



Sacred Heart  
UNIVERSITY

Sacred Heart University  
**DigitalCommons@SHU**

---

Academic Festival

---

Apr 21st, 1:00 PM - 3:00 PM

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

Amanda Orsillo  
*Sacred Heart University*

Follow this and additional works at: <https://digitalcommons.sacredheart.edu/acadfest>

---

Orsillo, Amanda, "MRE Nutrition and Performance Among Male Armed Services Personnel in Hot Climates" (2017). *Academic Festival*. 80.

<https://digitalcommons.sacredheart.edu/acadfest/2017/all/80>

This Poster is brought to you for free and open access by DigitalCommons@SHU. It has been accepted for inclusion in Academic Festival by an authorized administrator of DigitalCommons@SHU. For more information, please contact [ferribyp@sacredheart.edu](mailto:ferribyp@sacredheart.edu), [lysobeyb@sacredheart.edu](mailto:lysobeyb@sacredheart.edu).

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



**EXERCISE SCIENCE**  
SACRED HEART UNIVERSITY

Amanda Orsillo, Dr. Wendy Bjerke

College of Health Professions

Department of Physical Therapy & Human Movement Science

## 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.<sup>1</sup> 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.<sup>2</sup> Heat illness can be prevented with proper nutrition, hydration, and climate awareness.<sup>1,2</sup> 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 to feed personnel during 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.<sup>3</sup> Hot environments tend to decrease food intake in order to reduce thermic effect and maintain body temperature in unacclimated personnel.<sup>4</sup> MREs can efficiently support military performance in moderate environments, but this may differ in operations in fields with extreme temperatures.<sup>5,6</sup> Inadequate nutrition in regards to over-exertion of physical activity in extreme climates can depress immune function; elongate recovery from illness and injury, and compromise physical performance.<sup>3</sup> 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.<sup>5</sup>

## MAIN POINTS:

- Personnel typically engage in 16+ hours of vigorous physical activity per day in field operations<sup>3,7</sup>
- Recommended that personnel consume between 4,000-5,000 kcal/day due to increased exposure to stressors in the field<sup>3</sup>
- According to Military Dietary Reference Intakes, MREs exceed daily nutritional requirements contingent on at least parts of each component consumed<sup>8</sup>
- Energy requirements can increase 2.5-10% in temperatures between 86°F and 104°F<sup>3</sup>
  - Average temperature in Iraqi War theater is above 104°F and often exceeds 118°F<sup>9</sup>
- MREs not designed for long-term consumption in hotter climates<sup>8</sup>

## METHODS:

- Richmond et al.<sup>10</sup> calculated energy expenditure (EE) and total body water by using doubly labeled water technique
  - MREs weighed with average calorie content to determine energy intake (EI)
- Friedl et al.<sup>5</sup> measured strength and maximal aerobic capacity to estimate energy deficits and performance
- Lieberman et al.<sup>11</sup> designed computerized vigilance task on computer to mimic mental operational stressors
- Costill et al.<sup>12</sup> used thigh musculature biopsies 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

*Soldiers have increased nutrient and energy requirements that exceed 125% of Military Dietary Reference Intakes for energy due to the long duration and high intensity level of field missions<sup>13</sup>*

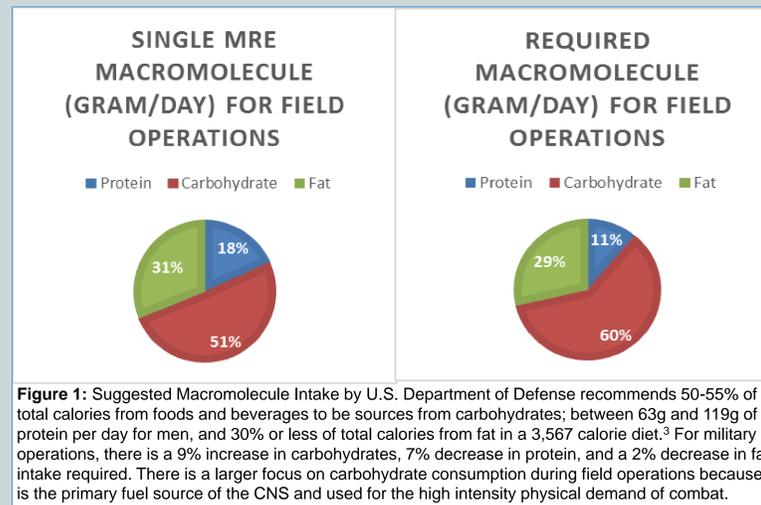
*"...MREs are luck of the draw when it comes to macromolecules, vitamins, minerals, etc. because you could get everything you need by trading different items with different people, or you could not get nearly enough, and be detrimental to getting the mission done as a result, because you are tired, or your food wasn't cooked enough so your stomach is having problems, or really for any number of reasons."<sup>14</sup>*

**- A1C Petersen, U.S. Air Force, currently stationed in Okinawa, Japan**

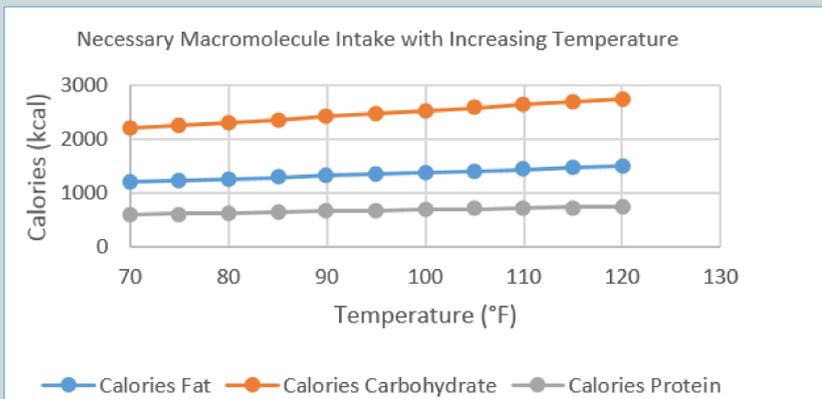
Nutrition Facts	
Serving Size 1 Package	
Amount Per Serving	
Calories 1440	Calories from Fat 650
% Daily Value*	
Total Fat 72g	111%
Saturated Fat 16g	80%
Cholesterol 30mg	10%
Sodium 1230mg	51%
Total Carbohydrate 165g	55%
Dietary Fiber 15g	60%
Sugars 69g	
Protein 47g	
Vitamin A 10%	Vitamin C 35%
Calcium 70%	Iron 35%

Nutrition facts for the Southwestern Style Chicken with Black Beans and Rice MRE. An Operational MRE contains 91g protein, 494g carbohydrate, and no more than 35% fat from total kilocalories per meal.<sup>3</sup>

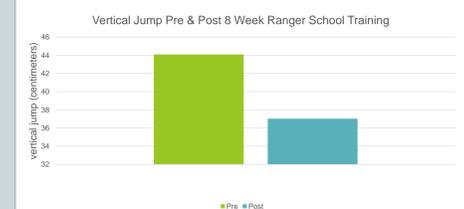
## RESULTS:



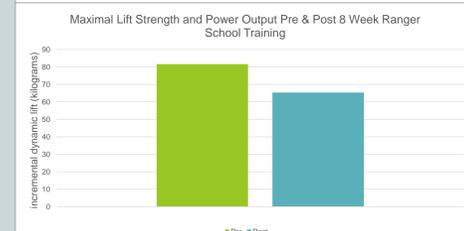
- 50% less glycogen in thigh musculature stores 4-5 days post-field activity<sup>12</sup>
  - 3,700 kcal/day at 580 grams of carbohydrates
  - Suggests 30-40% decrease in endurance if expected to continue high intensity loads over prolonged period
- Target detection times decreased over 3-hour period with cognitive impairments after 60 minutes in temperatures over 95°F<sup>11</sup>



Richmond and colleagues<sup>10</sup> observed that soldiers were in a negative energy balance throughout 8-week course. The Army regulations of 3,299 kcal/day were provided, but soldiers were in a theoretical 1,388 kcal/day energy deficit. Soldiers would have had to consume an extra 1,331 kcal/day in addition to the MRE in order to maintain energy balance during training after the second week.



Richmond and colleagues<sup>10</sup> observed that soldiers were in a negative energy balance throughout 8-week course. The Army regulations of 3,299 kcal/day were provided, but soldiers were in a theoretical 1,388 kcal/day energy deficit. Soldiers would have had to consume an extra 1,331 kcal/day in addition to the MRE in order to maintain energy balance during training after the second week.



Richmond and colleagues<sup>10</sup> observed that soldiers were in a negative energy balance throughout 8-week course. The Army regulations of 3,299 kcal/day were provided, but soldiers were in a theoretical 1,388 kcal/day energy deficit. Soldiers would have had to consume an extra 1,331 kcal/day in addition to the MRE in order to maintain energy balance during training after the second week.



Richmond and colleagues<sup>10</sup> observed that soldiers were in a negative energy balance throughout 8-week course. The Army regulations of 3,299 kcal/day were provided, but soldiers were in a theoretical 1,388 kcal/day energy deficit. Soldiers would have had to consume an extra 1,331 kcal/day in addition to the MRE in order to maintain energy balance during training after the second week.

