

# Performance-Based Nutrition (PN)



*“Fueling the weapon system”*

**Warning:**

For maximum effect, these strategies are best used in combination with Controlled Response, Mind Tactics, Recharge, Primal Fitness, Purpose, and the Code Modules.



## Performance-Based Nutrition (PN) Module

### **Introduction:**

The Performance-Based Nutrition Module examines the nutritional needs of the warrior athlete in/out of combat based on performance demands. Compiled in collaboration with USUHS, the information provided should assist warriors to maintain a high level of performance through nutritional strategies used by elite military units and athletes.

### **Description:**

Nutrition and physical fitness are familiar terms used by the military and relate directly to a Warfighter's health and performance. Warfighters are first introduced to nutrition in basic training, and the importance of nutrition in mission readiness is reinforced during their tenure in service. Proper Warfighter nutrition is extremely important for success in combat.

### **Effects on Performance:**

In spite of continued individual and systemic efforts to improve Warfighter health and fitness, many continue to struggle with meeting weight and Body Mass Index (BMI) standards and receive substandard scores on their annual physical fitness tests. Pressure to comply with branch-specific standards lead Warfighters to engage in rapid weight loss and performance-enhancement programs popular for their immediate effects. However, the promising results of these programs are often short-lived due to their extreme nature and harmful side effects. Consequences of failed attempts often lead to remedial fitness and weight-loss programs, disciplinary actions, and even negative impact on promotion and retention.

### **Critical Components of Performance-Based Nutrition:**

The body needs fuel for energy, and fuel is provided when carbohydrates, protein, fat, and alcohol are consumed. Ideally, approximately 55% of daily calories should come from carbohydrates, 20% from protein, and 25% from fat. As few calories as possible should come from alcohol. Note: Energy intake needs can vary depending on the task.

#### ***Carbohydrates:***

Carbohydrates provide the energy needed for endurance and resistance training, competitive athletic events, mental agility, and combat. Some believe that carbohydrates contribute to weight gain, so they restrict their intake—especially “bad” carbs, i.e., the carbohydrates in white flour and refined sugar. Instead of restricting carbohydrates and degrading performance, foods such as fruits, vegetables, whole grain pasta, rice, grains, beans, and other legumes should be consumed.

#### ***Proteins:***

Proteins are found in every cell of the body; they are made up of amino acids—the building blocks of protein. Protein is not a main energy source, as are carbohydrates, but they do contribute to energy production; in addition, they are essential for muscle contraction, the formation of muscle, hair, nails, skin, and other tissues, and repair of injuries. Some persons believe that athletes should consume more protein to increase their muscle mass, but when excess protein is consumed, it is converted/turned into fat. Warfighters should choose low-fat protein sources such as lean cuts of meat and poultry, fish, beans, low-fat milk and yogurt, low-fat cheeses, nuts and seeds, and eggs.

### ***Fats:***

Fats are essential to the human body, where they serve to insulate, transport other nutrients, protect organs, and provide energy during exercise and in cold environments. Trans fats are “bad” fats that are typically found in processed foods, commercially baked cookies, crackers, and pies. Saturated fats, although not “bad,” should be consumed in limited amounts; they are found in high-fat cheeses, high-fat cuts of meat, whole milk and cream, butter, and ice cream. Most of the fats in a Warfighter’s diet should come from polyunsaturated and monounsaturated fats such as nuts; vegetable, canola, olive, corn, and safflower oils; and fish.

### ***Alcohol:***

Alcohol is a source of energy not readily used by the body. It is not essential and contains little in the way of other nutrients. The amount of alcohol consumed should be minimized.

## **Nutrition Strategies:**

### ***Strategy #1: Nutrient Timing***

Nutrient timing can be achieved in three phases: 1) exercise—when energy stores are being depleted; 2) Refueling Interval (RFI)—the critical 45-minute period after exercise; and 3) recovery or maintenance. The timing of “when” nutrients are consumed may be as important as “what” nutrients are consumed.



### ***Strategy #2: Fatigue and Glycogen Depletion***

Fatigue is a complex phenomenon caused by failure at multiple sites during exercise. One nutritional cause of fatigue is depletion of muscle glycogen. All strenuous exercise—be it endurance, resistance training, or missions—will deplete glycogen. Muscle glycogen must be replenished through nutritional interventions to override fatigue and accelerate recovery. It takes at least 24 hours to replenish muscle glycogen stores following exhaustive exercise or operations. Glycogen repletion occurs when enough carbohydrate is provided. If carbohydrate intake is neglected over time, “staleness” can become a problem.



### ***Strategy #3: All Carbohydrates are NOT Created Equal***

Not all carbohydrate (CHO) foods are equally effective in restoring blood glucose. Certain foods raise blood glucose concentrations more rapidly, which should promote a more rapid glycogen synthesis. The term “Glycemic Index” (GI) is used to describe (and rank) how high a particular food raises blood glucose; foods with a high GI are more effective for restoring glycogen after exercise than are low GI foods. A high GI food produces a “spike” in blood glucose, whereas a low GI food takes a longer time for glucose to peak. Immediately after a mission, foods and beverages with a moderate to high GI should be consumed. During later recovery and maintenance, foods with a low GI are preferable.



### ***Strategy #4: Hydration***

Sweat loss varies depending on age, training, and acclimation status, exercise intensity and duration, air temperature, humidity, wind velocity, cloud cover, clothing, and individual sweat rates. The adequate fluid intake is about 13 cups/day for men between 19–50 years of age and about 9 cups/day for women in the same age range. These amounts are independent of physical activity. On average, 20–25% of fluid typically comes from food and 75–80% from beverages. Plain water, coffee, tea, soups, fruits, and vegetables also provide fluids and support hydration. A small amount of caffeine in tea or coffee (< 200 mg) should not negatively affect hydration, but more caffeine may negatively affect fluid balance.



### ***Strategy #5: Performance-Based Nutrition Tips***

- ⇒ Three primary ways to be nutritionally prepared during missions are: (1) Eat a high CHO diet to maintain and sustain glycogen stores. (2) Be well hydrated—follow a forced-fluid-replacement schedule since thirst is not always a good indicator of fluid needs under extreme environmental conditions. (3) Eat a snack (~150 calories) every two hours to maintain blood glucose.
- ⇒ Increase energy intake by 10% when living and working in temperatures ranging from 86 to 104° F (30 to 40° C).
- ⇒ Energy requirements can increase 25–50% during cold weather operations as compared to warm weather operations.
- ⇒ Ideally, during cold weather operations, 50–60% of energy should come from CHO, 30–35% from fat, and 10–20% from protein; high-CHO snacks should be eaten between meals.

### ***Strategy #6: Dietary Supplements***

Dietary supplements include vitamins, minerals, amino acids, herbs, and botanicals. Making an informed decision to use dietary supplements for performance and health optimization can be difficult and could result in adverse health effects. Always look up dietary supplement information so that you can make safe decisions regarding supplement use. The Human Performance Resource Center is linked to a great resource for looking up dietary supplements—the Natural Medicines Comprehensive Database.

#### ***Additional Strategies:***

⇒ **Mind Tactics:** The power of the mind is critical in optimal fueling. Thinking ahead and visualizing the nutritional choices to be made during the day are important for optimizing nutrition. Evaluating what refueling strategy is working is an example of using mind tactics to boost nutrition (see Mind Tactics Module).



⇒ **Controlled Response:** Regular use of stimulants, especially to substitute for sleep, can distort interpretation of body cues and lead to difficulties disengaging from “over-drive” and modulating out of the Red Zone (see Controlled Response and Recharge Modules). Nutrition fuels performance, so eating a well-balanced, healthy diet is key to preparing the body to respond optimally. Additionally, being able to maintain discipline by reducing portion sizes, using a smaller plates, and resisting second helpings are essential elements of self-assessment and balance (both crucial to controlled response; see Controlled Response Module).

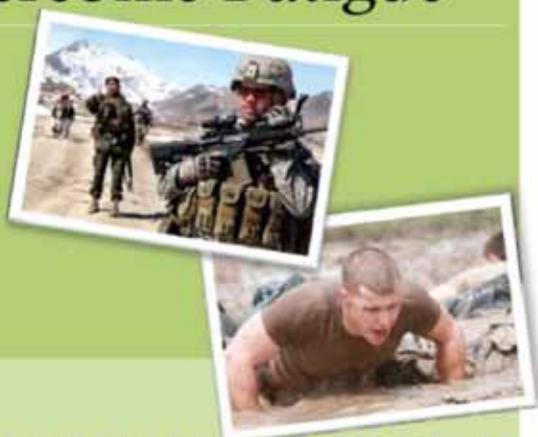


⇒ **Recharge:** One principle of proper nutrition and exercise is the need to recharge and achieve restful patterns of sleep. During this time, internal resources transition to repair tissue and restore muscles during sleep. The process of total body rejuvenation begins during the sleep process and allows the body to prepare for the next event (see Recharge Module).



# Performance Nutrition (PN): Increase Power and Overcome Fatigue

*For performance and recovery to be optimal, the everyday diet of Warfighters must be as good as it possibly can be. Routine dietary habits must be considered to determine what should be done to ensure operational performance and overall good health. The usual CPF (Carbohydrates-CHO: Protein: Fat) pattern should approximate: CHO—55%; Protein—20%; and Fat—25%.*



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## FATIGUE AND GLYCOGEN DEPLETION

Fatigue is caused by failure at multiple sites during exercise. The causes of fatigue can affect your mind and muscle tissue. One nutritional cause of fatigue is depletion of muscle glycogen, the main metabolic fuel used during heavy and prolonged exercise. All strenuous exercise, be it endurance, resistance training or missions, will deplete glycogen. Muscle glycogen must be replenished through nutritional interventions to override fatigue and accelerate recovery.

The term "staleness" is believed to be the result of too little recovery time following intense training and a nutritional deficit. A multitude of symptoms include:

- Unexplained, persistently poor performance
- Moodiness, general fatigue, depression, and irritability
- Painful muscles
- Elevated morning resting pulse
- Insomnia
- Weight loss
- Overuse injuries
- Increased susceptibility to upper respiratory infections and gut problems

### The Remedy = Carbohydrates (CHO):

- Make sure that you get adequate rest (see Recharge issue)
- Eat a meal (2 g of CHO per lb of body wt) = 4 hrs prior to exercise
- Ingest 0.4 g of a low GI CHO drink or solid food per lb of body weight 1 hr before exercise
- Ingest an easily digested, high-CHO drink/food (50 g CHO and 12 g protein) = 45 min post-exercise
- Consume 0.5 g of CHO per lb of body wt (at least 50 g) = every 60 min for up to 6 hrs post-exercise
- Consume a high CHO drink or solid food (at least 60 g) with each meal

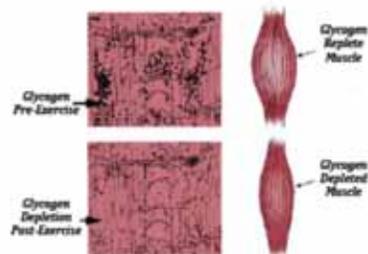
### CHO Content (g) of Various Foods:

Low-fat milk (1 c. = 12 g)	Bread (1 slice = 13 g)	Oatmeal cookie (1 = 15 g)
Pound cake (1 slice = 15 g)	Wheaties (1 c. = 25 g)	Baked potato (1 = 25 g)
Banana (1 = 35 g)	Sweet corn (1 c. = 40 g)	Macaroni (1 c. = 40 g)
Rice (1 c. = 40 g)	Cinnamon bagel (4" = 50 g)	Bagged pretzels (10 = 50 g)
Pancakes & syrup (2 = 90 g)	Seedless raisins (1 c. = 130 g)	

### NUTRIENT TIMING

The timing of nutrients should be viewed as 3 very distinct phases:

- Exercise - when energy stores are being depleted
- Re-Fueling Interval (RFI) - critical period after exercise
- Recovery or maintenance



*It takes at least 24 hours to replenish muscle glycogen stores following exhaustive exercise or operations.*

*Glycogen repletion occurs when enough CHO is provided. If diet is neglected over time, "staleness"*

