

EPISODE FORTY-FIVE OF "ARMED WITH SCIENCE: RESEARCH APPLICATIONS FOR THE MODERN MILITARY," A DEPARTMENT OF DEFENSE WEBCAST HOST: DR. JOHN OHAB GUESTS: DR. ANDY YOUNG, CHIEF OF MILITARY NUTRITION DIVISION, U.S. ARMY INSTITUTE OF ENVIRONMENTAL MEDICINE; JERRY DARSCH, DIRECTOR OF COMBAT FEEDING PROGRAM, NATICK SOLDIER SYSTEMS CENTER DATE: MONDAY, NOVEMBER 23, 2009

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ANNOUNCER: "Armed with Science: Research and Applications for the Modern Military" is a weekly webcast that discusses cutting-edge science and technology and how they apply to military operations. Each week, we will interview, scientists, administrators and operators, to educate and inform our listeners about the importance of science and technology to the modern military.

DR. OHAB: Good afternoon, and welcome to episode number 45 of "Armed with Science: Research and Applications for the Modern Military." Today is Monday, November 23rd, 2009. I am Dr. John Ohab at the Office of the Assistant Secretary of Defense for Public Affairs. If you have an insatiable hunger for science knowledge, then you are in luck today. I have the pleasure of welcoming Dr. Andy Young, chief of the military nutrition division at the U.S. Army Institute of Environmental Medicine, or USARIEM, and Mr. Jerry Darsch, director of the Combat Feeding Program at the Natick Soldier Systems Center, both experts in the field of military nutrition.

Today we'll be discussing how military organizations are working together to provide soldiers healthy, good-tasting, sustainable and nutritionally sound combat rations. Gentlemen, thank you for taking the time to be here during the busy holiday schedule.

DR. YOUNG: Glad to be here.

MR. DARSCH: Nice to be here, John.

DR. OHAB: As always, we do take questions on Twitter, so tweet them if you've got him. I'll relay the questions to our guests and hopefully get you those answers by the end of the show.

Now, broadly speaking, military and civilian life have some distinct differences. Are military nutritional requirements actually

different than civilian nutritional requirements? I'll direct that to Andy.

DR. YOUNG: Well, lots of military personnel have jobs very similar to those in the civilian sector, and for those folks, their nutritional requirements aren't going to be very much different than their civilian counterparts. The challenge is supplying them their food out in the working environment, wherever that might be.

However, there are some warriors who are the most closely engaged in combat operation and other very demanding, strenuous tasks that involve carrying heavy loads over long distances with little sleep. And for those folks, definitely they have greater fueling requirements than do most civilian people. And it's much more difficult for them to achieve their nutritional requirements while they're working in the field.

DR. OHAB: Now, Jerry, many have probably heard of the Meal, Ready-to-Eat, or the MRE. Is this the most common individual combat ration provided to military personnel?

MR. DARSCH: Yes, John, it is. As you may or may not know, between the USARIEM team and the DOD Combat Feeding team, we're charged with a fairly awesome task, and that is to fuel the Defense Department's most flexible and adaptable weapons platform, and that of course is the individual warfighter.

So the MRE, or the Meal, Ready-to-Eat, is in fact the standard individual combat ration. It provides approximately one-third the military-recommended dietary allowance. And it has to meet quite a few challenging requirements, not the least of which is a minimum shelf life at three years at 80 degrees Fahrenheit, six months at 100. It has to be stored, distributed for minus 60 degrees Fahrenheit to 120 degrees Fahrenheit. It has to be able to be thrown -- free fall out of a chopper at 100 feet, and obviously airdropped with parachutes from about 2,000 feet and higher.

The goal of course is to provide these 24 meals. Each meal provides, as I said, one-third the MRDA, or military-recommended dietary allowance. And in total, we have 24 different menus. So the ration for the MRE would be three meals per day. We do have a business philosophy here, the DOD Combat Feeding Directorate, and that is warfighter recommended, warfighter tested, and warfighter approved. And that is driving our continuous product-improvement program so that every year we go to the field, we actually field test with warfighters, and that will drive what new products and components go into the MRE and which items we remove.

