Military Nutrition Research

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The Military Nutrition Division conducts studies to determine the nutritional requirements of fighting men and women and the nutritional adequacy of the military food supply. We study individual field rations and group feeding systems for their effects on nutritional status, health, and performance. Besides field feeding situations, we assess the dietary status of military populations subsisting in dining facilities on base. These dietary surveys are conducted to determine the nutritional adequacy of soldiers' diets at specific points in time and in specific situations. Although the study population often represents a large segment of the military, we do not survey a truly random sample of military personnel. Many of our dietary surveys are conducted to assess the effectiveness of nutrition interventions to lower fat, cholesterol, and sodium in the military diet.

When more control of the environmental or testing situation is needed we conduct laboratory or metabolic testing at the facilities in Natick. Here we can test nutritional strategies to support or enhance performance in environmental extremes. For example, we have studied the effects of different sodium intakes on heat acclimation or the effects of different levels of carbohydrate intake on perceived exertion of carrying a heavy load.

Most of our ration tests are conducted in the field, using troops in their usual environments, while they carry on their everyday military duties. Because many of our research questions deal with the effects of environmental extremes on nutritional requirements or the effect of nutritional status on tolerance to these environments, our studies are often conducted under the adverse conditions of high altitude, desert heat, or bitter cold.

Besides putting up with the weather, it is often not easy to get to our test subjects. Our subjects are often in isolated locations far off the beaten path. Dietary data collectors have had to be transported by helicopter and track vehicle. They have been stuck in the mud in the back of a truck and stranded on top of a mountain in a snow storm. It requires a dedicated data collector to ride in the back of an unheated track vehicle for one to two hours just to be able to stand in the cold to interview test subjects. Because it takes so long to get to our subjects, we often have to start work in the early hours of the morning. It is not unusual to start the work day at three or four o'clock a.m.

For studies of individual field rations, the dietary data is collected by self-recorded food record. With this method, the subject is provided cards precoded and printed with the menu items. The subject has only to circle the quantity consumed

next to the appropriate menu item. There are separate prompts for the recording of canteens or cups of water. When it is important to accurately determine water intake, we provide the subject with graduated bottles or canteens to measure their fluid consumption. A food record is a reasonably accurate method of collecting food intake data because the ration items are individually packaged, single-serving pouches or bars. When the test subjects are accessible, dietitians daily collect and review the food records with the subjects. In some situations the subjects are not accessible and weekly log books must be used.

When it is known that most food intake will be from the military dining facility or when hot meals are served in the field, the dietary intake data is collected by a modified visual estimation technique. In this method the test subject shows his or her tray to a data collector before sitting down to eat. The data collector records the food items selected and visually compares the portion sizes on the subject's tray to a weighed standard of the same food. The data collectors are trained to estimate portion sizes to within 10%. After the meal, the test subject returns to the data collector who records the quantity of food remaining on the tray. Foods consumed outside of the dining facility are recorded by the subject on food records.

The visual estimation technique cannot be used in all situations. Space constraints in the dining hall or rushed meal times may dictate the use of the food record method of data collection. If time can be scheduled with the test subjects on a daily basis, a combined food record-interview method has been used. In this method, the subject reviews the prior day's food record with a dietitian. Food models are used to clarify portion sizes and a collection of food pictures is used to elicit recollection of items not recorded. In many military training environments, time is not afforded to interview subjects. In this situation, the food record is independently reviewed by a dietitian. The dietitian fills out a query sheet to communicate to the subject questions or inconsistencies on the food record. In many of our studies we know the menu in advance or we have dictated the menu. In these situations we preprint the menu on the food record to facilitate recording by the test subject.

All of our data is coded and entered into the computer at the study site. Once we leave the study site we have no contact with the test subject, so any questions we have must be clarified at the time. Besides coding and entering the data, heroic attempts are made to verify or clean the data files at the study site. For many of our studies we hire temporary data collectors, usually students or Army Reserve dietitians, and once the study is over these people are no longer available to clear up discrepancies in coding or data entry.

Recipe preparation data is collected in the kitchen for all studies. Trained recipe specialists track food production for each meal, obtaining labels of ingredients, weights or measures of ingredients, and weight or volume losses of recipe items due to cooking. Most ingredient weights are obtained by difference. This technique

minimally interferes with the cook's routine. The recipes are later computer analyzed using in-house developed software. We code and analyze every recipe served, even though the same recipe item may be served on different days.

The Military Nutrition Division nutrient database is part of our in-house developed system for the computerized analysis of nutrients, the CAN. This system, including the nutrient database, continues to develop and evolve. The major applications of the nutrient database are dietary testing of field rations and dietary surveys of military populations as well as menu planning or diet design for metabolic studies and menu analysis.

There were a variety of factors in the decision to develop our own database. Foremost of the considerations was the need to add foods not in commercial databases, i.e, military ration items, wild edibles, and foreign foods. Another factor was the need to add or impute specific nutrients not in most commercial databases, e.g., carnitine. Also considered were the availability of computer capability in-house and the availability of Oracle, a large relational database management system, already on the mainframe computer.

The CAN nutrient database is comprised largely of data from USDA Standard Reference and CSFII data sets. We are currently using release 8 of Standard Reference. The composition of military field rations is the third major component of the CAN nutrient database. Another database that we are using, although it is separate from the CAN database, is the database of the National Cancer Institute for the Block Food Frequency Questionnaire (FFQ). We use the FFQ mainly to gather background information on subjects prior to our study periods. We are investigating the option of linking the FFQ to the CAN database.

To tailor the USDA nutrient databases to our specific needs a few modifications were made. The Standard Reference and CSFII databases were combined. Duplicate items from CSFII were deleted but any imputed nutrient values were inserted into the Standard Reference data. Also combined were the units of measure from Standard Reference, the Primary Data Set, and CSFII. The CSFII recipes that are variations of cooking fats were removed. Because we analyze recipes as prepared during each study, we have little need for these CSFII recipes. The removed food items are stored in a separate Oracle table in case they are needed. These modifications were made primarily to speed the search and retrieval of items from the database.

Another modification made was the addition of USDA food group codes to each nutrient data base item to link these foods to nutrient retention factors. New codes were added for distinguish cooked and raw foods to allow application of the appropriate retention factor. A source code was added to each nutrient for each item in the database. Still another modification was the addition of reliability codes for the

nutrient data for each food item. The reliability code designates whether the nutrient value is derived from analytical data with a large number of samples, analytical data with a small number of samples, calculated, imputed data, manufacturer's label claim data, or calculated from a recipe with or without missing data for an ingredient.

Future enhancements to the CAN nutrient database are planned. We have a need for more commercially-prepared foods to accommodate dietary surveys of more freely-living military populations. The units of measure need to be expanded to include institutional foodservice container sizes that we encounter on our studies.