## DISCUSSION & CONCLUSION:

Adequate dietary intake of macromolecules help to facilitate skeletal muscle adaptations to aerobic training 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.<sup>17</sup> 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 effect.<sup>15</sup> An operational MRE contains 51% carbohydrate, 31% fat, and 18% protein, which would suggest an emphasis on the high intensity, long duration workload, but not enough on the rebuilding of muscle tissues. Thirty out of every 100 male soldiers experience a musculoskeletal injury as a result of high running mileage and weekly exercise.<sup>18</sup> An adequate supply of macromolecules are used to repair all injuries to the body, but only if there is a reserve of 13% of total energy intake from protein.<sup>6,18</sup> A higher intake of carbohydrates in MREs may also be necessary to reduce the feeling of overall fatigue and perception of work intensity because muscular work is done with less 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.<sup>4</sup>

## 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 & increased perception of work intensity<sup>6</sup>
  - Cause personnel to feel more fatigued sooner
  - Cause tasks to feel more difficult
- Consumption of 500g to 550g of carbohydrates is optimal for male soldiers to ensure speed of recovery of local muscle & overall fatigue<sup>6</sup>
- 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:

- Department of the Army. U.S. Army Medical Department: Army Public Health Center. Heat Illness Prevention. [https://phc.amedd.army.mil/PHC%20Resource%20Library/HeatIllness\\_FS\\_12-005-0316.pdf](https://phc.amedd.army.mil/PHC%20Resource%20Library/HeatIllness_FS_12-005-0316.pdf). Published 2017. Accessed February 6, 2017.
- Department of the Army, Department of the Air Force. Heat Stress Control and Heat Casualty Management. March 2003. [http://armypubs.army.mil/med/dr\\_pubs/dr\\_a/pdf/tbmed507.pdf](http://armypubs.army.mil/med/dr_pubs/dr_a/pdf/tbmed507.pdf).
- Shineski EK, Nelson RA, Roadman CH. Nutrition Standards and Education. <https://www.dtic.mil/100.2/ADA403178>. Accessed March 12, 2016.
- Hill NE, Followfield JL, Delves SK, Wilson DR. Nutrition research in the military. *J R Army Med Corps*. 2014;160(2):99-101. doi:10.1136/jramc-2013-000234.
- Friedl KE, Hoyt RW. Development and biomedical testing of military operational rations. *Annu Rev Nutr*. 1997;17:51-75. doi:10.1146/annurev.nutr.17.1.51.
- Lenhart MK. Military Quantitative Physiology: Problems and Concepts in Military Operational Medicine. 2012. [https://ke.army.mil/bordeninstitute/published\\_volumes/mil\\_quantitative\\_physiology/QPFrontMatter.pdf](https://ke.army.mil/bordeninstitute/published_volumes/mil_quantitative_physiology/QPFrontMatter.pdf). Accessed March 14, 2016.
- Tharion WJ, Lieberman HR, Montain SJ, et al. Energy requirements of military personnel. *Appetite*. 2005;44(1):47-65. doi:10.1016/j.appet.2003.11.010.
- Marriott BM. *Conclusions and Recommendations*. National Academies Press (US); 1993. <https://www.ncbi.nlm.nih.gov/books/NBK236234/>. Accessed March 26, 2017.
- Iraq Climate. <http://www.globalsecurity.org/military/world/iraq/climate.htm>. Accessed March 21, 2016.
- Richmond VL, Horner FE, Wilkinson DM, Rayson MP, Wright A, Izard R. Energy balance and physical demands during an 8-week arduous military training course. *Mil Med*. 2014;179(4):421-427. doi:10.7205/MILMED-D-13-00313.
- Lieberman HR. Nutrition, brain function and cognitive performance. *Appetite*. 2003;40(3):245-254.
- Jacobs I. Nutrition and Physical Performance in Military Environments. March 1988. <http://www.dtic.mil/dtic/tr/fulltext/u2/a192015.pdf>. Accessed February 8, 2017.
- Margolis LM, Crombie AP, McClung HL, Young AJ. Energy Requirements of US Army Special Operation Forces During Military Training. May 2014. Accessed March 17, 2017.
- Petersen K. Questions about MREs and Performance. March 2017.
- Kobrick JL, Johnson RF. Effects of Hot and Cold Environments on Military Performance. July 1988. <http://www.dtic.mil/dtic/tr/fulltext/u2/a197471.pdf>. Accessed March 7, 2016.
- Nindl BC, Barnes BR, Alemany JA, Frykman PN, Shippee RL, Friedl KE. Physiological consequences of U.S. Army Ranger training. *Med Sci Sports Exerc*. 2007;39(8):1380-1387. doi:10.1249/MSS.0b013e318067e27f.
- Margolis LM, Pasiakos SM. Optimizing intramuscular adaptations to aerobic exercise: effects of carbohydrate restriction and protein supplementation on mitochondrial biogenesis. *Adv Nutr Bethesda Md*. 2013;4(6):657-664. doi:10.3945/an.113.004572.
- Kaufman K. Military Training-Related Injuries: Surveillance, Research, and Prevention. *Am J Prev Med*. 2000;18(3):54-63.