Back in Desert Shield and Desert Storm, MRE was unaffectionately referred to, in some cases by Meals Rejected by Everyone. Based on this product-improvement program, we now have a widespread consumer base or warfighters who recognize these improvements. And MRE, if you will, today stands for Meals Respected by Everyone.

DR. OHAB: I understand that you've also developed more on-the-move rations known as the first-strike ration, or FSR. Could you talk a little bit more about the first-strike ration and who exactly would benefit from that?

DR. YOUNG: Sure. I'd be delighted to. Up until the introduction of the first-strike ration for warfighters who were outside the wire of a FOB, or Forward Operating Base for two to seven or up to 10 days, obviously their rucksack is their resupply line. And after that rucksack is filled with batteries and ammunition and ballistic protection and water and other mission-essential gear, there's not a lot of room left in there for food product, specifically the MRE.

So what was happening is the warfighter would be given two or three MREs. They would fieldstrip those meals and actually discard up to 50 percent of the components. And the reason they discarded them wasn't because they didn't necessarily like them or not like them; it's just they did not have room for that product and all of the products they were taking were basically products that could be consumed on the move because they were obviously in a very highly and a very high op-tempo mission state.

So consequently, in our science and technology program, we kind of looked ahead, had a little bit of vision or were lucky, or a combination of both, and we were able to come up with something called the first strike. The first strike, in essence is issued at one per warfighter per day instead of two or three MREs. It reduces the weight and cube by approximately 50 percent, and it saves the American taxpayer about 37 percent in cost. But most importantly, the first-strike ration provides all the components that can be easily eaten on the move. And we now can regain control, if you will, of nutrition and make sure that those warfighters are getting the nutrients that they so desperately need to maintain and/or enhance both cognitive and physical performance.

DR. OHAB: Andy, would you mind adding a few thoughts about how the first-strike ration differs from the Meal, Ready-to-Eat.

DR. YOUNG: Well, the first-strike ration, as Jerry said, was designed to be consumed at the rate of one ration per day as opposed to three rations per day. So right off the bat, we've got a smaller platform. And our challenge nutritionally was to actually pack the most optimal nutrient content in a much smaller container, so to speak, and make sure that we got the greatest bang for the buck nutritionally that we could in that small cube.

As Jerry mentioned, the warriors for a variety of reasons were discarding parts of their MREs. We call this field-stripping. The load factors are important. The warriors don't have a lot of time to eat when they're in a dynamic mission.

We see this with not only ground-based warriors but as well we see it in truck drivers and other vehicle operators that simply don't have time to eat.

And there was simply -- there's also -- there's menu boredom. When they throw these items away from their MRE, the biggest problem that we get into is that while the MRE was constructed to be nutritionally complete and provide 100 percent of the nutrients required by warriors per day, those nutrients are not necessarily evenly distributed across all of the different subcomponents of the ration.

So it could be that one could throw out a particular heavy component that you didn't want to carry and be throwing out -- I'll just make an example -- you could throw out all of that day's supply of zinc inadvertently. And so as a result, the warriors were not getting the right kind of nutrition by picking and choosing what components of the MRE they wanted to carry with them. And that was the central concept that was driving the first-strike ration and our efforts to nutritionally optimize what was in that first-strike ration.

DR. OHAB: I want to get back to one earlier point about how this is really something to eat on the move, which suggests that it promotes snacking. Can you talk about why snacking would be important?

DR. YOUNG: Well, snacking -- for one thing, it simply makes it more likely that the individual is going to consume the adequate amount of total energy and nutrients that are needed in a given day. As we said, warriors -- it's not just the field stripping that's the problem. There are other problems such as the time to actually eat. And if you can provide a meal that promotes snacking, that means that smaller time breaks can be used to consume a little bit of food.

In addition, there's the thought that eating all of your calories in one or two big meals may lead to periods in between those two big meals where your energy levels would not be where they want to be. And so it's been thought that snacking might provide you some countermeasure toward that occurring.

And in addition, when people are hungry between meals, that causes their mind not to be on their business. And if they have an easy-to-eat, out-of-hand snack that can quickly be consumed, hopefully they'll keep their mind on their business. And so that was all why snacking was considered to be a good design feature of this new first-strike ration.

