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MRE Nutrition and Performance Among Male Armed Services Personnel in Hot Climates

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INTRODUCTION:

There are approximately over 300 cases of exertional heat stroke and over 2,000 cases of other heat-related illnesses per year across all active-duty military branches. Heat illness is caused by environmental conditions, work intensity, hydration status, and nutrition status. Excessive amounts of heat can degrade mental and physical performance, which have the potential to cause heat casualties.1 Heat illness can be prevented with proper nutrition and hydration awareness.1,2 Although the main nutritional concern in hot environments is maintaining the body’s hydration status, the focus of this literature review is on the specific military food rations “Meal, Ready-to-Eat” (MRE). MREs are the main rations consumed by the U.S. military personnel to fuel their rigorous training deployment. Prolonged exposure to environmental heat extremes may affect hydration and energy needs for military personnel through significant losses of several minerals in profuse sweating.3 Hot environments tend to decrease food intake in order to reduce thermic effect and maintain body temperature in unacclimated personnel.4 MREs can efficiently support military performance in moderate environments, but this may differ in operations in fields with extreme temperatures.5,6 Inadequate nutrition in regards to over-consuming and overeating in extreme climates can depress immune function; elocogue recovery from injury and illness, and compromise physical performance.7 Thus, military nutritionists focus on identifying optimal nutrition content in MREs so that personnel’s performances will not be comprised due to intense physical activity and climate extremes.

MAIN POINTS:

- Personnel typically engage in 16+ hours of vigorous physical activity per day in field operations.8
- Recommended that personnel consume between 4,000-5,000 kcal/day due to increased exposure to stressors in the field.9
- According to Military Dietary Reference Intakes, MREs exceed daily nutritional requirements contingent on at least parts of each component consumed.10
- Energy requirements can increase 2.5-10% in temperatures between 80°F and 104°F.11
- Average temperature in Iraq Theater is above 104°F and often exceeds 140°F.12
- MREs not designed for long-term consumption in hotter climates13

METHODS:

- Richmond et al.14 calculated energy expenditure (EE) and total body water by using doubly labeled water technique. Energy requirements were based on average carbohydrate content to determine energy intake (EE).
- Fried et al.15 measured strength and maximal aerobic capacity to estimate energy deficits and performance.
- Lieberman et al.16 designed computerized vigilance task on computer to mimic mental operational stressors.
- Costil et al.17 used muscle biopsy techniques to determine glycogen storage levels in carbohydrate-poor diets (40% of total calories) and high-carbohydrate diets (70% of total calories) after intense physical activity.

RESULTS:

- Soldiers have increased nutrient and energy requirements that exceed 125% of Military Dietary Reference Intakes due to the long duration and high intensity level of field missions.13

- MREs are lack of the draw when it comes to macromolecules, vitamins, minerals, etc., because you could get everything you need by trading different items with different people, or you could not get near enough and, therefore, be detrimental to getting the mission done as a result, because you are tired, or your food wasn’t cooked enough so you can store it and having problems, or really for any number of reasons.14

- AIC Petersen, U.S. Air Force, currently stationed in Okinawa, Japan

DISCUSSION & CONCLUSION:

Adequate dietary intake of macromolecules help to facilitate skeletal muscle adaptations to aerobic exercise especially in military personnel. Research shows that maintaining carbohydrate availability in glycogen stores can sustain and enhance aerobic exercise performance by delaying the onset of muscle fatigue.15 In increased heat temperatures, military cognitive and vigilance tasks performed during operational forces begin to become impaired above 90°F. Tasks of boring and repetitive nature are affected most by heat due to an overall blunting of cognitive performance.16 An operational MRE contains 51% carbohydrate, 31% fat, and 18% protein, which would suggest an emphasis on the high intensity, long duration activities but not enough on rebuilding muscle tissue. A study out of every 100 male soldiers experience a musculoskeletal injury as a result of high running mileage and weekly exercise.17 An adequate supply of macromolecules are used to fuel the activities to the body, but only if there is a reserve of 13% of total energy intake from protein.18 A higher intake of carbohydrates in MREs may also be necessary to reduce the feeling of overall fatigue and perception of the intensity because muscular work is done less with effort if there is an adequate supply of glycogen available. Because protein is primarily used for the repair and rebuilding of tissues, a higher amount should be provided in operational MREs to decrease the likelihood of injury and stress fractures.18

TAKE HOME MESSAGE:

- Acute shortages of carbohydrates with successive days of long, intense exercise in sustained operations may result in depletion of glycogen stores, decrease in performance and increased perception of work intensity.15
- Cause personnel to feel more fatigued sooner
- Consumption of 500g to 550g of carbohydrates is optimal for male soldiers to ensure speed of recovery of local muscle & overall fatigue.17
- Most effective MRE for personnel would maintain body weight, provide adequate nutrients for prevention of nutrient deficiencies, provide adequate protein, and maximize carbohydrate intake

REFERENCES: