Food for Trans-Atlantic Rowers: A Menu Planning Model and Case Study

Nancy Clark, Cato Coleman, Kerri Figure, Tom Mailhot, and John Zeigler

Every 4 years, rowers from around the world compete in a 50- to 60-day trans-Atlantic rowing challenge. These ultra-distance rowers require a diet that provides adequate calories, protein, vitamins, minerals, and fluids so they can perform well day after day, minimize fatigue, and stay healthy. Yet, the rowers are confronted with menu planning challenges. The food needs to be lightweight, compact, sturdy, non-spoiling in tropical temperatures, calorie dense, easy to prepare, quick to cook, and good tasting. Financial concerns commonly add another menu planning challenge. The purpose of this case study is to summarize the rowers’ food experiences and to provide guidance for sports nutrition professionals who work with ultra-endurance athletes embarking on a physical challenge with similar food requirements. The article provides food and nutrition recommendations as well as practical considerations for ultra-distance athletes. We describe an 8,000 calorie per day menu planning model that uses food exchanges based on familiar, tasty, and reasonably priced supermarket foods that provide the required nutrients and help contain financial costs.

Key Words: ultra-distance athletes, sports nutrition, ocean rowing, menu planning, food exchanges, Atlantic Rowing Race

Introduction

Although few people aspire to row across the Atlantic Ocean, a small group of international rowers excitedly compete every 4 years in a 50- to 60-day transatlantic rowing competition, the Atlantic Rowing Race. To be able to perform repeated days of hard exercise, these ultra-distance athletes need to eat well enough to minimize fatigue and stay healthy. A palatable sports diet that provides adequate calories, protein, vitamins, minerals, and fluids is essential to meet these goals. The food needs to be lightweight, compact, sturdy, non-spoiling, good tasting, calorie dense, easily prepared, and quick cooking. Financial concerns commonly add another menu planning challenge. Nutrition education is also important to optimize

Contact Information: N. Clark is the Director of Nutrition Services, SportsMedicine Associates, 830 Boylston Street Suite 205, Brookline MA 02467. C. Coleman is with the National Institute for Diabetes, Digestive and Kidney Disease, Bethesda, MD 20892-2560. K. Figure is with the Brigham and Women’s Hospital, 75 Francis Street, Boston MA 02115. T. Mailhot is a rower from Essex, MA. J. Zeigler is a rower from River Edge, NJ.
consumption of the planned menu; the ultra-distance rowers need to know what, when, and how much to eat so they can responsibly consume appropriate amounts of nourishment.

Trans-Atlantic rowers are not the only group of athletes confronted by menu planning challenges. Other ultra-distance athletes who travel from point to point include hikers completing the Appalachian Trail, high-altitude mountaineers, long-distance sailors and canoeists, and others who participate in extreme sports. Currently, little information about menu planning for these ultra-distance athletes exists in the literature. Hence, the purpose of this article is to describe a menu-planning model for nutritionists who work with endurance rowers and other ultra-distance athletes with similar nutritional requirements.

This model is for an 8,000 calorie per day menu plan based on food exchanges using primarily supermarket foods. It was designed for two trans-Atlantic rowers, Tom and John, who would be competing in an international rowing challenge during October and November 2001. The men planned to row 14 to 16 hours per day for 50 to 60 days from the Canary Islands off the coast of Africa to Barbados, an island in the Caribbean (2,900 nautical miles or 3,330 statute miles). Given the route was near the equator, the men would be exercising in the tropical heat.

Menu Planning: A Daunting Task

Overwhelmed by the daunting task of developing an effective menu, procuring the food, and packing it into water-tight units, Tom and John sought the help of a sports nutrition professional (the lead author) who had experience counseling other ultra-distance athletes. This professional, who also saw the enormity of the job, requested assistance from two dietetic interns (the second and third authors). The three nutritionists met with the rowers, assessed their standard daily diets, and asked: “If you were to plan your own menu, what do you think you would want to eat for 60 days on the ocean?” After learning about the rowers’ food preferences, we then made a template for the 8,000-calorie menu. Appendix A outlines the many factors we took into consideration when planning the menus; Appendix B describes the exchange system used to create the menus; Appendix C outlines the rowers nutritional needs.

We did not attempt to create a sports diet with the recommended 6 to 10 g carbohydrate/kg, 1.2 to 1.7 g protein/kg, and 25% of the calories from fat as is recommended by the American Dietetic Association and the American College of Sports Medicine (4). Rather, we believed that within the abundance of daily food, the rowers would manage to consume the nutrients they needed. This assumption proved true; the menus approximated:

- 65% of calories from carbohydrate; 15 g carbohydrate/kg body weight
- 10% of calories from protein; 2 g protein/kg body weight, more than twice the RDA and typical of the rowers’ usual protein intake
- 25% of calories from fat; 220 g fat

Appendix D describes two sample menus.

This 25% fat menu offered less fat than the > 45% fat diets that ultra-distance meal plans commonly offer. This was because the authors were concerned about appetite loss in the tropical heat (3) and, in particular, unpalatability of very high fat
foods. However, the rowers did pack extra olive and canola oil, so they could take advantage of oil’s calories to boost their energy intake, if needed and tolerated.

The menus provided generous amounts of vitamins and minerals because many of the foods (i.e., energy bars, breakfast cereals) were vitamin and mineral fortified. The overall diet lacked vegetables, but it provided a substantial amount of dried fruits for fiber and nutritional value.

Based on conversations with rowers who had completed this challenge in previous years and had lost significant amounts of weight, Tom and John decided to bulk up in advance of the event: John gained about 15 lbs. (7 kg) above his standard weight; Tom gained about 10 lbs. (4.5 kg).

Results

The rowers completed the 2,900 nautical mile trans-Atlantic rowing challenge in 58 days and 3 hours. They arrived in Barbados tired, sore, and leaner. They were eager to eat fresh foods—orange juice, pancakes, coffee, steak, Caesar salad, pizza, cookies, ice cream—and some nice wine!

• John estimated he lost about 25 lbs. (about 11 kg). This represents a daily deficit of about 1,500 kcal (6,300 kJ). (John had started the event 15 lbs. [7 kg] heavier than usual, so this was a net loss of 10 lbs. [4.5 kg] below his standard weight. He regained those 10 lbs. within a month of finishing the event.)

• Tom lost about 20 lbs. (~9 kg; approximately a 1,200 kcal [5,000 kJ] per day deficit), all of which he regained within 5 weeks. (Tom reports he lost weight because of lack of time to consume adequate calories, not because of lack of food.)

In comparison to other teams of rowers, Tom and John were described by their families as “looking good.” Other rowers had lost about 40 lbs. (18 kg) and were described as looking emaciated and weak upon completion of the race.

Physical Problems

Both rowers suffered from numerous physical challenges during the event:

• John developed a bad rash from microorganisms at the sea’s surface within 5 days of the start; it evolved into open sores. He also suffered another open sore on his buttocks from a misfit seat. He reported he had never experienced such pain in his life. He started with an infection on his foot, a bad knee that got increasingly swollen throughout the journey, and an elbow that became so swollen he could barely bend it past 100°.

• Tom suffered from the same rash starting about 5 weeks into the event. He endured open, bleeding sores in his armpits. By the end of the race his knees, elbows, and fingers constantly ached.

• They initially suffered from some sea sickness but, by 5 days, they acclimatized to an oceanic lifestyle. Sea sickness was less of a problem than had been anticipated; the trade winds had been unusually calm this particular year. Hence, the rowers were almost always physically able to consume adequate calories.
Effectiveness of the Food Plan

Overall, the method for creating the menus worked well. However, the translation of the menu into reality was riddled with problems peculiar to this particular rowing team. Given that unexpected problems are common with any undertaking of this sort (“Murphy’s Law”—anything that can go wrong, will go wrong), the problems these rowers encountered are not out of the ordinary and may offer appropriate warnings to future rowers who might learn from these negative experiences.

Tom and John experienced unforeseen difficulties surrounding food substitutions (due to unavailability of certain menu items at the bulk-food warehouse, and lack of time and dedication to follow the menu exactly as planned), haste in food packing, and overall inexperience in implementing this huge undertaking. Described below are some of the problems encountered.

Haste in Food Packing

- Prior to leaving the United States, the rowers organized a “food packing party.” Unfortunately, the food was not always packed according to the menu plan. For example, refried beans, gravy, and other dinner items often appeared in the breakfast bags. This added to confusion and wasted time shuffling through bags, looking for the desired food items.
- The day before the start of the race, the rowers unexpectedly had to install a new water desalinator. This meant the boat had to be unloaded, only to be hastily reloaded at the last minute with no organizational system in place for the food. The rowers also failed to pack everything they needed. This included:
  - Proper cooking utensils, such as a spatula, metal spoon, and colander. Hence, cooking with plastic spoons was problematic, as was draining foods such as pasta.
  - Herbs, spices, and flavorings such as salt, pepper, hot sauce, cinnamon, and so on. (For salt, they added some ocean water to the water used for cooking pasta.)

Unforeseen Difficulties

- The single burner stove was limiting; a double burner would have enabled quicker and easier cooking. Due to having only one small pot and one burner on the stove, dinner meals had to be cooked in two time-consuming batches.
- The (spot-welded) handle on the pasta pot rusted and in 3 days fell off while Tom was washing the pot. The pot fell to the bottom of the ocean, leaving the rowers with only a coffee pot for cooking the rest of the journey’s meals.
- The rowers had initially planned on having an occasional cooked breakfast, but because of the stove/time constraints, they decided to cook only dinner. Hence, they did not use powdered eggs, coffee, or other breakfast foods that required cooking. (They did cook a meal every night, however, and this was a highlight of their day.)
- The stove broke on day 53, so they had no cooked food for the last 5 days. (Tortillas and peanut butter became standard fare.)
• The Endurox became unusable (it was too powdery to easily put into the water bottles) and the CytoMax seemed unpalatable to the rowers. This resulted in a shortage of flavorings for the water.
• The water desalinator worked progressively slower and slower, resulting in limited availability of water. Tom reported drinking twelve 20-oz. (560-ml) bottles of water per day (about 2 gallons; 8 L), yet this was barely adequate. As the water supply became less available, the rowers drank less. Tom reported having very dark brown urine for 5 weeks and, at one point, he described having an extra layer on the roof of his mouth and a very swollen tongue. Upon arrival in Barbados, they were literally drinking their last bottle of water. Inexperience contributed to other problems.

Food Shopping Errors

• In a few instances, the wrong foods were purchased (such as long-cooking instead of instant rice). The long-cooking rice required too much time to cook, even if it was left to soak all day.
• Lack of a full variety of food items. For example, the menu recommended multiple flavors and brands of energy bars per day, yet the maximum variety of flavors were not always purchased because of unavailability at the local stores.
• Purchase of nonfat, rather than low-fat or whole milk powder, also because of local unavailability and lack of time to find the correct item.

Menu Planning Errors

• Not enough cheese. This was partially because the cheese was so desirable, and the rowers did not always follow the menu according to plan.
• Too many nuts and peanuts, peanut butter, and chocolate (they got tired of them); not enough “solid food” like meat sticks.
• The NutriGrain bars not only crumbled but also lost their flavor appeal. The Nature Valley Granola Bars and PowerBars tasted dry and hard.
• Bars with peanut butter became less desirable as the rowers “burned out” on peanuts and peanut butter.
• The chocolate covering on some of the energy bars melted and was messy to eat. (Specifying purchase of “no melt” energy bars would have avoided this problem.)

Food Packing Errors

• The rowers had vacuum-packed the food to make an airtight package that would minimize space requirements plus better preserve the food. However, some of the foods exploded or crumbled from the stress of the vacuum-packing and some of the packaging broke. This meant the rowers were left with crumbles of NutriGrain Bars and cookies, and Gatorade powder interspersed throughout the bags—and significant food waste.
• Some foods, such as Triscuits, were taken out of their original packaging, and they became stale and undesirable.
The MREs (Meals Ready to Eat) they brought for emergency food on stormy days were left behind to lighten the load. They wished they had brought them.