DR. OHAB: Jerry, do you have anything to add in terms of the impetus behind the development of the new ration pack?

MR. DARSCH: Yes, I would like to add another important point, and that is that we -- to design the actual first-strike ration and the initial concept and field test it we did a lot of survey with warfighters who were engaged in foot patrols where their rucksack was their resupply line.

We did a lot of focus groups and surveys with warfighters who did in fact fieldstrip their MRE and looked at the commonality of products that we could find in terms of what they took and what they left behind in the general sense, and then put together a list that we worked

on with Andy and his group over in USARIEM in terms of value-added components that would provide the appropriate carbohydrate, fat and protein. It was kind of a wish list, if you will, and we allowed warfighters to select those kinds of items.

So there was a lot of behavioral science that went into the design and ultimately the fielding of the first-strike ration, and a lot of food technology, food science and packaging technology that made the eat-on-the-move claim more than just a buzz phrase but an actual can-do mission-essential focus. And I think we were successful in doing that.

I'll give you a specific example. This has to do with packaging. And we'll talk a little bit more about the challenges of food science in a moment, but by ergonomically designing some of the packages, the primary packages that went into the first-strike ration, we were able to design an hour-glass-shaped package with a zip-lock feature so that the warfighter did not have to rely on his canteen cup; he could actually put water directly from the canteen or from the CamelBak into this package, then zip it closed, shake it up and actually consume the beverage right out of this package or this pouch.

And that made a big difference, and I'll give you a specific example. The electrolyte powder that's in the MRE and that we were looking at to include in the first strike, the consumption rate in the MRE for that electrolyte powder was down around 33 percent. And the reason for that is that many warfighters did not want to go through the challenge of actually putting this beverage powder into the canteen cup and then rehydrating it and having to clean the cup itself.

So by changing the design of the package with an ergonomically designed shape, we saw the consumption of that electrolyte powder go from about 30 (percent), 33 percent well over 70 percent. So if we make it easy for the warfighter to consume those valuable nutrients he or she needs, they will in fact take advantage of that. DR. OHAB: And you're really trying to meet the nutritional requirements of an enormous diversity of military personnel. And I imagine this poses a number of challenges, as you mentioned. Jerry, can you talk about some of the challenges that you needed to address to develop the ration.

DR. YOUNG: Yes, I would be happy to. One of the components that was requested by the warfighter is a sandwich-type item that we could include into the first-strike ration. And many of the analogies that were being drawn by the warfighter would be a Hot Pocket. Now, as you know, and as your listeners know, Hot Pockets are found in the frozen-food section. One would buy them, bring them home, put them in the microwave to prepare them.

Now, obviously we can't issue every warfighter a small microwave oven and 6,000 miles of extension cord. That's not going to work. So we were tasked with the challenge of coming up with a shelf-stable pocket sandwich that could remain of high quality for a minimum of two years at 80 degrees Fahrenheit. And that was indeed a technological hurdle that we had to overcome.

And the technology we actually used is called Hurdle Technology, no pun intended. But the point being is we came up with a family of shelf-stable pocket sandwiches by controlling the water activity of the product itself, controlling the atmosphere within the package, controlling the PH, which is the level of acidity in that product.

So rather than going through what we would refer to as conventional sterilization processes, we developed this Hurdle Technology where in essence we want these pathogenic microorganisms to die trying getting over these hurdles. And if we put enough hurdles in front of them, we will in fact have a very safe and very wholesome product, and that's exactly what we are able to do.

I can give you a quick comment -- obviously the proof is in the pudding. Here's some quick comments from warfighters who had an opportunity to utilize the first-strike ration both in Iraq and Afghanistan, and the quote is, "An excellent concept because it significantly reduced the load my soldiers carried on short- and long-range foot patrols." And another comment is, "Nutritious, filling and quick to eat made this a quick and perfect meal on the go."

So in terms of hitting the target, in terms of warfighters who need this capability, I think we probably have hit a home run.

DR. OHAB: Andy, do you have anything to add in terms of challenges that your organization needed to address?

