Army Comprehensive Body Composition (ACBC) Study

ACBC Study Overview

U.S. Center for Initial Military Training (CIMT), through U.S. Army Training and Doctrine Command (TRADOC), has directed U.S. Army Research Institute of Environmental Medicine (USARIEM) to lead the Army Comprehensive Body Composition (ACBC) study to provide contemporary data regarding the body weight and composition of the force that may inform potential future changes to the Army Body Composition Program (ABCP). The population of the study, approximately 2,500 Soldiers, is to include Active, Reserve, and Army National Guard Soldiers representative of diverse backgrounds, including age, sex, and race/ethnicity.

The initial phase of the study will be conducted at Fort Bragg, N.C. from October 18-29. At the direction of TRADOC, additional sites will be selected as needed to ensure the study is inclusive of a diverse population.

The study will assess Soldier body size (height, weight, and circumference) and composition, current physical fitness score of record (either the ACFT or APFT), profile dates, and for females, the number, dates of pregnancies and delivery methods.

The study will use four measurement techniques to assess body composition: standard AR 600-9 tape test, dual-energy X-ray absorptiometry (DXA), three-dimensional total body scanning (3D scanning), and bio-electrical impedance analysis (BIA). The specific methods are detailed below:

1. **Manual circumference measurements (AR 600-9 tape test)** – measures are conducted by a trained individual using a standard measuring tape in accordance with AR 600-9. Measurements are made in triplicate to the nearest 0.5 in; for males at the neck and abdomen; females at the neck, waist and hips. Measurements are used to calculate body fat percentage, utilizing sex specific equations in Table B-2 of AR 600-9. Taping is a mobile, convenient, easily scalable, and economical method ($5/unit).
2. **Dual-energy x-ray absorptiometry (DXA)** – measures the absorption of low-energy x-ray photons by different body tissues, accurately quantifying the amount (weight) of muscle, fat, and bone. DXA emits less radiation than a chest x-ray. DXA is a non-invasive, precise measurement (e.g., ± 0.5% accuracy of measure for fat and ±1.0% for total body bone mineral density). DXA is considered the "gold-standard" (most accurate) body composition assessment.
3. **Bioelectrical impedance analysis (BIA)** – uses low-level electrical currents flowing at different rates through the body (e.g., fat has less water content than muscle, so fat has greater resistance to electrical current). The BIA output provides body composition and body water levels, based on the size of individual (i.e., height and weight). BIA is a non-invasive, user-friendly (limited training required) and time efficient (~60 seconds/scan). That said, BIA results can be affected by dehydration, previous exercise, alcohol ingestion, etc. (basically, anything that affects the amount of water in your body).
4. **3-dimensional body scan** – a total body surface scanner that uses infrared technology to collect over 2 million data points. Data are used to calculate over hundreds measurements of length and circumference in less than 2 minutes. 3D scans are non-

invasive, quick (~8 seconds/scan), contact-free and precise measures (e.g., +/- 5 mm) with no ionizing radiation exposure. Because one pound of muscle takes up less volume than one pound of fat (muscle is denser than fat), the 3D body scan can estimate the amount of muscle and fat based on the relationships between various body measurements (much like the Army's "tape test").

The ACBC study will examine the associations of body composition, as assessed by these four measurements with physical performance. Additional information will provide relationships between type of musculoskeletal injury and duty time lost due to injury or pregnancy

