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Introduction

Supplemental on-shift food and drink are important for sustaining the wildland firefighter (WLFF) due to long work shifts and potentially high caloric expenditures.[1, 2] However, supplemental food and drink (SFD) should not be sought to replace the meals provided on large incidents. Research indicates that a WLFF typically consumes 3,200 to 4,000 Calories in a day (breakfast, shift provisions, and dinner).[3] Shift provisions are intended to provide 1,500 calories, while Meals Ready-to-Eat (MREs)[3], on average, contain 1,200 Calories.[4] WLFF 24-hour energy expenditures (ranging from 3,600 to 6,300 Calories)[1, 5] create a challenge to match with energy intake and may create situations of hypoglycemia (low blood sugar). The goal of SFD is to provide readily available energy and promote hydration to reduce instances of hypoglycemia and to enhance work productivity.

Between meals, carbohydrate (CHO) stores within the body can be depleted during active workshifts.[6] CHO consumption during activity can help preserve energy stores that are commonly depleted during exercise.[6] During instances of insufficient dietary replenishment or physically demanding work shifts, on-the-job hypoglycemia may result. Indeed, field research demonstrates that WLFFs accomplish more work with the provision of CHO supplemental energy.[3, 7] The goal of additional food intake during the work shift is to provide readily available energy, largely in the form of CHO, to maintain energy needs for continued productivity and promote wildfire personnel safety.

In addition to concerns of macronutrient maintenance in the active WLFF is the parallel concern of total body hydration. The fluid demands of WLFFs in the field can approach or exceed 7 liters or more in a work shift.[1, 4, 5, 8] As a convenient solution to both nutrient intake and hydration support, supplemental drinks can accomplish the provision of glucose and promote fluid absorption and retention.[9] Rehydration beverages should include sufficient sodium (enough to replace but not an excessive amount) to prevent or resolve imbalances that may occur due to sweat and urine losses. However, WLFF dietary sodium intake (ranging from 3,000 to 10,000 mg on large incidents) exceeds recommended values for the general population[3]; therefore, sodium from supplemental beverages should be modest. Sodium needs are largely individual and vary based on training, heat acclimation, and other sodium-containing food and drink availability. In fact, high sodium-containing beverages are not better during exercise in the heat.[10, 11] Supplemental drinks that are palatable can improve attempts to maintain proper hydration status while working in hot environments and wearing personal protective equipment (PPE). Currently, available rehydration beverages contain varying CHO, sodium, and potassium levels, with recommendations for content that generally lack consensus and depend on the duration, intensity, and environment where individuals are performing activity. During long shifts, particularly with high work demands or extreme environmental conditions, SFD may be an important addition to WLFF health and safety. Based upon this rationale, these guidelines provide recommendations for best practices in the provision of SFD.

General SFD Guidance

There are two main categories of SFD: solid food (bars, trail mixes, etc.) and drinks/mixes (including gels and sports chews). Absent of a more restrictive agency policy or geographic area standard, SFD may be provided and purchased under the *NWCG Standards for Interagency Incident Business Management*, PMS 902, Chapter 20, Supplemental Food and Drinks, https://www.nwcg.gov/publications/902. *(Note: the medical unit may have special requests based on the need of patients.)*

Additional Guidance Includes:

1. SFD can be purchased in a liquid (including powder) or solid format.
2. The current shift provisions (sack lunch) are designed to be eaten in small amounts throughout the work shift. SFD should fit into this frequent feeding strategy.
    a. SFDs are not recommended to be consumed within an hour of meals or unnecessarily combined.
3. Energy drinks, coffee, soda, jerky products, tobacco, and gum are not considered SFD and do not meet the standards in this policy.
    a. Energy drinks are beverages that typically contain caffeine, taurine, glucuronolactone, vitamins, herbal extracts, proprietary blends, and/or amino acids, and are marketed as boosting mental alertness and physical stamina.[12]
4. SFD should not contain more than 100% of any recommended daily recommended intake (DRI) value.
    a. The Nutrition Facts labels on all products provide the percentage of the recommended daily value of several required nutrients and any voluntarily provided by the manufacturer. As a balanced diet is already provided on large incidents, supplemental items should not contain excessive (> 100% DRI) levels of nutrients. (See Appendices 1 and 3.)
5. SFD should not contain substances other than vitamins, minerals, carbohydrates, protein, fat, electrolytes, and caffeine, unless otherwise specified.
    a. Caffeine is contained in some gels and other food items, which is allowable.
    b. Most individuals can get all the necessary vitamins, minerals, and electrolytes through a healthy eating pattern of nutrient-dense foods.
    c. The known vitamins include A, C, D, E, and K, and the B vitamins: thiamin (B_1), riboflavin (B_2), niacin (B_3), pantothenic acid (B_5), pyridoxal (B_6), cobalamin (B_{12}), biotin, and folate/folic acid. Several minerals are essential for health: calcium, phosphorus, potassium, sodium, chloride, magnesium, iron, zinc, iodine, sulfur, cobalt, copper, fluoride, manganese, and selenium.

