The Endurance Diet

By William Misner, Ph.D.

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From 1996 until his retirement in 2006, Dr. Bill worked full-time as Director of Research & Development at Hammer Nutrition. Among his many accomplishments, both academically and athletically, he is an AAMA Board Certified Alternative Medicine Practitioner and the author of *"What Should I Eat? A Food-Endowed Prescription For Well Being"*.

Some foods transfer calories more efficiently producing more energy to meet the extraordinary demands imposed by extreme endurance exercise. The "Best" diet is the one that supports healthy cardiovascular function including implications for longevity and quality of life. During the first half of the 20th Century, obesity related to diet was non-existent in the USA, few Americans suffered from cardiovascular disease. It is now known that specific menu orders either a reward or an unnecessary harmful consequence.

This paper reviews 5 Diets to identify what if any positive health indices result from their application.

This then begs a question: Should athletes avoid the current American "Western" diet? Eight of the top ten causes of death are linked to the "Western" diet:

DIET RELATED CAUSES OF DEATH ("Western Diet")
#1-Heart disease 726,974
#2-Cancer 539,577
#3-Stroke 159,791
#4-Chronic pulmonary 109,029
#5-Accidents 95,644 not related to diet
#6-Pneumonia/flu 86,449
#7-Diabetes 62,636
#8-Suicide 30,535 not related to diet
#9-Liver/cirrhosis 25,175
#10-Alzheimers Disease 22,475

The diet that accomplishes cardiovascular health is the model for endurance performance. The endurance diet should not only advance cardiovascular health but also reverse degenerative coronary heart disease. Nowhere is this more dramatically illustrated than from Esselstyn's hallmark research," Resolving the Coronary Artery Disease Epidemic through Plant-Based Nutrition.[3] In particular, he recorded one case study exemplary supporting the application of the plant-based diet recommendation:

"The recent case of a colleague is particularly telling. During September and October of 1996, a 44-year-old surgical colleague experienced occasional chest discomfort, yet neither electrocardiogram, stress echocardiography, nor thallium scanning found evidence of disease. While eating the typical

American diet, he had total cholesterol of 156 mg/dL and an LDL of 97 mg/dL. He was lean, non-diabetic, and normotensive, did not smoke, and had no family history of coronary disease. His lipoprotein (a) and homocysteine levels were normal. On November 18, 1996, after his surgical duties, he became acutely ill with pain in the left arm, jaw, and chest. Immediate coronary catheterization found all vessels to be normal except for the left anterior descending artery, the distal third of which was diseased. Enzymes confirmed a myocardial infarction. However, no intervention was deemed appropriate. This patient was aware of my ongoing study and was curious for more information. He and his wife consulted me for an in-depth review of the plant-based diet and techniques of this arrest and reversal study. He became the personification of commitment to the plant-based diet. Over the next 32 months, without cholesterol-lowering drugs, he maintained mean total cholesterol of 89 mg/dL and an LDL of 38 mg/dL. The repeat angiogram 32 months after his infarction showed the disease was completely reversed." (see Fig.1 below)

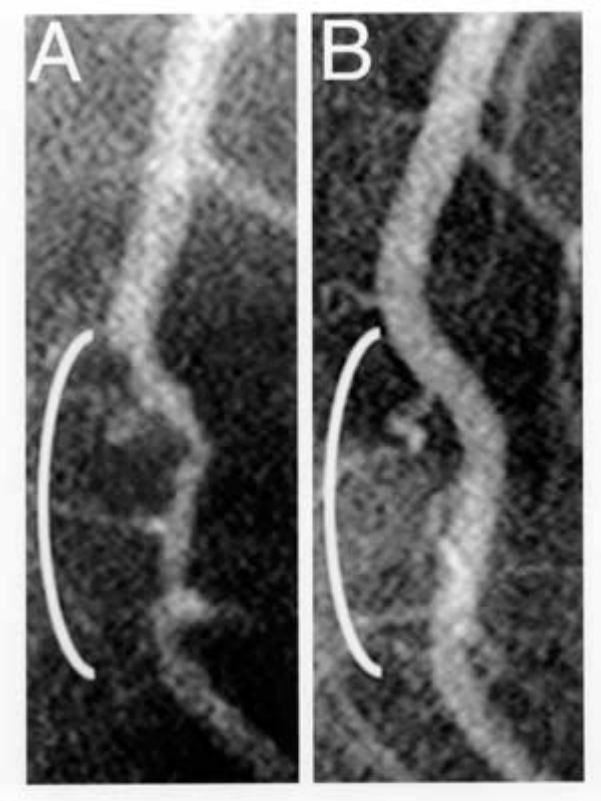

Figure 1 -- Coronary angiograms of the distal left anterior descending artery before (left) and after (right) 32 months of a plant-based diet without cholesterol-lowering medication, showing profound improvement.

Furthermore, the expert faculty at the First National Conference on the Elimination and Prevention of Coronary Artery Disease issued a new set of recommendations:[4]

1) Present nutritional guidelines of government and national health organizations do not provide a maximal opportunity either to arrest or to prevent coronary artery disease.

2) The optimal diet consists of grains, legumes, vegetables, and fruit, with <10%-15% of its calories coming from fat.

This diet minimizes the likelihood of stroke, obesity, hypertension, type II diabetes, and cancers of the breast, prostate, colon, rectum, uterus, and ovary. There are no known adverse effects of such a diet when mineral and vitamin contents are adequate.

A comparative analysis of food-born proteins, fats, and carbohydrates in a multi-country statistical approach involving 32 countries distinctively concludes that cardiovascular health and diet are closely

related. William B. Grant, Ph.D. in Milk and Other Dietary Influences on Coronary Heart Disease[5] (tables 1-2 & 7) correlated *positive* cardiovascular disease associations with dietary sugar, animal protein, milk, saturated fat meat, total fat, eggs, sweeteners, and smoking cigarettes. Conversely, Grant correlated *negative* cardiovascular disease associations with dietary cereal, fish, fruit, and vegetables.

GENERAL CHARACTERISTICS AND EFFECTS FROM DIETS

Characteristics of the Endurance Diet, the Paleolithic-Early 20th Century Diet, the American Heart Association Diet, the Syndrome X Diet, and Western Diet Summary are listed below:

#1 THE ENDURANCE DIET[6]		
AREA	**PERCENT**	**COMMENT**
PROTEIN	12-20%	
CARBOHYDRATES	50-60%	Ninety 90% of the carbohydrates are from complex whole food produce while less than -10% of the carbohydrates as processed simple sugar. Fiber intake ratio is minimally 30 grams soluble fiber to 10 grams insoluble fiber.
FATS	15%	Fat intake is recommended at no more than 5% saturated fats to 10% poly-mono unsaturated fats, translating to the ratio to 1 saturated "bad" fat for every 3 "good" mono-polyunsaturated fats.
DISEASE RATE	NIL TO LOW	Sodium intake restricted to 1100-2400 milligrams per day, with a minimum of 100 ounces fluids per day.
EXERCISE RATE	HIGH AND FREQUENT FROM AEROBIC EXERCISE	

#2 PALEOLITHIC TO EARLY 20TH CENTURY TRADITIONAL DIETS [7]		
AREA	**PERCENT**	**COMMENT**
PROTEIN	12-33%	The meat supply came from wild or range fed animals or fish and were leaner than today's high-fat, steroid injected, antibiotic treated sources.
CARBOHYDRATES	45-65%	No dietary sugar, most carbohydrates came from vegetables and fruit including 60-150 grams daily of soluble and insoluble fiber with only 700 milligrams sodium ingested per day.
FATS	21%	The ratio of polyunsaturated fats to saturated fats is 1.41, or for every 7 grams of artery-clogging "bad" fats, 10 grams of good fat were eaten to balance lipid profiles.
DISEASE RATE	LOW	Cardiovascular Disease and a number of degenerative diseases we have in America today were virtually unheard of at the turn of the 20th century in America.
EXERCISE RATE	FREQUENT EXERCISE AT WORK OR PLAY	

#3 THE AMERICAN HEART ASSOCIATION DIET [8]		
AREA	**PERCENT**	**COMMENT**
PROTEIN	15%	Include low-fat milk products, fish, legumes (beans), skinless poultry and lean meats.
CARBOHYDRATES	55-60%	Eat 5 or more servings of fruits and vegetables and 6 or more servings whole grains.
FATS	30%	Fat intake recommended is no more than 5-10% saturated fats to 20% poly- & mono- unsaturated fats, translating to a ratio to 1 saturated "bad" fat for every 2 "good" fats. Limit foods high in saturated fat, trans fat and/or cholesterol, such as full-fat milk products, fatty meats, tropical oils, partially hydrogenated vegetable oils and egg yolks. Instead choose foods low in saturated fat, trans fat and cholesterol from the first four points above.
DISEASE RATE	TO MODERATE	Eat less than 6 grams of salt (sodium chloride) per day (2,400 milligrams of sodium)
EXERCISE RATE	MODERATE	Maintain a level of physical activity that keeps you fit and matches the number of calories you eat. Exercise at least 30 minutes on most days.

#4 SYNDROME X DIET [9]		
AREA	PERCENT	COMMENT
PROTEIN	15%	A diet with increased vegetable source controlled intake protein is recommended.
CARBOHYDRATES	45%	A modified low carbohydrate lifestyle with exclusion of simple sugar is valuable. Food that does not deliver a high glucose load is preferred (low glycemic index foods).
FATS	30-45%	Fat intake is recommended no more than 5-10% saturated fats to 30-35% poly-mono unsaturated fats, translating to the ratio of 1 saturated "bad" fat for every 3-7 "good" mono-polyunsaturated fats. A diet with a reduced saturated fat but increased intake of "good" fats is the essential omega-3 fatty acids in fish oil.
DISEASE RATE	LOW	A diet with a reduced intake of salt is recommended.
EXERCISE RATE	Moderate	This diet works best with vigorous exercise while moderate exercise is less effective.

#5 WESTERN [10] [11]		
AREA	**PERCENT**	**COMMENT**
PROTEIN	31%	
CARBOHYDRATES	25%	Carbohydrates are largely from refined sugar. Only 11-15 grams daily dietary fiber is consumed contributing to fat re-absorption that elevates blood serum lipids resulting in elevated harmful cholesterol levels.
FATS	44%	The ratio of polyunsaturated fats to saturated fats is 0.41, or for every 2 grams of healthy fat eaten 5 grams of artery-clogging "bad fat" from meat

		or dairy byproducts.
DISEASE RATE	HIGH	Sodium intake approaches 7000 milligrams and alcohol intake comprises 7-10% of the total calories excessively adding 7 calories per gram.
EXERCISE	LOW-NIL	

No one can perform at their best consuming the too much saturated fat, trans fat, processed simple sugar, sodium (processed salted foods), that distinctly lack plant-sourced soluble and insoluble fiber, and phytonutrients absent from the deadly health-debilitating, performance-limiting menu. The results from eating a "Western or American" diet fails to advance endurance performance and negatively compromises quality of life with reduced mortality. Now, what foods will meet the required health-enhancing, endurance exercise performance prescription?

THE MACRONUTRIENTS (Protein, Fat, Carbohydrates)

PROTEIN requirements for endurance athletes have been determined by research collected at the Colgan Institutes and others based on urinary nitrogen balance in which athletes were evaluated during sedentary activities, endurance exercise, strength exercise, and power or speed exercise.[12]

TYPE OF EXERCISE	PROTEIN REQUIRED (To Maintain Nitrogen Balance)
Strength or Short Distance Speed	2.0 grams/kg. Body weight
Ball Sports - Medium-distance cycling/running	1.7 grams/kg. Body weight
Endurance Sports - Long-distance cycling/running	1.4 grams/kg. Body weight

Protein quality is rated according to the weakest single amino acid of its essential amino acid profile. The only protein foods projecting a "perfect" Predicted Digestibility Corrected Amino Acid Score (PDCAAS) of 1.0 are Soy, Whey, or Egg Whites. Thus the highest protein PDCAAS score from a protein food is 1.0.

There are ways to protein sources with less than a perfect 1.0 protein PDCAAS score if the dietary proteins are combined within 24-hours. Meats are not a complete protein (as once thought); most meats range between 0.90-0.92. Produce proteins score as follows: peas 0.73, Oats 0.57, peanuts 0.52, rice 0.47, corn 0.42 and wheat 0.25. If however cereal grains are combined with vegetables, legumes, nuts, or seeds, a complete 1.0 PDCAAS score results.

The optimal protein intake for an endurance athlete is 1.4 grams protein per kilogram body weight. The exceptions to this rule occur when endurance efforts exceed 3 hours aerobic exercise or speed workouts are performed, raising the need to 1.7 grams per kilogram bodyweight. Most sedentary persons get enough protein, but eating incomplete proteins such as meat, poultry, or dairy byproducts containing more saturated fat and cholesterol than is ideal for endurance performance or health outcome.

HIGH PROTEIN INTAKE MAY RESULT IN HEALTH PROBLEMS

Too much or the less perfect protein sources may contribute to health compromise in time. High protein diets stimulate serious metabolic changes that lead to bone calcium loss and kidney stones. Red meat, poultry, fish, shellfish, and eggs are acidic (below 5.0 pH). Vegetable foods are more alkaline pH. Our bodies carefully monitor acid-base balance (pH) so that health-enhancing pH-dependent biochemical reactions occur with no delay. Every meal containing animal protein foods generate an acid pH-load that requires buffering or raising pH. The primary buffering system of the body is bone minerals phosphate and calcium recruited to raise any diet-induced acidic pH to a more alkaline pH. The alkaline minerals recruited buffer diet-induced animal protein acid. Too much bone mineral loss may lead to osteoporosis. A secondary condition in osteoporosis consists of changes in kidney physiology caused by acidic foods, all sulfa-containing amino acids (plentiful in meat), and an

increased solute load, contribute to additional loss of bone minerals, particularly calcium, voided in urine. This can induce an environment contributing to calcium-based kidney stones.

The Nurse's Health Study recently reported that women who consumed 95 grams of protein a day compared with those who consumed less than 68 grams a day had a 22% greater risk of forearm fractures.[13] Metabolic ward studies found a negative calcium balance is created when 95 grams of protein are consumed with 500 mg of calcium. The calcium intake must be increased to 800 mg before calcium balance is achieved (the calcium entering the body is the same as the amount leaving). People following the Zone Diet commonly consume 100 grams of protein and less than 800 mg of calcium. Athletes who follow the Zone diet will likely consume at least 140 grams or more of protein a day. Even with a very high calcium intake of 1400 mg daily these athletes are predictably in constant negative calcium balance.[14]

Comparison of DIETARY FAT intake may predict either an excellent blood lipid profile (required for health and performance) reducing progression of vascular disease (#'s 1-4) or advance progressive vascular disease (#5):

1. AMERICAN HEART ASSOCIATION (AHA)
2. SYNDROME X (SX) Dr. Gerald Reaven M.D.
3. TRADITIONAL DIET (TD) (supported by longevity and health reports from the Tarahumara Indians, Hunzas, Abkhasians, and Vilacambas in the first half of the 20th century.
4. ENDURANCE DIET (ED) fatty acid profile is similar to #3 TD (above) from dietary intake of cultures recording superior longevity and health.
5. MODERN WESTERN (MW) dietary fat menu is associated with the highest rate of degenerative cardiovascular disease.