Key terms

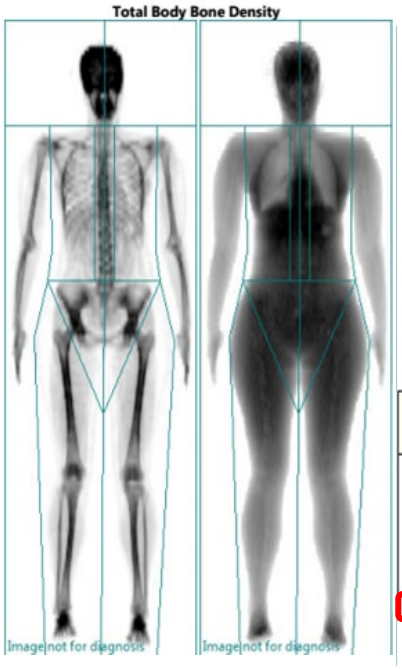
- **Height –** measured in centimeters and inches (1 inch = 2.54 cm)
- **Total Mass** - The total amount (weight) of fat, lean mass, and bone in your body.
    - Measured in kilograms (1 kg = 2.2 lbs.)
- **Lean Mass -** The amount of lean tissue (muscle and organs) in your body. In your arms and legs, this is effectively all muscle. In your trunk, this includes organs. However for adults, we can consider all changes in lean mass to be changes in muscles, as organ size doesn't really change after adolescence.
- **Fat Mass** - The total amount (weight/mass) of fat in your body.
- **Percent Body Fat (%BF or PBF)** – Percentage of your total mass that is comprised of fat.
    - $\%\boldsymbol{BF} = \frac{\boldsymbol{Total\ Fat\ Mass\ (kg)}}{\boldsymbol{Total\ Body\ Mass\ (kg)}}\ \boldsymbol{x\ 100}$
- **Body Mass Index (BMI) -** a person's weight/mass in kilograms divided by the square of their height in meters (m). BMI is correlated to % body fat, however it doesn't accurately account for differences in body composition. For example, a heavy, muscular person might have a high BMI but a low % body fat.
    - $\boldsymbol{BMI} = \frac{\boldsymbol{Body\ Mass\ (kg)}}{\boldsymbol{Height\ (m^2)}}$
- **Bone Mineral Content (BMC)** - The weight of your dry bone mass. Typical BMC ranges for the whole body are 1.5-2.5 kg (3.3-5.5 lbs.) for women and 2.5-3.5 kg (5.5-7.7 lbs.) for men.
- **Bone Mineral Density (BMD)** - This is your total bone mineral content (i.e., calcium) relative to your total body bone surface area (cm^2).
    - $\boldsymbol{Bone\ Density} = \frac{\boldsymbol{Bone\ Mineral\ Content(g)}}{\boldsymbol{Bone\ Surface\ Area\ (cm^2)}}$

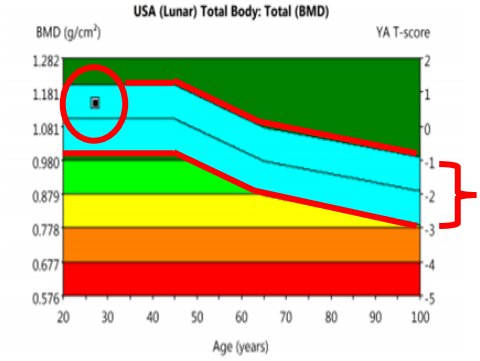
Centile - The numbers in the Centile columns compare your results against data from the National Health and Nutrition Examination Survey (NHANES) database, the largest public health database of US citizens matched for age, sex and ethnicity (black, white or Hispanic).

Understanding your results

Dual-Energy X-Ray Absorptiometry (DXA)

Page 1: Bone Mineral Density





Densitometry: USA (Lunar) (Enhanced Analysis)

Region	BMD (g/cm²)	Young-Adult T-score	Age-Matched Z-score
Head	2.267	-	-
Arms	0.849	-	-
Legs	1.204	-	-
Trunk	0.865	-	-
Ribs	0.755	-	-
Spine	0.936	-	-
Pelvis	0.944	-	-
Total	1.148	0.7	0.5

Light Blue region indicates **Average** Bone Density relative to those with similar: **Age, Sex, and Ethnicity**

This is your total bone mineral content (i.e., calcium) relative to the participant's bone surface area.

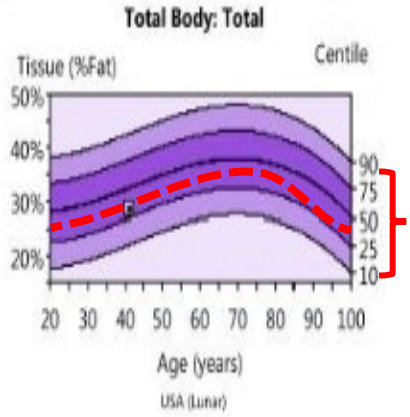
Page 2: Body Composition (% Body Fat and Lean Body Mass)

Composition (Enhanced Analysis)