**What Did Work**

Many parts of the menu did work well:

- Breakfasts of instant cream of wheat or oatmeal + milk powder + raisins + brown sugar tasted delicious! Because the rowers did not want to cook at breakfast, they simply let the cream of wheat (or oatmeal) sit and soften in the milk.
- Spicy, salty foods such as Slim Jims and beef jerky were popular. (The bland foods, in comparison, seemed even blander than usual.) Tom enjoyed Slim Jims the whole trip; John got tired of them yet enjoyed the beef jerky, which had never been a desired food prior to the trip.
- Olive oil and canola oil got used generously and were a good source of calories. The olive oil was more popular than the canola oil.
- Cheese was highly desired. They took Gouda (wrapped in wax), Edam, Jarlsberg, and Gruyere. All held up well despite the heat, with Edam being what they would recommend to others.
- Honey roasted peanuts were the most popular choice of nuts.
- Ramen noodles worked well. The rowers enjoyed many meals with ramen noodles mixed with oil and cheese.
- The rowers completed the race with about 4 to 6 days of food left—a nice comfort zone in comparison to some teams who actually ran out of food.

**Recommendations**

Based on what they learned from this 58 day adventure, the rowers made the following recommendations:

- Allow more time than anticipated to purchase, organize, and pack the food. Have a person experienced with camping and food preparation do the food shopping (to prevent errors such as buying regular instead of instant rice).
- Both rowers (or the person assigned to food details) should carefully review the food and equipment purchases, and double check for items such as salt, spices, spatula, cooking utensils.
- Include larger portions of high fat food items: more cheese, pepperoni, salami.
- Be sure to have a dental exam prior to an adventure of this type, and be cautious of foods (such as caramels) that could lead to dental problems (pulled fillings or broken teeth). Although Tom had had a dental exam, he nevertheless experienced a broken tooth.

**Conclusion**

The rowers finished 11th of 35 teams. Despite the numerous technical, physical, and mental challenges, they ate well enough to remain competitive. Their families report they looked and felt far better than some of the teams who had eaten less favorably. If only they had had more time and assistants to properly prepare the planned menu, the men believe they could have better implemented the nutrition program.
References


Appendix A:
Factors Incorporated in the Menu Design

The rowers embarked upon their journey with a 60-day supply of primarily standard supermarket foods—instant oatmeal, granola, nuts, chocolate bars, energy bars, peanut butter, dried fruit, cheese, salami, ramen noodles, and so on. These foods were selected based on weight, flavor appeal, sturdiness (ability to withstand compression/packing), ease of preparation, and calorie density. The decision to use standard supermarket foods was based on the desire to optimize palatability, provide familiar “comfort foods” so the rowers would look forward to each meal, and help contain financial costs.

Many of the food items were heavier than the alternative freeze-dried foods, but that burden of added weight was deemed to be balanced by the potential benefits (lower cost, better taste). A day’s supply of food averaged 4.5 lbs. (2 kg) per person, which is heavier than the target 3.5 lbs. (1.6 kg) per 8,000 cal (33,600 kJ) allotted by hikers on the Appalachian Trail (1).
## Appendix A Meal Planning Concerns

<table>
<thead>
<tr>
<th>Menu Planning Concern</th>
<th>Scientific principles and practical considerations</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enjoyable foods that enhanced the desire to eat</td>
<td>Food would be the highlight of the rower’s day. The menu answered the question: “Based on your previous athletic endeavors, what do you think you would like to eat during 60 days of rowing in the heat?”</td>
<td>(a) Menu used familiar supermarket foods; (b) inclusion of personal treat foods; (c) each rower planned his personal menu based on food exchanges.</td>
</tr>
<tr>
<td>Palatability</td>
<td>Variety needed to reduce food boredom over 50–60 days.</td>
<td>(a) 10-day cycle menu, (b) multiple flavors of energy bars, instant oatmeal, beverages, candy bars, and so on; (c) use of herbs and spices.</td>
</tr>
<tr>
<td>Easy to prepare foods</td>
<td>(a) Limited time to cook; (b) limited fuel; (c) only one burner on the stove.</td>
<td>(a) High use of “instant” foods (oatmeal, potato, rice) and quick-to-cook items (ramen noodles, couscous); (b) limited use of freeze-dried foods due to financial constraints.</td>
</tr>
<tr>
<td>Durable food</td>
<td>Items that would transport well without crumbling and becoming unpalatable.</td>
<td>High use of nuts, energy bars, ramen noodles, and so on, and limited use of cookies, Pringles, apples, and so on.</td>
</tr>
<tr>
<td>Weight of food</td>
<td>Carrying excess weight would slow the speed of rowing.</td>
<td>(a) Limit of 4.5 lbs. (2 kg) food per person per day; (b) use of calorie-dense foods (nuts, salami, cheese, oil); (c) use of dried foods (dried fruit, powdered tomato sauce). Budget prohibited extensive use of freeze-dried foods.</td>
</tr>
</tbody>
</table>
### Variable cooking conditions
Weather (extreme heat, storms, rough water) would affect ability to cook.
- (a) Two days with cooked breakfasts and cooked dinners;
- (b) 6 days with cooked dinners;
- (c) 1 day with no cooking (for stormy weather);
- (d) 1 day with “emergency food” (5,000 cal of foods that require no preparation).