DR. YOUNG: Right. The biggest challenge was to optimize the nutrient content in a smaller fixed space than we had available than was provided by the MRE. And the other big challenge was keeping up with Jerry's ration-development effort. In the medical research arena, we tend to move a little slower with our processes to get approvals for using human subject testing and things like that. So those were a couple of behind-the-scene challenges.

What we did right off the bat was we convened the National Academy of Sciences' Institute of Medicine to have a worldwide expert panel. We essentially brought them together for two days and these are nutrition experts from all over the world, many of whom have actually served in the military in their youth but were now in universities and in industry around the world.

And we said, okay, here's what you've got -- the weight, the size, the cube. This is the space. What do we put in that space in terms of carbohydrate, fat, protein, sodium, micronutrients, vitamins? What can we do with the space we have available to get us the best nutrition into this box? And they spent two days and provided us with a great jumpstart which was useful in putting together the very first menu. So we knew what was going on. After that, it was simply a matter of testing the actual performance improvements and capabilities of the ration in human subjects, in the field conditions that would be used.

One of the biggest challenges -- I mean, if we wanted to simply provide the most calories that we could in the given space, we could fill

the space up with fat. But that provides you the most power -- bang for the buck. But we know biologically that doesn't make a whole lot of sense since most soldiers have at least a little bit of fat on their body. What they can't carry in their body is a large supply of readily available carbohydrate.

And so a lot of our effort was spent on determining exactly how much was the optimal amount of carbohydrate. And we did come up with a number and the ration contained that optimum amount of carbohydrate.

We also incorporated some performance-enhancing nutrients such as caffeine. We know from a large number of studies that we've done that at the right time in the right place, supply of caffeine can be the warrior's best friend in terms of keeping them vigilant and on task. And so this ration contained quite a few components that were a delivery vehicle for caffeine.

And at the end of the day when we took it out and actually did the field testing, we were able to show not only did we increase the total calories that someone would eat who was provided this ration as opposed to being provided the MREs, we also were able to increase the carbohydrate intake, and using sophisticated technologies, the self-paced work that the individual -- the actual physical work and activity that the individual sustained while consuming first-strike rations was greater than when consuming a lesser amount of MREs.

And along with that, we measured improvements in their cognitive function and vigilance over consuming lesser amounts of MREs. So given a choice, the first-strike ration the warrior chose to eat more and it benefited him or her more than did given the choice of eating the MRE.

Now, remember, these warriors that we're interested in are a special group of those warriors. They have the most demanding task, the most challenging workload and perform for the longest period without rest. So this is a ration specially made for those kinds of folks.

DR. OHAB: Now, you mentioned the National Academy of Sciences is one organization that you worked with. Can you talk about some of the other organizations and expertise that you had to leverage to overcome some of the challenges? And I can open that question to either of you.

DR. YOUNG: Well, I'll lead just because it's a follow on to our performance testing. One of the organizations that we started testing the ration on in its early days was the U.S. Forest Service and we tested it on the woodland forest firefighters who were working out in the Western parts of the country. They have very, very similar metabolic demands and work demands as an infantry soldier on the ground.

And we were able to get in. These people were a little more flexible in allowing us to monitor some of their functions during their work than the soldiers are. So we were able to actually get in and do some of our earliest testing with these forest firefighters. And they definitely liked the product quite a bit. And they actually used the MRE when they're out in the woods and can't get regular catering. So they

were a good population to substitute in the early days. So we worked with them.

DR. OHAB: Jerry.

MR. DARSCH: One of the other important attributes is we have what's called a total lifecycle management approach here at the Soldier System Center, both the combat feeding directorate and USARIEM. And by that I mean we take a materiel-enterprise approach or attack in terms of solving problems. And specifically we involve our influencers, our partners, our funders and more importantly the warfighter as early on in this process as possible.

So by involving other government agencies like USDA Food and Drug Administration, for example, the veterinary community who do the surveillance, that was a very important process and one that we really believe in.

We also involved industry as a partner early on because we can come up with the best mousetrap in the world, if you'll excuse the pun, but unless we can find an industry partner or partners that can produce this in an economical fashion, have it consistently manufactured with high standards of quality, then we really haven't done our job. So by involving the key players early on, it was very, very important so we could get it done right the first time.