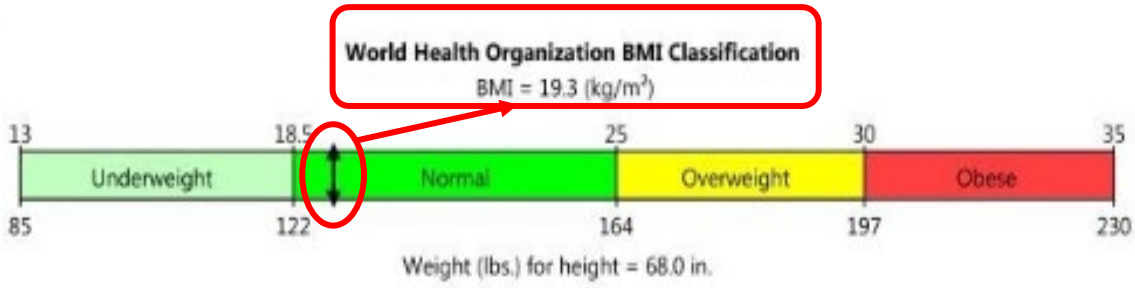
Region	Tissue (%Fat)	Centile	Total Mass (kg)	Fat (g)	Lean (g)	BMC (g)
Arm Right	20.5	-	6.3	1,234	4,782	309
Arm Left	22.0	-	6.1	1,283	4,536	294
Legs	27.1	-	34.5	9,990	24,169	1,374
Leg Right	27.9	-	16.9	4,524	11,694	683
Leg Left	26.4	-	17.6	4,466	12,475	691
Trunk	27.4	-	43.5	11,640	30,820	1,051
Trunk Right	26.8	-	21.7	5,671	15,518	512
Trunk Left	28.1	-	21.8	5,969	15,302	539
Total	26.2	99	95.8	24,154	68,016	3,661
Total Left	26.4	-	48.0	12,181	34,021	1,816

This section shows your % body fat. These values may differ compared to your estimated % body fat calculated from the "tape test" (AR 600-9)

Centile is relative to other participants with similar: **Age, Sex, and Ethnicity**



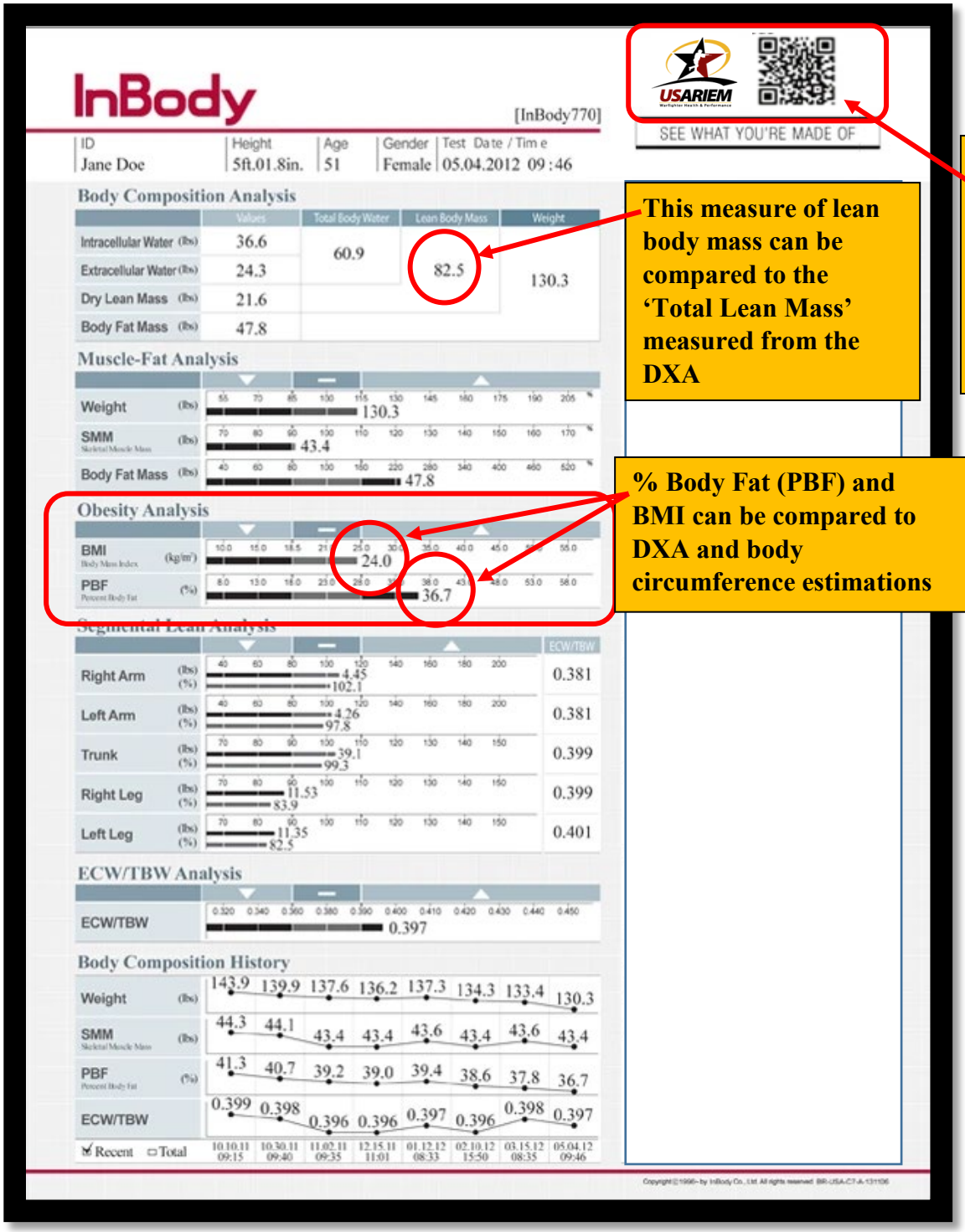
The number in the Centile column compares your results against data from the National Health and Nutrition Examination Survey (NHANES) database, the largest public health database of US citizens matched for age, sex and ethnicity (black, white or Hispanic). For example, a Centile score of 90 indicates that your values are higher than 90% of the population.