DIET	SAT FATS (SF)	POLY-MONO-UNSAT FATS (PMUSF)	IDEAL FAT RATIOS	TOTAL FAT
AHA	20%	1 SF:2-4 PMUSF	30%	
SX	5-10%	30-35%	1 SF:3-7 PMUSF	35-45%
TD	8-9%	12-13%	PMUSF	21%
ED	3%	12%	1 SF:3-5 PMUSF	15%
MW	31-32%	12-13%	2 SF: 5 PMUSF	44%

Dr. Ron Kennedy M.D. brilliantly described this diet-induced disease epidemic:

"This is a disease of modern civilization. Never before have people so young had atherosclerosis. As recently as the year 1900, heart disease was very rare. It may be that airborne industrial pollutants, as well as herbicides, pesticides and preservatives in our food, have something to do with the development of atherosclerosis. Even more likely is the advent of hydrogenated fats, e.g. margarine, the development of which perfectly coincides with the increase in vascular disease. The cholesterol content of these plaques can be handled by shifting to a no-fat, high-fiber diet. Plaques actually decrease in size, and the cholesterol content can eventually disappear. Lipid peroxidation itself can be halted by the liberal intake of antioxidants such as Beta-carotene (the precursor of vitamin A), mixed tocopherols (vitamin E) and vitamin C, so no further damage is caused to the arterial tree." [15]

CARBOHYDRATES (CHO) are the optimal fuel-of-choice for endurance performance. When CHO is depleted, it is a performance-limiting factor. Our individual biochemistry has a love affair with the carbohydrate moiety. It is much easier to convert blood glucose (CHO) or (CHO) from muscle glycogen than to convert fatty acids or lean muscle proteins into ATP for energy fuels during exercise. The rate of ATP synthesis from FAT is only 0.5 mol/minute, but from CHO it is 1.0 mol/minute. During an intense 90%+ VO2 Max exercise only CHO is burned at rate of 2.4 mol/minute.

APPROXIMATE ENERGY COSTS DURING ENDURANCE EXERCISE [16][17][18](AEROBIC PACE VO_2 MAX 30%-65%)			
MINUTES EXERCISE	**FATTY ACIDS**	**BLOOD GLUCOSE [19]**	**MUSCLE GLYCOGEN**
0-30'	37%	27%	36%
60'	40%	30%	30%
120'	48%	34%	20%
180'	50%	34%	14%
240'	62%	30%	8%

Serum blood sugar levels are best maintained by consuming complex long-chain carbohydrates as opposed to processed simple sugars that produce a high insulin peak response. Jenkins demonstrated this by comparing blood sugar responses from dietary simple sugars (short-chain CHO) to Complex carbohydrates (long-chain CHO)[20]

BLOOD GLUCOSE RESPONSE (Average Change: + or - mg/dl)[21]			
CARBOHYDRATE (CHO)	**30 MINUTES**	**60 MINUTES**	**90 MINUTES**
Fructose	+5	+1 to +2	-5
Sucrose, Glucose	+35	10 to -15	-10
Maltodextrin	+25 or +30	+10 to +15	+1
Complex Carbohydrates as other CHO	+25 or +30	+10 to +15	+1

REAL FOOD BLOOD GLUCOSE RESPONSE CURVE [22] (Blood serum glucose response is expressed as a percentage of taking the same amount of glucose CHO)	
FOOD	PERCENT GLUCOSE RESPONSE
Glucose	100%
Cornflakes, Carrots, Parsnips, Instant Potatoes, Maltose, Honey	80-89%
Bread, Rice, Potato	70-79%
Bananas, Raisins, Candy, Shredded Wheat	60-69%
All Bran, Peas, Yams, Table Sugar	50-59%
Potato Chips, Sweet Corn	40-49%
Canned Beans, Black-Eye Peas, Apples, Ice Cream, Milk, Yogurt, Tomato Soup	30-39%
Kidney Beans, Lentils, Fructose	20-29%
Soya-Beans, Peanuts	10-19%

GUIDELINES FOR MAXIMIZING FUEL SELECTION

1. For each hour of exercise, consume 1-2 grams complex carbohydrates per pound of bodyweight. The recommended ceiling for total carbohydrate intake depends on size and activity level, but most endurance athletes requires 600-900 grams per day during training.
2. Sedentary (when not exercising), the best dietary carbohydrate choice is one that generates 50% or less of the glucose insulin-response as listed in the table above. Dietary sugars should not exceed 10% of the daily carbohydrate calorie intake. During exercise, carbohydrates that provide maximum easily absorbed calories are the best choice. The human liver replaces exercise-depleted calories from energy fuels at only 4.0-4.8 calories per minute, but it may metabolize 10-15 calories each minute during aerobic exercise. Thus, aerobic pace exercise

creates a deficit of slightly over 10 calories per minute. Therefore a time occurs between 1-1.5 hours exercise when fat is the primary fuel mobilized into the energy cycle.[23] [24] [25]