### Storm days
Need for high calorie intake with no preparation or cooking.
- (a) Meals Ready to Eat (army rations more commonly known as MREs; information available at: [http://theepicenter.com/mre_military_meal_ready_to_eat.html](http://theepicenter.com/mre_military_meal_ready_to_eat.html));
- (b) ScandiShake, a high calorie, low volume beverage (information available at: [www.axcanscandipharm.com](http://www.axcanscandipharm.com) or 1-800-472-2634). Because of the high price of these products, the rowers opted to minimize their use rather than have them be a staple menu item.

### Emergency food
Extra rations in case the rowers took > 60 days.
Save extra food from the generous daily calorie allotment.

### Limited food budget
Price of the food affected how often it would be included in the menu.
- (a) Limited use of freeze-dried foods and other specialty foods (as mentioned below);
- (b) food shopping in bulk at discount food stores.
Appendix B:
Sample Exchange Lists Used for Menu Planning

The following sample list of “food exchanges” allowed each rower to create a personal 10-day cycle menu. To simplify matters, both rowers opted to eat from the same menu, but the system allows for individualized menus that honor personal food preferences.

The rowers created 10 days of menus by selecting from each exchange group foods they believed they would want to eat during the event. Each menu had to be individually adjusted to provide adequate calories. (For example, the starch exchange was for 800 to 900 calories, but one 7.25-oz. box of Kraft Macaroni and Cheese contained 780 calories. Hence, extra oil was added to bring the calories to the desired level.) The menu items were tallied for 10 days and then multiplied by 6 (for the estimated 60-day journey).

Breakfast

Pick one item from each group (or replace a protein and fat exchange with a combined protein/fat food item). Calories: 1,500 (6,300 kJ). Fruit and beverages can be added from the day’s snack rations.

**Starches (~600–700 cal, 2,500–3,000 kJ)**
- Four 1.4-oz. (40 g) packets instant oatmeal, assorted flavors
- Seven 1-oz. (28 g) packets Cream of Wheat, instant, plain
- Five 1.25-oz. (35 g) packets Cream of Wheat, instant, flavored
- 1.5 cups (5 oz., 150 g) Quaker 100% Natural Granola
- 1.5 cups (6 oz., 175 g) GrapeNuts
- 2 cups (6 oz., 175 g) Alpen
- Three 1.8-oz. (50 g) Pop Tarts
- Three 2.5-oz. (70 g) tortillas
- Two 3-oz. (85 g) packets ramen noodles

**Protein (~300–400 kcals, 1,200–1,700 kJ)**
- .75 cup (3 oz., 90 g) whole milk powder (add to hot or cold cereal or use for a beverage)
- 1.5 cup (3.5 oz., 100 g) nonfat milk powder
- 2/3 cup (2.5 oz., 70 g) powdered eggs
- Two 3-oz. (85 g) MetRx Protein Bars

**Fat (~400 cal, 1,700 kJ)**
- 1/4 cup (45 g) oil: canola or olive
- 2.5 oz. (70 g) nuts: peanuts, almonds, walnuts, etc.
- 4 tbsp. (65 g) peanut butter

**Combined Protein + Fat (500–700 kcals, 2,100–2,900 kJ)**
(replaces one protein + one fat exchange)
- 6 oz. (170 g) cheese: edam, gouda, Swiss, etc.
- 6 tbsp. (100 g) peanut butter
Snack Packs (3,400 cal, 14,300 kJ)

Pick a snack from each of the four categories.

**Nuts (1,000 cal, 4,200 kJ; or about 6 oz., 1.5 cups, 170 g)**
- Almonds, cashews, peanuts, macadamia nuts, walnuts, etc.

**Fruit (800-900 cal, 3,400-3,900 kJ; or about 10 oz., 300 g)**
- Dried apricots, dates, dried pineapple, prunes, raisins, etc.