This section provides your BMI in relation to the general population. Please note that a higher-than-average BMI doesn't always indicate greater body fat.

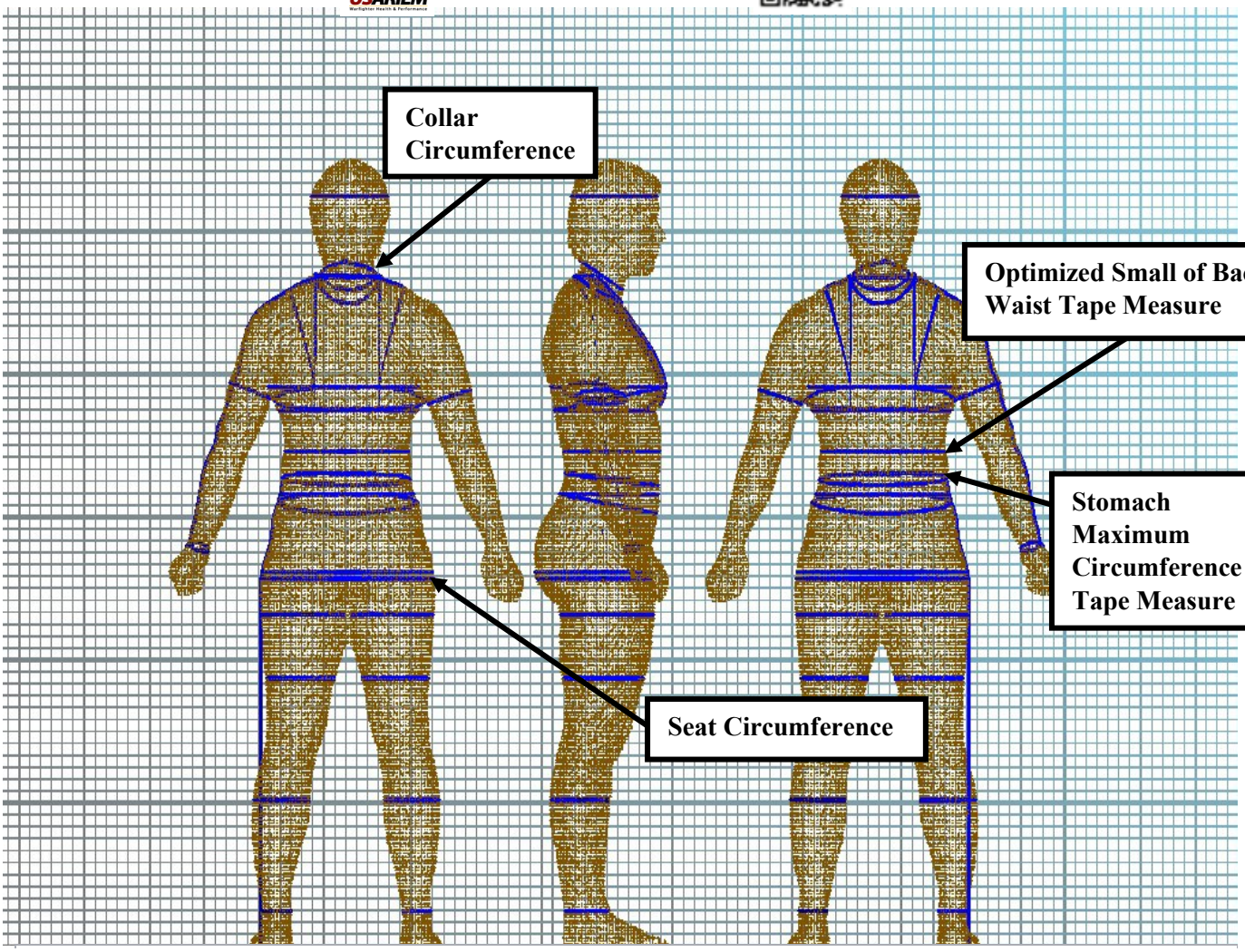
Bioelectrical Impedance Analysis (BIA)