Best Practices in the Selection of Supplemental Food:

- Should be within the Acceptable Macronutrient Distribution Ranges (AMDR) established by USDA.[13]
  - 45-65% carbohydrates.
  - 20-35% fat.
  - 10-35% protein.
- Contain sodium between 50-250 mg.
- Not provide more than 100% DRI for vitamins and minerals.
- Not contain substances other than vitamins, minerals, carbohydrates, protein, and fat.

Best Practices in the Selection of Supplemental Drinks (Including Liquids, Powders, and Gels):

- Gels and sports chews are concentrated supplements and are directed to be consumed with water (typically 0.5-1L).
  - These items should adhere to the recommendations listed below when considering their ideal water intake.
- Mixed powder or drinks should contain 1-10% carbohydrate in solution. (10-100 g/L).
- Contain no fat and <10 g protein.
- Contain sodium between 100-850 mg/L.
- Contain potassium between 25-400 mg/L.
- Drinks will not provide more than 100% DRI for vitamins and minerals.
- No carbonation.
- No substances other than carbohydrates, electrolytes, protein, and caffeine.

[*] It should be noted that using powdered supplements with carbohydrate increase the risk of bacterial growth in water bottles and will require frequent replacement.

References:

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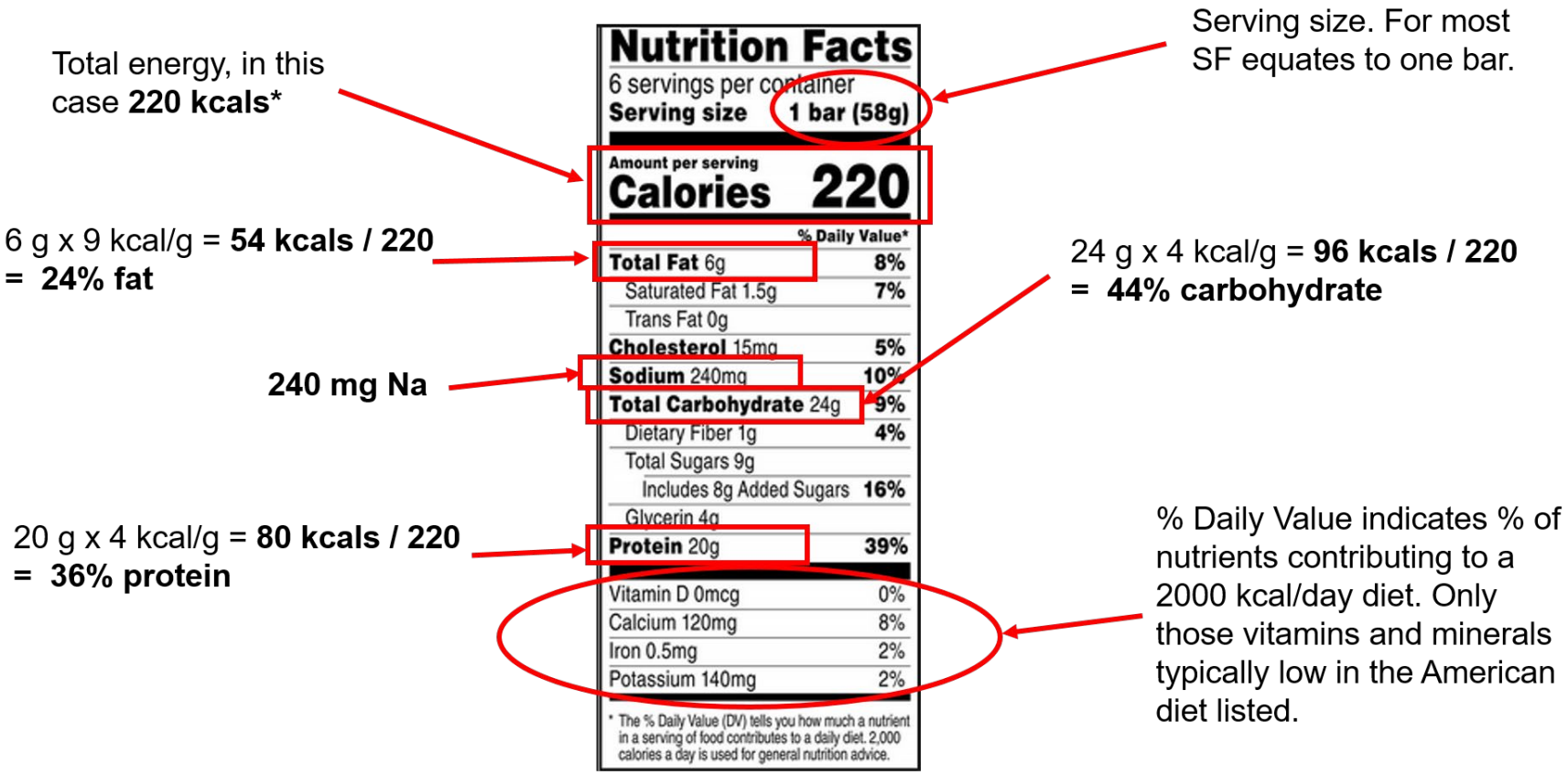
Appendix 1