**Bars (600-800 cal, 2,500-3,400 kJ)**
- Five 1.3-oz. (37 g) NutriGrain Bars, assorted flavors
- Three 1.5-oz (42 g) packets Nature Valley Granola Bars (2 bars/packet)
- Four 1-oz. (28 g) Chewy Granola Bars
- Four 1.8-oz. (50 g) Pop Tarts
- Four 1.7-oz. (50 g) Balance Bars
- Three 2.4-oz. (68 g) Clif Bars
- Three 2.3-oz. (65 g) Harvest PowerBars, assorted flavors

**Candy/treats (700-800 kcal, 2,900-3,400 kJ)**
If desired, save some for dessert at night.
- Three standard (your choice, examples below) or one large (7 oz., 195 g) candy bar
  - 1.5 oz. (43 g) Hershey Bar
  - 1.5 oz. (42 g) Kit-Kat Bar
  - 2 oz. (60 g) Snickers Bar
  - 5 oz. (140 g) Peanut M&Ms
  - Fourteen 0.5-oz. (15 g) Fig Newtons (or other Newton flavors)
  - Twelve 0.5-oz. (15 g) Golden Fruit Raisin biscuits

**Beverage for the Day (1,600 kcals, 6,700 kJ)**
One pound (16 oz., 450 g) drink mix, enough for 1 to 2 gallons (~4 to 8 L), depending on full strength (100 kcals/8 oz., 420 kJ/240 ml) or half-strength (50 kcals/8 oz., 210 kJ/240 ml) mix
- Apple cider mix, iced tea, lemonade, Kool-Aid (assorted flavors: cherry, lemon, lime, grape, raspberry, etc.), Tang, Gatorade powder (assorted flavors), Cytomax powder (assorted flavors), Endurox powder (assorted flavors).

Dinner

Pick one food item from each group. Total calories: 1,500–1,600, 6,300–6,700 kJ.

**Starches (~800-900 kcals, 3,400–3,800 kJ)**
- 2.5 cups uncooked (7.5 oz., 210 g) instant rice
- 1.25 cups uncooked (75 g) couscous
- One 7.2-oz. (206 g) box Kraft Macaroni and Cheese
- 8 oz. (225 g) uncooked angel hair spaghetti
- 8 oz. (225 g) uncooked alphabets
- 8 oz. (225 g) uncooked stellina
- Two 3-oz. (85 g) packets ramen noodles
- Four 2.5-oz. (70 g) tortillas
- One 5.6-oz. (155 g) package Lipton Noodles and Sauce, assorted flavors (beef, chicken, butter and herb, creamy chicken, etc.)
Protein (~300–400 kcals, 2,500–2,900 kJ)
- 5 oz. (140 g) beef jerky
- 4 oz. (110 g) corned beef
- 3 oz. (85 g) pepperoni
- 3 oz. (85 g) salami
- 6 oz. (170 g) sardines
- 6 oz. (170 g) salmon, canned
- 6 oz. (170 g) tuna
- One 3-oz. (85 g) MetRx Protein Bar
- .75 cup (3 oz., 90 g) whole milk powder (added to entrees or as a beverage)
- 1.5 cup (3.5 oz., 100 g) nonfat milk powder

Combo Protein + Fat (600–700 cal, 2,500–2,900 kJ)
(replaces one protein + one fat exchange)
- 4 oz. (110 g) cheese, assorted flavors
- 6 tbsp. (100 g) peanut butter, almond butter or other nut butters
- 6 oz. (170 g) salami or pepperoni

Fat (~400 cal, 1,700 kJ)
- 4 tbsp. (45 g) canola or olive oil
- 2.5 oz. (70 g) nuts, such as peanuts, almonds, walnuts, etc.

Condiments (As Desired)
Parmesan cheese, ketchup, mustard, garlic salt, Italian seasonings, Mexican seasonings, bouillon (chicken, beef), onion soup mix, cinnamon, nutmeg, brown sugar, and jelly.

Appendix C:
Nutritional Considerations for Menu Planning

To organize each day’s food intake, each menu component (such as oatmeal, dried fruit, or Pop Tarts) was packed into a waterproof zip-lock bag, and then those bags were compiled into a larger bag labeled “Breakfast,” “Snacks,” and “Dinner.”

The rowers were instructed to consume the majority of each meal’s ration in order to maintain adequate calorie intake and, consequently, maintain muscle glycogen stores (and thereby help achieve their goal of optimizing performance). The nourishing food would also help build and repair muscles and invest in a strong immune system to help fight infections and protect their health. The rowers were advised to monitor each other’s food and fluid intake to be sure each consumed adequate rations (see chart on following pages).
### Appendix C  Nutritional Concerns

<table>
<thead>
<tr>
<th>Nutritional concern</th>
<th>Scientific principles and practical considerations</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>High energy needs:</td>
<td>14 to 16 h/day rowing at 400 cal/h (~1,700 kJ; 7)</td>
<td>5,600 to 6,400 kcal rowing (23,500–27,000 kJ)</td>
</tr>
<tr>
<td></td>
<td>8 hours non-rowing activities at ~140 kcal (~600kJ)/h (9)</td>
<td>1,100 kcal (~4,800 kJ)</td>
</tr>
<tr>
<td>Estimated cost of rowing in ocean waters a boat that weighed approximately 2,500 lbs. (1,135 kg) fully loaded, 1,200 lbs. (545 kg) unloaded.</td>
<td>Extra calories to account for a 0.7% increase in calorie needs that occurs with the ambient temperature rises above 30 °C (86 °F)</td>
<td>500 kcal (2,100 kJ)</td>
</tr>
<tr>
<td></td>
<td>Allowance for food rendered inedible by salt water splashes, spillage, food washed overboard, etc.</td>
<td>200–800 kcal (840–3,360 kJ)</td>
</tr>
<tr>
<td>Consumption of adequate calories</td>
<td>Low calorie intake would lead to undesired muscle loss, reduced immune function, glycogen depletion, and impaired performance.</td>
<td>Peer monitoring of each other’s food and fluid intake. Food was packaged according to meals, so each rower would know exactly how much he needed to consume to meet the calorie target.</td>
</tr>
</tbody>
</table>
| Eating schedule     | Frequent eating throughout the day to prevent hypoglycemia, maintain high energy, and enhance performance. | The calories were divided into four categories:  
• Breakfast: 1,500 kcal (6,300 kJ); 300–400 kcal (1,200–1,700 kJ) protein-rich food; 600–700 kcal (2,500–3,000 kJ) starch; 400 kcal (1,700 kJ) fat. |
<table>
<thead>
<tr>
<th>Nutritional concern</th>
<th>Scientific principles and practical considerations</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fluids</strong></td>
<td>Maintain hydration: Allow 1 ml water/kcal expended during periods of moderate activity in a temperate climate (3). Fluids act as a vehicle to provide energy and to increase caloric intake. An additional purpose to flavoring the water was to increase palatability of the desalinated water and increase fluid consumption (10). The rowers stated a preference for commercial sports drinks, but they were also instructed in how to make a less expensive homemade sports drink (2).</td>
<td>• Snacks: 3,400 kcal (14,300 kJ) to be eaten every 60 to 90 min during rest breaks throughout the day. The snacks were divided into four types: 700–800 kcal (2,900–3,400 kJ) chocolates and other treats; 800–900 kcal (3,400–3,800 kJ) dried fruit; 1,000 kcal (4,200 kJ) nuts; 600–800 kcal (2,500–3,400 kJ) energy bars, granola bars. • Dinner: 1,500 kcal (6,300 kJ); 300–400 kcal (1,300–1,700 kJ) protein-rich food; 800–900 kcal (3,400–3,800 kJ) starch; 400 kcal (1,700 kJ) fat, or 600–700 kcal (2,500–2,900 kJ) protein-fat combination. • Fluids: 1,600 kcal (6,700 kJ).</td>
</tr>
<tr>
<td></td>
<td>8,000 ml (8 L, about 2 gallons). Of this, an estimated 1 L would be obtained via foods (such as the water used to cook oatmeal, ramen noodles, and couscous), plus at least 7 L from beverages. 1,600 kcal (6,700 kJ) flavoring for water throughout the day (enough for 1 to 2 gallons of water at 50 to 100 cal/8 oz. water; 200 kJ/240 ml). Recipe for homemade sports drink: add 1 tsp (6 g) of salt (2,300 mg Na)/gallon of flavored water sweetened to 50 cal/8 oz. (200 kJ/240 ml). (This is the equivalent of half-strength Kool-Aid.)</td>
<td></td>
</tr>
<tr>
<td>Nutritional concern</td>
<td>Scientific principles and practical considerations</td>
<td>Outcome</td>
</tr>
<tr>
<td>---------------------</td>
<td>-------------------------------------------------</td>
<td>---------</td>
</tr>
<tr>
<td>Iron</td>
<td>Iron is lost with high sweat losses (5).</td>
<td>Strong consumption of iron-fortified foods (breakfast cereals, beef jerky).</td>
</tr>
<tr>
<td>Sodium</td>
<td>Adequate sodium intake needed to replace sweat losses, optimize fluid absorption and retention.</td>
<td>Menu included salty foods (ramen noodles, plus boullion instant dinners). The menus averaged about 7,500 mg sodium per day without sports drink and about 9,800 with sports drink.</td>
</tr>
<tr>
<td></td>
<td>Routers estimated to lose on average 7,000 mg sodium per day via sweat (6), based on a sweat rate of 8 L (2 gallons) of sweat per day. This recommendation was considered baseline, because sweat loss can increase threefold with heavy exertion in hot temperatures (3).</td>
<td>Because extra dietary sodium may be required when more than 3 L of sweat are lost per day (3), the rowers were instructed to consume more salt if they started to crave it. (The rowers had neglected to pack salt among their food supplies, but they added salt to their diet by cooking with ocean water.)</td>
</tr>
<tr>
<td></td>
<td>Each rower was instructed to identify his personal need for fluids by monitoring the color of his urine, with the goal being light colored urine of significant volume.</td>
<td>Menu included many fortified foods (energy bars, instant oatmeal, Pop Tarts). The rowers opted to take a multivitamin and mineral supplement for “health insurance.”</td>
</tr>
<tr>
<td>Vitamins</td>
<td>Adequate intake required to prevent deficiencies and optimize health and healing.</td>
<td></td>
</tr>
</tbody>
</table>
Appendix D:
Sample Menus With and Without Cooking