3. Intermittent carbohydrate small meal loading of 200-300 grams long-chain maltodextrins or complex carbohydrates within 30 minutes of cessation of workouts, during workouts, but no sooner than 3 hours prior.[26]
4. Avoid the use of niacin-rich supplements or foods prior to a workout session.[27]
5. Avoid simple sugars such as sucrose, fructose, or any type of high fructose corn-syrup solids before or during an exercise. Limit intake to no more than 10% of total carbohydrate calories.

WEIGHT CONTROL: LEAN MUSCLE GAIN & BODY FAT LOSS

A dramatic example of "You are what you eat" was captured by Magnetic Resonance Imagery (MRI): Magnetic Resonance Imaging was performed on 3 subjects, a vegetarian, an "omnivore"(standard WESTERN DIET), and a diabetic "omnivore". The 3 Carbon 13 MRI's were interpreted by a Physician, an MRI Technician, and a Lipid Biochemist. The evidence from these 3 images is not a validating, reliable conclusion, but it begs the question, favoring dietary the plant-based raw organic menu resulting in healthy lean muscle mass composition. Those who ate "Cow Meats" present muscle tissue marbling like the meat they ate, while those who ate a high plant-sourced menu demonstrated a healthy well-developed vascular system in corresponding lean fat muscle mass. [28]

For each calorie overdose is stored as in limited liver and muscle glycogen stores, or as adipose fat stores in unlimited amounts. No one has defined nutrition science more succinctly than sport scientist, endurance athlete, Ellen Coleman, M.P.H. R.D.:

"When it comes to weight control, what matters aren't carbohydrates and insulin, but calories. A person's weight depends on how many calories are taken in compared to how many are burned off. Eating a high percentage of calories from carbohydrate doesn't make a person fat--they must eat too many calories relative to their needs for insulin to lay down fat. [30]

Paying attention to calories is critical for weight control. When people are encouraged to eat more carbohydrate and less fat, some get the wrong message. They think they can eat as much high-carbohydrate food as desired, as long as the food is fat-free. The result -- these individuals can't lose weight because they eat too many calories in the form of low-fat sweets and extra large portions of starches. Instead of blaming their forks, they blame the carbohydrate. The bottom line--a person can't eat an unlimited amount of carbohydrate by cutting down on their fat intake. Cutting back on dietary fat does reduce total calories more than cutting back on dietary carbohydrate, because fat supplies more than twice the calories by weight. Dietary fat is also more likely to promote body fat storage than is dietary carbohydrate. [31]

However, a person who cuts back on fat calories but adds them back in the form of carbohydrate calories is not going to lose weight. Carbohydrate, not fat, is the preferred energy source during exercise at or above 70% of V02Max--the intensity at which most endurance athletes train and compete. Athletes don't usually work out long enough to burn significant amounts of fat during exercise. Rather, it is the caloric deficit resulting from the exercise session that promotes body fat utilization. No diet improves access to the body's fat stores so that more fat is burned during exercise without caloric intake being reduced to lower levels than a higher caloric expense.[29, 30]

In contrast, Thomas Incledon, MS, RD, LD, LN, CSCS, NSCA-CPT, Director of Sports Nutrition Human Performance Specialists, Inc., wrote this view on how nutrient timing impacts body composition:

"Data from animals is convincing in demonstrating eating immediately after exercise results in more LEAN body mass than when eating the same number of calories 4 hours later.[32] Data on female athletes eating a large evening meal preserves LEAN body mass as opposed to eating the same number of calories for breakfast. [33] Small meal frequency may or may not benefit everyone since research is not agreed on the small portion vs. large portion entree-protocols. [34]