One of the other interesting attributes of the first-strike ration is that both Andy and I happen to be a part of the NATO research task group. And we were able to work with 11 NATO countries or partners for peace in this very important endeavor.

And they often say that imitation is the sincerest form of flattery. By being aware of the first-strike ration that we were in fact conceptualizing and ultimately fielding, many of those NATO partners were very interested in this new capability that the first-strike ration could provide and in fact have begun to design their version of an eat-on-the-go ration for soldiers outside the wire, or FOB.

DR. OHAB: Now, Jerry, earlier you mentioned some anecdotal evidence that the -- suggested that you were accomplishing your objectives with the ration. But how are you -- how are the organizations evaluating success more broadly over the entire military?

MR. DARSCH: Well, as I mentioned earlier, John, we do a lot of field testing. And all of our family of combat rations undergo what we call a continuous product-improvement program. Consequently, we get consistent feedback on our entire family of which the first-strike ration is now a proud member.

As a matter of fact, in the first quarter of fiscal year '09, we went to Fort Benning, the 75th Ranger Regiment, the pre-ranger course. And based on recommendations and suggestions by warfighters who have used the first-strike ration, we were actually successful in evaluating a number of new components for the first-strike ration.

The goal of this particular field test was to expand the number of menus. We currently have three menus. We heard Andy Young a moment ago talk about a partial solution and we looked at this as an 80 percent solution until the rest of the data that USARIEM and Natick had collected. Now, that data is going to be instrumental in using those components of which 40 components were approved, and we will expand the number of menus from three to nine.

Andy, who happens to be a dear partner for the DOD Combat Feeding Program, mentioned that the medical community moves slower. I'd like to hop in and offer the fact that they move in a more deliberate fashion.

DR. OHAB: (Chuckles.) Andy, how is your organization evaluating success?

DR. YOUNG: Well, we had a number of performance tests, but I think that the most critical one -- the most critical two tasks were how much work would an individual do voluntarily in a self-paced manner when they're consuming this ration in comparison with the MRE ration, and how was cognitive function affected while they consumed the first-strike ration as compared with the Meal, Ready-to-Eat rations.

So for those types of performance assessments, we have a variety of technologies to measure activity and work. We can mount sensors all over the body, which when the body moves, the sensors record the motion and transmit that data to a data logger which is downloaded at the end of the exercise.

We also have wearable cognitive testing devices that will give an audio signal to an individual, require them to push a button in a certain order in a certain amount of time. Or we even have simple PDA-type screen testing where the individual will see symbols and be asked to recollect those symbols later in the task. Those are all tools to measure physical and cognitive performance. They're field- portable, and we typically take them out and work with actual soldier volunteers who are completing regularly scheduled field-training activities.

In this case, our most recent and final field testing was done at Quantico, Virginia, with the U.S. Marine Corps' officer candidate school and a group of young Marine officer candidates who were completing what they call the war, I believe. It's a five-day training exercise that comes very near the end of their training. And they get very little sleep or rest during that period of time and they conduct a variety of different light infantry or U.S. Marine Corps- type activities.

And during that testing, we would provide them either the MRE or the first-strike ration, and we would step in and conduct some testing and some testing was done without them actually knowing or being involved -- just the monitoring of their physiological functions went on throughout.

DR. OHAB: I'm interested in how this work impacts other military rations. Jerry, are there any other technologies -- are the technologies in the first-strike ration being used elsewhere?

MR. DARSCH: Yes -- yes they are, John. We're looking at movement on two fronts, one on the international ministry of defense arena we're seeing a number of countries who are experiencing a similar issue in terms of their general purpose, individual combat ration really not meeting the needs or providing the capability, particularly on an asymmetric battlefield, particularly again in Afghanistan at the moment. And there are a number of countries who are looking to adopt capability of the first-strike ration, obviously customizing it with their cultural expectations in terms of what's traditional and familiar.

The current technology that permits a shelf-stable pocket sandwich is being adopted.

The United States vendors are providing that to a number of NATO countries so that they can actually evaluate it and then combine it with more traditional and familiar components, all of which are designed to be eaten on the move.