Day #1:
Menu With No Cooking at Breakfast or Dinner

Breakfast
Starch: 4 packets instant flavored oatmeal (softened in milk)
Protein: 1.5 cups dry milk powder, added to oatmeal
Fat: .5 cup almonds
Miscellaneous: handful of dried apricots (from the day’s snack bag of fruit); beverage (from the day’s supply)

Snacks
Nuts: 1.5 cups peanuts
Fruit: 10 oz. dried apricots (some eaten at breakfast)
Bars: 4 bars (1 Balance Bar, 2 NutriGrain Bars, 1 Clif Bar)
Sweet: 1 large (7 oz.) Hershey bar

Beverage
16 oz. Kool-Aid (mixed into 1 to 2 gallons of water)

Dinner
Starch: 4 tortillas
Protein/fat: 4 oz. cheese
Miscellaneous: chocolate from day’s snack ration; beverage from day’s fluid ration

Total
Total calories: 8,100
Carbohydrate: 55% (1,114 g, 13 g/kg)
Protein: 10% (202 g, 2.4 g/kg)
Fat: 35% (315 g, 3.8 g/kg)
Sodium: 7,500 mg
Weight: 4.1 lbs. of food

Day #2:
Menu With a Cooked Dinner

Breakfast:
Starch: 1.5 cups granola
Protein: 1.5 cups dry milk powder, reconstituted
Fat: 4 tbsp. peanut butter (added to the granola)

Snacks
Nuts: 6 oz. mixed nuts
Fruit: 10 oz. dried dates
Bars: 3 Harvest PowerBars, assorted flavors
Sweet: 3 Snickers Bars

Beverage
1.5 gallons (6 L) Gatorade
Dinner
Starch: 2 packets ramen noodles
Protein/fat: 6 oz. (170 g) salami
Miscellaneous: beverage from the day’s supply; Snickers Bar (saved from snacks)

Total
Total calories: 8,300
Carbohydrate: 55% (1,140 g, 13 g/kg)
Protein: 10% (205 g, 2.4 g/kg)
Fat: 35% (325 g, 3.8 g/kg)
Sodium: 13,000 mg (9,500 mg from food + 3,500 mg from sports drink)
Weight: 4.5 lbs. of food