WHAT FUEL DEMAND OCCURS DURING ENDURANCE EXERCISE

During exercise, serum glucose levels increase while serum insulin levels fall. This occurs due to exercise-induced increase in hormones, specifically catacholamines (epinephrine and norepinephrine) and growth hormone, which inhibits the release of insulin from the pancreas. This increases liver glucose output by making the liver more sensitive to the effects of glucagon and epinephrine. These hormonal changes during exercise prompt greater fat oxidation rate in the energy cycle. [35]

Endurance training generates several adaptations in muscles that increase fat metabolization rate:

1. First, endurance training increases the number of capillaries in the muscles stressed so that they receive more blood and oxygen.
2. Second, endurance training increases the activity of specific muscle enzymes that control the rate of burning fat for energy.
3. Carbohydrate feeding 30-60 minutes before exercise raise insulin levels and lowers blood glucose, but this response is temporary and will not harm performance. This insulin response does not impair fat mobilization or cause accelerated glycogen depletion. Furthermore, endurance training increases tissue insulin sensitivity, resulting in lower plasma insulin levels. [36]
4. Consuming carbohydrate an hour before exercise can actually improve performance. [37]

IMPORTANT NOTE: Research clearly demonstrates that the increase in insulin that occurs when carbohydrate is consumed 1-2 hours prior to exercise will cause faster-than-normal glycogen unloading (depletion). For events longer than 90 minutes, that will cause the athlete to bonk sooner than if the athlete fasted 3 hours prior to the start of the event. On the other hand, for a fast, hard, 90-minute-or-less event (perhaps even up to 120 minutes), consuming a few easily digested carbohydrates will advance performance, because carbohydrates consumed prior to exercise make the body super-expend its glycogen stores, like a flood gate wide open. The fit athlete, and the one who has been consistently replenishing their body with fuel immediately following workouts, will have up to 90 minutes of muscle glycogen, the first fuel the body will recruit when exercise begins. With that in mind, athletes competing in events longer than 90-120 minutes should complete all pre-exercise/race food consumption 3 hours prior to the start while athletes competing in shorter duration events may benefit from a small fuel donation sooner than 3 hours prior to the start. Please see the article The Pre-Race Meal for more information.

5. Carbohydrate feedings 3-4 hours before exercise may best advance performance by "topping off" muscle and liver glycogen stores without temporary elevation of blood sugar hormones.[38]
6. Carbohydrate feedings during exercise (lasting longer than 1 hour) aid performance by replacing part of the glucose spent the muscles burn off from glycogen stores.[39] [40]
7. The claim that a high carbohydrate diet promotes greater body fat storage is also unfounded. Insulin is not a "monster" hormone. Insulin is required for transport of glucose into the body's cells, where it is used to fuel energy. [41] [42]

PRACTICAL APPLICATIONS

PROTEIN - FAT - CARBOHYDRATE

"What foods lend themselves for health and optimal endurance performance?"

1. PROTEIN sources and amount: Current research recommends 3-4 units Carbohydrate to 1 each unit protein 1.4-1.7 required grams protein per kilogram bodyweight for recovery each 24 hour period: • Complete proteins are:Whey, Soy, or Egg Whites • Food Combinations offer a complete PDCAAS 1.0 profile score: -BEANS with [Cheese, Corn, Nuts, Rice, All Seeds, Wheat] -BROWN RICE with [Beans, Cheese, Sesame Seeds, Wheat] -CORNMEAL [When fortified by Lysine] -ANY GRAINS, NUTS & SEEDS, LEGUMES added to MIXED VEGETABLES. • Meat is not a complete protein, but if meat is chosen, red meat, poultry, or dairy byproducts should be limited to 1-2 per week. • The exception to the " Meat Rule" is fish for its essential fatty acids to balance the "Bad" saturated fat from approximately 50% of the cholesterol.
2. FAT - Plant source fats should outnumber animal fats by 3-5 to 1. During a 24-hour course, 1 serving of red meat, poultry or dairy byproducts (cheese or milk), should be complimented by a 3 to 5 servings of foods rich in essential fats. The human body cannot make its own essential fats [EFA] Omega-6 and Omega-3 EFA's. Sources of Omega-3 are Fish, Flaxseed Oil, Hemp Oil, Chia Seeds, Pumpkin Seeds, Soybeans, and Kukui or Candlenut Seeds. The