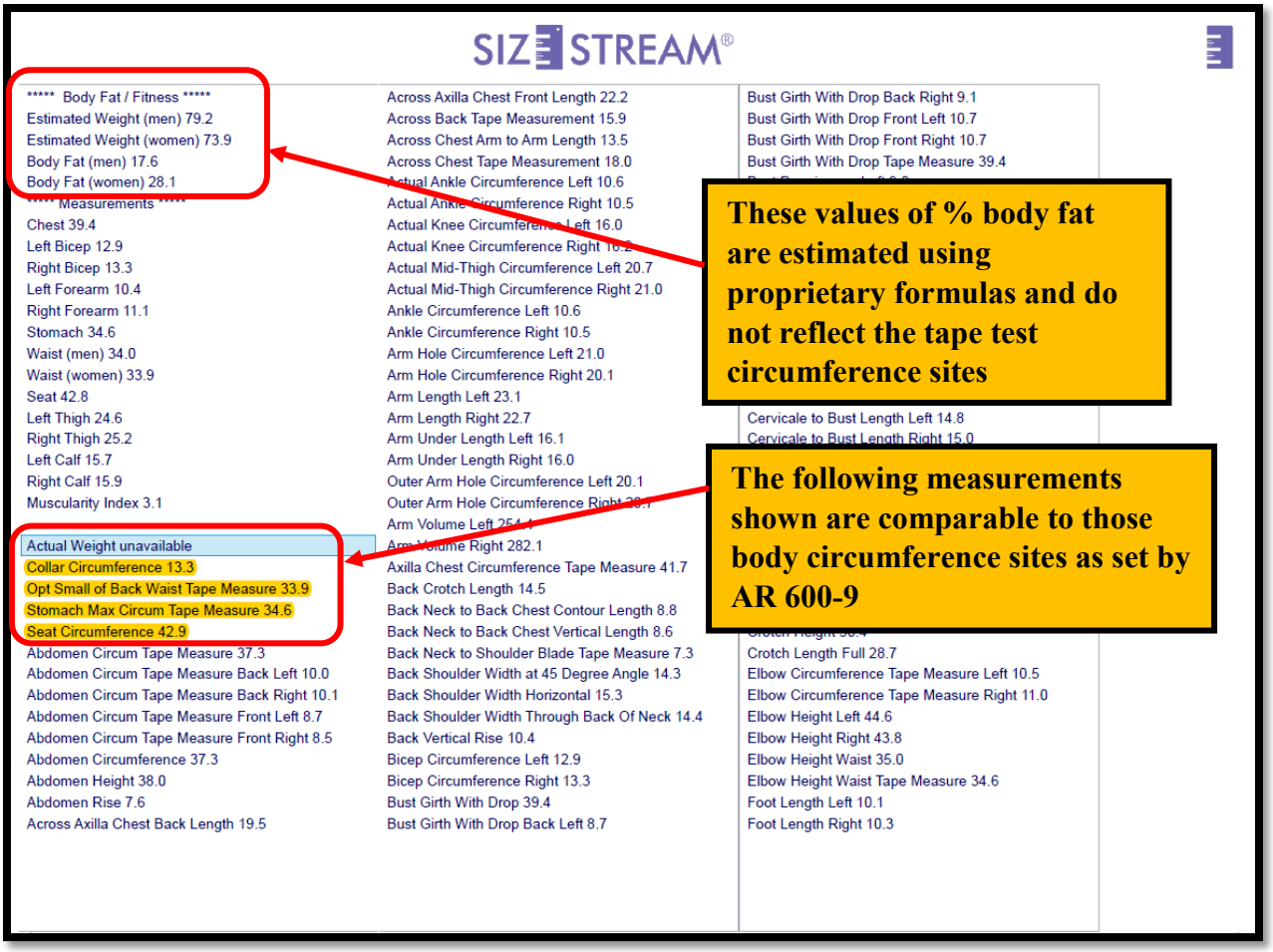
This page will provide a general overview of your results, while a more detailed description can be found here: https://inbodyusa.com/general/770-result-sheet-interpretation/



3-dimensional body scan

These pages will provide a general overview of your results, while a more detailed description can be found here: https://www.sizestream.com/technology





If you have additional questions regarding your results and your unit receives H2F services, please reach out to your unit H2F dietitian as needed. If your unit does not have H2F services, please contact the Ft. Bragg Army Wellness Center at 910-643-2101 or https://awc.army.mil