*Example: CHO in grams for a 185 lb warrior:*

*Pre-Exercise:  
370 g (185 x 2 g) of CHO (4 hrs prior)  
74 g (185 x 0.4) low GI CHO (1 hr prior)*

*Post-Exercise:  
50 g of CHO and 12 grams of protein*

*1-4 hours after exercise  
93 g (185 x 0.5) of CHO every 30 minutes until 4 hrs*

Courtesy of the *Warfighter Nutrition Guide* (<http://hprc-online.org/nutrition/nutrition-resources>)

During exercise the environment is "catabolic" so that energy can be delivered to the working muscles. Insulin, an important hormone for promoting muscle protein synthesis, is not released during exercise because it is not needed. After exercise the environments must become "anabolic," so the process of recovery and building up what was lost begins: insulin release must be stimulated. Ingestion of CHO stimulates "insulin." Thus, immediately after exercise, when glycogen stores and muscle protein synthesis are low, is the critical time to provide what muscle needs (CHO + small amount of protein). Running on an empty tank for too long after strenuous operations or PT will be detrimental to performance and duties the next day. To avoid performance decrements, or fatigue, a C-P-F of 80%/20%/0%, or as little fat as possible, is recommended. This means a small meal of CHO (50–60 g) and protein (12–15 g), taken as food or fluid within 45 minutes after completing exercise, will help begin repletion of muscle glycogen stores and synthesis of muscle protein. This RFI will set the stage for recovery, repair, and muscular growth.

Possible Re-Fueling Index (RFI) Foods

Food and/or Beverage Product (s)	CHO (g)	Protein (g)
Peanut butter (2 Tbsp) and jelly (2 tsp) on wheat bread (2 slices)	43	14
Hard-boiled egg (1) and bagel	56	12
Oatmeal Raisin Cookie and 6" Deli Turkey Breast Sub	76	21
Low-fat yogurt with fruit (8 oz)	47	11
Soldier Fuel Bar (1) or other high CHO Sports Bar	40	10
String cheese (2) and apple or pear, (1) large	23	14
Cereal with low-fat milk (1 cup)	53	13

After the first 45 minutes, nutrient intake will depend on the duration, intensity, and type of activity. Low intensity exercise of short duration will require regular meals at regular intervals, whereas high intensity exercise of both short and long duration will require regular snacks of carbohydrate and protein, with some fat. Obviously, the longer the duration of the activity, the greater the energy drain, thus a greater need for refueling the tank. A recovery meal to ensure nutrients, fluids, and calories are replenished immediately after PT during the RFI and over the course of the day is important. Examples of nutrient-dense recovery foods include the following:

- Sports bar, 1, with 50 g CHO and 12 g protein
- Low-fat yogurt, 8 oz.
- Honey, 1 oz.
- Tuna fish, 3 oz.
- Whole fruit, 1 piece.
- 100% fruit juice, 8 oz.
- Whole grain bagel, 1
- Cottage cheese, 4 oz.
- Tomato or V8 juice, 8 oz.
- Homemade trail mix, 6 oz.

ALL CARBOHYDRATES ARE NOT CREATED EQUALLY

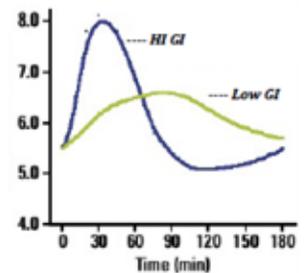
Not all CHO foods are equally effective in restoring blood glucose. Certain foods raise blood glucose concentrations and promote glycogen synthesis better than others. The term Glycemic Index (GI) is used to describe (and rank) how high a particular food will raise blood glucose: foods with a high glycemic index are the most effective for restoring glycogen. As shown in the graph, a high GI food produces a "spike" in blood glucose, whereas a low GI food takes a longer time to peak. Immediately after a mission, foods and beverages that have a moderate to high GI should be consumed. During recovery and maintenance, foods with a low GI are preferred.

Med-High GI (RFI 45 min post-exercise)

White bread	71	Corn chips	74	Jelly beans	80
Golden Grahams	71	Pop tarts	70	Cantaloupe	65
Watermelon	72	Waffles	76	Rice Krispies	82
Puffed wheat	74	Doughnut	76	Cornflakes	83
Wheat bread	71	Raisin Bran Cereal	73	Quick Oats	66
Special K Cereal	69	Cheerios	74	Bagel	72
Macaroni & Cheese	64	White Rice	88	Banana	62
Honey	62	Gatorade	78	Potato, instant	83

Low GI (Recovery/Maintenance Phase)

Yogurt	38	Grapefruit	25	Grapes	46
Peanuts	15	Whole milk	27	Grapefruit juice	48
Almonds	15	Kidney beans, boiled	29	Multi grain bread	48
Asparagus	15	Soy milk	30	Baked beans, tinned	48
Broccoli	15	Apples	38	Oatmeal, non instant	49
Celery	15	Pears	38	Yam	51
Cucumber	15	Ravioli, meat filled	39	Orange juice	52
Green beans	15	Carrots, cooked	39	Kidney beans, tinned	52
Lettuce, all varieties	15	Apple juice	41	Kiwi fruit	53
Bell Peppers	15	Spaghetti, white	41	Pound cake	54
Peas	15	All-Bran Cereal	42	Bananas	54
Spinach	15	Oranges	44	Cottage cheese	30
Tomatoes	15	Macaroni	45	Grapefruit	25
Chocolate Milk	34	Pineapple juice	46		



Remember: Ensure that you are using the following guidelines when selecting foods CHO—55%; Protein—20%; and Fat—25%.

# What to EAT when...

## Foods Producing Heat:

- Food high in CHO produce more heat during digestion
- Drinking hot beverages increases body heat and enhances mental awareness

## Foods that Hydrate you:

- Foods rich in H<sub>2</sub>O help replenish fluids lost due to high temperatures

## Foods Good for COLD Ops:

- Granola/Power Bars
- Fig Newtons
- Hot Chocolate
- Bagel with Jam
- Pretzels, Popcorn, Corn Chips, or Tortilla Chips
- Trail Mix
- Crackers

## Foods Good during HEAT Ops:

- Watermelon
- Oranges
- Strawberries
- Fruit Popsicles
- Grapes
- CHO Beverages with Electrolytes

## NIGHT OPS

Choose foods **LOW** in CHO and **HIGH** in Protein

## AVOID (makes you sleepy)

- Oats
- Bananas
- High-Protein Meat (Fish, Poultry, Steak)
- Sesame seeds, Pumpkin seeds
- Milk and Yogurt
- Sunflower Seeds, Peanuts
- Cheese
- Eggs
- Ham

## EAT (sustains energy)

- Power Bars/ClifBar
- Bagel with Cream Cheese
- Protein/CHO Beverage
- Trail Mix
- Crackers with Peanut Butter or Cheese
- Dark Chocolate (semi-sweet)
- Hot Tea or Iced Tea
- Coffee
- Coffee-Flavored Yogurt

## Refueling Index (RFI) - Critical period post mission/workout

- Eat within 45 minutes of strenuous activity to jump start muscle repair & reduce fatigue
- Ratio (Carbs - 80%; Protein - 20%; Fat - 0%)

Examples: Food and/or Beverage Product(s)	CHO (g)	Protein (g)
Peanut butter (2 Tbsp) and jelly (2 tsp) on wheat bread (2 slices)	43	14
Hard-boiled egg (1) and bagel	56	12
Oatmeal Raisin Cookie and 6' Deli Turkey Breast Sub	76	21
Low-fat yogurt with fruit (8 oz)	47	11
ClifBar	42	11
Cereal (Cheerios, Raisin Bran, etc.) with low-fat milk	53	13

## Recovery Foods:

- Eat these after low-intensity exercise/short-duration activities at regular meal intervals
- Eat these as snacks in addition to regular meals during high-intensity/long-duration activities
- Add some fat

Examples: Food and/or Beverage Product(s)	Size
Low-fat yogurt	8 oz
Honey	1 oz
Tuna Fish	3 oz
Whole fruit	1 piece
100% fruit juice	8 oz
Whole-grain bagel	1 piece
Cottage cheese	4 oz
Tomato or V8 juice	8 oz
Trail mix	6 oz