We're also seeing the application of the shelf-stable sandwich in the commercial sector. Here in the continental United States there are a number of countries -- excuse me, companies that are looking for the shelf-stable sandwich that can be provided in a vending machine. And that's an exciting endeavor as well. So any time we can spin off technology developed by or for the military into the commercial sector, that's obviously a win-win as well.

DR. OHAB: Now, Jerry, we do have just a few minutes left here. Where does this go from here? What are the next steps?

MR. DARSCH: Well, the next steps of course is to complete the menu expansion from three to nine meals -- rations I should say. And a lot of the science and the technology that was developed by the combat feeding directorate in concert with the nutrition science that Andy and his team have accomplished out of the USARIEM house here at Natick are going to be instrumental to optimize even further the capability of the first-strike ration. And we're excited about that.

Again, these drivers are going to be those put forth by the warfighter based on field testing that we do. I know Andy talked about some of the physiological testing that is essential to the success, and obviously we will continue to use what we call the hedonic scale where we will go to the field and warfighters get an opportunity to rate these new components and these new menus, where 1 is dislike extremely, 9 is like extremely. So we have a good statistical significant base to go on when we make changes.

I think the bottom line from our particular point of view is that, you know, we feel very, very honored to be able to help our warfighters in terms of good science and nutrition to have them outlast any adversary any place at any time.

DR. OHAB: Andy, what are the next steps for your organization?

DR. YOUNG: Well, we're particularly interested in pursuing some of the topics that we studied in development of the first-strike ration. Our group is very much interested in identifying specific proteins or amino acids which are the building blocks of protein that are helpful for building muscle. When we don't eat enough, we've heard stories and reports of weight loss and muscle loss during exercises and combat missions in Afghanistan. We're concerned about that.

We're also interested in whether there are specific amino acids and protein that enhance the mind function, and we're pursuing that type of a thing. We're very much interested in exploring new probiotics that might be suitable for incorporation into the military rations because probiotics enhance gut health and immune function, and we know that there's a huge problem with disease out there among a lot of our soldiers when they -- and our warriors when they first arrive in one of these new environments. And we're of course very much interested in micronutrients, minerals and botanical and herbal type of products that have the potential to enhance health and sustain performance.

DR. OHAB: You guys have sure covered a lot of terrain today. As we wrap up today's show, I'd like to give you the opportunity to offer a take-home message or, you know, perhaps offer what your -- what the feature is in the first-strike ration that is most important to you.

DR. YOUNG: The most important thing about the first-strike in particular and nutrition in general for the warrior in the field is it's not nutrition unless it's eaten. So it doesn't do you any good to take the package; you've got to actually eat it. And that's why the first-strike is such an important step forward for the particular audience it was targeted at, that it actually improves consumption and that in turn improves the nutrition.

MR. DARSCH: And as far as the DOD combat feeding directorate is concerned, I hope a takeaway message will be the following. That for all of the husbands and wives and fathers and mothers and daughters and sons that are out there concerned about warfighters worldwide, please rest assured that there is an organization in concert with Andy's division whose sole mission and whose sole focus is to ensure that our warfighters are the best-fed on the planet.

DR. OHAB: Our guests today were Dr. Andy Young, chief of the Military Nutrition Division at the U.S. Army Institute of Environmental Medicine, and Mr. Jerry Darsch, director of the Combat Feeding Program at the Natick Soldier System Center. Thank you again both for your time today and for your work on what is really a critical aspect of soldier health and well-being. Best of luck and have a wonderful holiday.

MR. DARSCH: Thank you, John.

DR. OHAB: Listeners, please tune into our next show, Wednesday, December 2nd, when we are joined by Dr. Brendan Godfrey, Director of the

Air Force Office of Scientific Research. For almost 60 years, the Air Force Office of Scientific Research has pioneered everything from lasers in stealth to space weather and self-healing materials. Dr. Godfrey will discuss the organization's plans for continued success and the development of the next generation of outstanding scientists and engineers both in the Air Force and around the world.

Please have a safe and happy Thanksgiving holiday. I am Dr. John Ohab and you've been scienced.

END.