 1 tbsp Worcestershire Sauce (0.5 fl oz)
+ 1 tbsp lemon juice (0.5 fl oz)
180 kcal + 12.5 kcal + 2.5 kcal = 195 kcal for 2 oz of dressing

Caesar Dressing #2:
1 beaten egg (1.3 oz)
+ 2 tbsp olive oil (1 oz)
+ 3 ground anchovy, from can (0.3 oz)
+ 2 tsp raw garlic, crushed/chopped (0.2 oz)
+ 1 tsp lemon juice (0.2 fl oz)
54 kcal + 195 kcal + 24 kcal + 8 kcal + 1 kcal = 282 kcal for 3 oz of dressing

(Caesar Dressing #2 is from earlier times, and shown here only to illustrate food calorie accounting. Today, the consumption of raw eggs is not recommended because of the possibility of salmonella poisoning.)

TOTAL (Salmon Caesar Salad) = 1441 kcal

Fresh Fruit Medley

1 navel orange (4.9 oz) = 69 kcal

1 banana, (5 inches, 13 cm, 2.9 oz interior) = 73 kcal

1 pear (4.9 oz) = 81 kcal

20 blueberries (1 kcal each) = 20 kcal

4 oz or 0.5 cup pineapple (14 kcal/oz) = 56 kcal

4 oz or 0.5 cup strawberries (10 kcal/oz) = 40 kcal

TOTAL (Fruit Medley) = 339 kcal

Herbal tea at 1 kcal/cup is also consumed 4 times during the day (4 kcal).

TOTAL (all food) = 1784 kcal

The above meal plan would work well for Joe Typical (BMR = 1750 kcal/d). A two-thirds portion of the above food contains a total of 1189 kcal, a good choice for Jane Typical (BMR = 1155 kcal/d).

At an *activity level* AL equal to 1.6, Joe's MR would equal 2800 kcal/d. So, when he ceases his period of weight reduction and enters his weight maintenance phase, *while continuing at the same AL,* he would be able to consume an extra 1050 kilocalories a day. The additional allowance for Jane, once in her maintenance phase with AL = 1.6, would be 693 kilocalories per day. The wider range of gustatory enjoyment made possible by a significant *activity level* should be a strong inducement for maintaining that activity.

Weight Loss And Maintenance

The point of being on an optimized weight loss regimen is to burn body fat and reduce your weight to a desired *target weight* as quickly as is possible in a healthy way. The *target weight* should be slightly below the average weight you will want to maintain in the long term, because you want to allow for the likely upward creep of weight that can occur after "reaching your goal," if in a celebratory exuberance you reduce exercising and increase and enrich your diet. Weight maintenance is the same as weight loss, but with more food. Be wise and make the transition gradually, ideally without a reduction of exercising.

Because weight fluctuates from morning to night, and from day to day, you cannot reliably spot a trend in under three days. For this reason it may be good to space out your caloric intake indulgences by three days to a week, a caution we can state as: one day's weight gain requires three days of weight burn. When I am offered a cup cake I ask myself: "how many push-ups is this going to cost?" and "is this moment of possible enjoyment that good?" This type of test helps me filter out the special sugar moments in life from the unnecessary ones. I am happy to pay the calisthenic costs for the Manhattan Cocktails (doubles!) I enjoy at Christmas and New Year's with my family members. Since my caloric intake window is only so big, the foods and beverages that are permitted entry must be very fine indeed.

As I write this I am in the 138th day of my weight loss program, and my BMI has reduced from 31.7 (126.8% of *ideal weight*) to 25.5 (102% of *ideal weight*). My target BMI is 24.5 (98% of *ideal weight*). My PRFMM is the way of life for my duration. Now, I feel better.

Manuel García, Jr. is a retired engineering-physicist and has long been interested in energy, both natural and technological. He blogs at http://

manuelgarciajr.com, and his e-mail is mangogarcia@att.net.

Notes

[1] "Obesity and Overweight (Data for the U.S.)," Centers for Disease Control and Prevention,
http://www.cdc.gov/nchs/fastats/overwt.htm,
(accessed 22 February 2013)

[2] "Obesity And Cancer Risk," National Cancer Institute (a the National Institutes of Health),
http://www.cancer.gov/cancertopics/factsheet/Risk/obesity,
(accessed 22 February 2013)

[3] Aquaculture Of Salmon,
http://en.wikipedia.org/wiki/Aquaculture_of_salmon,
(accessed 23 February 2013)

[4] Susan S. Lang, "Stick to wild salmon unless heart disease is a risk factor, risk/benefit analysis of farmed and wild fish shows," 2005,
http://www.news.cornell.edu/stories/Dec05/salmon.ssl.html,
(accessed 23 February 2013)

[5] Harris-Benedict Equation,
http://en.wikipedia.org/wiki/Harris-Benedict_equation,
(accessed 24 February 2013)

[6] Energy Balance (biology),
http://en.wikipedia.org/wiki/Total_energy_expenditure,
(accessed 24 February 2013)

[7] Thermic Effect Of Food,
http://en.wikipedia.org/wiki/Thermic_effect_of_food,
(accessed 28 February 2013)

[8] Calisthenics,
http://en.wikipedia.org/wiki/Calisthenics,
(accessed 1 March 2013)

"Calisthenics originated in ancient Greece, where it was mentioned in a Persian scout report on Spartan warriors before the Battle of Thermopylae, with the Persians interpreting the odd synchronized movements as a form of dance, and thus a sign of weakness."

Abbreviations

A (age)

AL (activity level)
BMI (body mass index)
BMR (basal metabolic rate)
cal (calorie)
cm (centimeter)
d (day)
EXm (total calisthenic moves per day)
fl oz (fluid ounce)
H (height)
hp (horsepower)
Hz (hertz)
in. (inch) [defined with period]
J (joule)
kcal (kilocalorie)
kg (kilogram)
kJ (kilojoule)
kW (kilowatt)
lb (pound)
m (meter)
mmHG (pressure as millimeters rise in mercury manometer)
MR (daily metabolic rate)
oz (ounce)
PRFMM (personal routine for metabolic management)
s (second)
tbsp (tablespoon)
tsp (teaspoon)
Tt (daily exercise time in minutes)
W (watt) [when used to show units of power]
W (weight) [when used as a variable in BMR formulas]
WLR (optimized weight loss rate)