How to Read a Supplemental Food Label



* - kcals=calories; fat=9 kcals/g; carbohydrate= 4 kcals/g; protein=4 kcals/g.

Appendix 2

Table of Supplemental Food Categories

Category	Examples	Total Energy	Macros	Sodium	Potassium	Pros	Cons
Granola Bars	Nature Valley NutriGrain Quaker	150-250 kcals	60% CHO 20% fat 20% protein	20-100 mg	0-80 mg	• Inexpensive • Familiar • Good macro balance	• May be already available via snack lunches • May be low in protein
Sports Bars	ClifBar PowerBar Luna Bar	200-450 kcals	40% CHO 20% fat 40% protein	>200 mg	10-100 mg	• Greater kcals may be a benefit between meals	• May be overly protein focused • Expensive
Trail Mix	Kirkland GreatValue Meijer	100-300 kcals	40% CHO 50% fat 10% protein	20-100 mg	50-200 mg	• Nuts and seeds may enhance fiber and healthy fat intake	• High fat content may not meet CHO needs
Salty Snacks	Chips Crackers Goldfish	150-300 kcals	40% CHO 50% fat 10% protein	>200 mg	0-80 mg	• With water can aid fluid retention	• High fat content may not meet CHO needs • Contributes to already high Na diets of WLFF

Total energy is per serving or individually packaged items; kcals=calories; CHO=carbohydrate; Na=sodium; WLFF=wildland firefighter

Appendix 3

How to Read a Supplemental Drink Label

Total energy, in this case **140 kcals***

With no fat or protein, carbohydrates = 100% of the total energy

270 mg Na in 591 ml = **458 mg/L** (270/.59=458)

75 mg K in 591 ml = **127 mg/L** (75/.59=127)

36 g carbohydrate in 591 mL = **61 g/L** (36/0.59 = 61)

* - kcals=calories; 1 oz=30 mL

Serving size. For most drinks equates to one bottle. In this case, 1 bottle = **0.59 L***

% Daily Value indicates % of nutrient contributing to a 2000 kcal/day diet. Not all nutrients need to be listed, just those that are typically low in the American diet, vit A, C, calcium and iron.

Appendix 4

Table of Supplemental Gels, Drinks, and Powders Categories

Category	Examples	CHO	Sodium	Potassium	Pros	Cons
Gels	Gu Clifshot Hammer gel	~40-70 g/L*	<100 mg/L*	<100 mg/L*	• Can rescue hypoglycemia in absence of other CHO food or drink	• CHO only • High sugar
Enhanced water	Propel G2 Vitamin Water	<40 g/L	0-200 mg/L	<100 mg/L	• Palatability promotes drinking • May have Na for retention	• Expensive water • Artificial sweeteners
Flavored Drinks	Kool Aid Tang	~80 g/L	<200 mg/L	0-100 mg/L	• Palatability promotes drinking • Powder can be mixed to taste • Inexpensive	• Too low Na for ideal fluid retention • High sugar content
Sports Drinks	Gatorade Powerade All-Sport	40-80 g/L	200-400 mg/L	~100 mg/L	• Palatability promotes drinking • Powder can be mixed to taste	• Expensive water • High sugar
High Sodium Drinks	Gatorade Endurance Drip Drop ORS	30-80 g/L	>700 mg/L	>300 mg/L	• High Na content promotes fluid retention in absence of Na containing foods	• Expensive • High sugar • Contributes to already high Na diets of WLFF

Assumes gel taken with 12 oz (360 ml) water; L=liter=34 oz=1 large Nalgene; CHO=carbohydrate; Na=sodium; ORS=oral rehydration solution; WLFF=wildland firefighter