recommended optimal daily allowance is 2-9 grams from Omega-3 fatty acids. Sources of Omega-6 are Safflower Oil, Hemp Seed Oil, Chia Seeds, Kukui Seeds, Sunflower Seeds, Walnuts, Pumpkin Seeds, Corn Oil, Almonds, Cashew Macadamia Nuts and Grapeseed. The recommended optimal daily allowance for Omega-6 is 9-18 grams per day. Most calorie-sufficient menus easily supply 18 grams Omega-6 fatty acids but are noticeably deficient in Omega-3 fatty acids. Norwegian North Sea purified Salmon Oil supplement is an extraordinary source providing DHA/EPA-enriched omega-3 fatty acids.

3. CARBOHYDRATE - Complex long chain carbohydrates are preferred in a ratio of 9 to 1 simple sugar unit. Simple sugars should be avoided during athletic events due to interfering with the mechanics of hormone metabolism, reduced gastric absorption, and disrupt the sensitive balance between depleting fluids and electrolytes. Simple sugars not exceed 10% of the total dietary carbohydrates selected during sedentary meals.
4. SODIUM - The requirement to keep a sedentary subject alive is 500 mg per day. Endurance athletes need maintain their dietary sodium intake to between 1100-2400 mg per day. Sodium chronic overdose is associated with high blood pressure and several pathological disorders. One American in 5 has a genetic hypersensitivity to sodium that raises blood pressure to dangerously high levels. Too much sodium may also produce damaging effects to the kidneys and the heart. Sodium loading prior to an event should not be practiced unless it is in a limited buffered Sodium Phosphate form. Sodium is absorbed rapidly with carbohydrates and fluids at 300-600 mg per hour in hyperthermic conditions. Nevertheless, 100-300 mg rate may meet the athletes needs during hypothermic conditions. Sodium absorption and depletion varies based on individual biochemistry significantly. Endurolytes or Endurolytes Extreme is designed to replace electrolytes in endurance events.
5. FIBER from plant-sourced foods is required to chelate or remove numerous toxic wastes, reduce cholesterol, reduce triglycerides, and lower harmful oxidizing lipids, LDL. A major cause of fatigue in Americans is bowel irregularity from eating too little soluble and insoluble plant fiber. To maintain bowel wall muscle tone, and waste removal, the diet should provide 30 grams fiber grams per day. The rate for most Americans is 11-14 grams per day, which delays toxic refuse elimination, delays bowel transit time, and raises "Bad" cholesterol and triglycerides. For every 3 grams soluble fiber the diet should include 1-gram insoluble fiber. Adding a probiotic supplement that increases "Good" bacteria number over "Bad" bacteria should contain 15-billion count of both upper intestinal and lower intestinal flora.

CONCLUSION: Any deviation from the current MODERN WESTERN diet will improve both health and performance. Since the human cellular environment is replicated 98% new every 180 days, it is necessary to employ diet for at least 90 days before measurable gains in health or performance can be assessed. It is unfortunate that our modern dietary choices rigidly linked to taste, lifestyle, emotions, age, activity level, and gender. Any athlete who responsibly adapts to any or all the dietary premises presented, it is highly likely that proportionate gains in health, lower BMI, lower body fat, higher energy state, and performance gains will occur.

ADDENDUM: I wish to express my appreciation to these nutrition scientists: Dr. Ron Kennedy M.D., Dr. John McDougall M.D., Thomas Incledon, MS, RD, LD, LN, CSCS, NSCA-CPT, Director of Sports Nutrition Human Performance Specialists Inc. and Ellen Coleman M.P.H., R.D. for their contribution to this article. Each quote was interpreted to support the The Endurance Diet rationale but does not imply any or all subscribe to this position; rather what they said is my interpretation of their material.

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