# Calculation of the Healthy Eating Index-2010 component and total scores based on data from the Diet History Questionnaire II (DHQ II) and Diet\*Calc output

This SAS program, along with the two additional required SAS macros, can be used to calculate Healthy Eating Index (HEI)-2010 scores from data collected using the DHQII in conjunction with the most recent Diet\*Calc database, released January 2015, that includes values from the Food Patterns Equivalents Database (FPED).

This program calculates HEI-2010 component and total scores for each individual, and must be run in SAS version 9.4 or higher.

The total score and the 12 components of the HEI-2010 are:

Total HEI-2010 Score (HEI2010\_TOTAL\_SCORE)

Total Fruit (HEI2010\_COMP\_TOT\_FRUIT)

Whole Fruit (HEI2010\_COMP\_WHOLE\_FRUIT)

Total Vegetables (HEI2010\_COMP\_TOT\_VEG)

Greens and Beans (HEI2010\_COMP\_DRK\_GRN\_BEAN)

Whole Grains (HEI2010\_COMP\_WHOLE\_GRAIN)

Dairy (HEI2010\_COMP\_TOT\_DAIRY)

Total Protein Foods (HEI2010\_COMP\_TOT\_MEAT\_PRO\_FD)

Seafood and Plant Proteins (HEI2010\_COMP\_SEA\_FD\_PLANT\_PRO)

Fatty Acids (HEI2010\_COMP\_FATTY\_ACID)

Refined Grains (HEI2010\_COMP\_REFINED\_GRAIN)

Sodium (HEI2010\_COMP\_SODIUM)

Empty Calories (HEI2010\_COMP\_EMPTY\_KCAL)

Additionally, the output contains the density variables used to create the component scores:

DENSITY OF FPED TOTAL VEGETABLES/1000 KCAL (TOT\_VEG\_FPED\_DEN)

DENSITY OF FPED DARK GREEN VEG AND BEANS/1000 KCAL (DRK\_GRN\_BEAN\_FPED\_DEN)

DENSITY OF FPED TOTAL FRUIT/1000 KCAL (TOT\_FRUIT\_FPED\_DEN)

DENSITY OF FPED WHOLE FRUIT PER/1000 KCAL (WHOLE\_FRUIT\_FPED\_DEN)

DENSITY OF FPED REFINED GRAINS/1000 KCAL (REFINED\_GRAIN\_FPED\_DEN)

DENSITY OF FPED WHOLE GRAIN/1000 KCAL (WHOLE\_GRAIN\_FPED\_DEN)

DENSITY OF FPED DAIRY/1000 KCAL (TOT\_DAIRY\_FPED\_DEN)

DENSITY OF FPED TOTAL MEAT/PROTEIN/1000 KCAL (TOT\_MEAT\_PRO\_FD\_FPED\_DEN)

DENSTIY OF FPED SEAFOOD AND PLANT PROTEIN/1000 KCAL (SEA\_FD\_PLANT\_PRO\_FPED\_DEN)

FATTY ACID RATIO (FATTY\_ACID RATIO)

DENSITY OF SODIUM/1000 KCAL (SODIUM\_DEN)

PERCENT EMPTY KCAL FROM SOLID FAT, ADDED SUGAR, AND ALCOHOL (PCT\_EMPTY\_KCAL)

Some of these components come directly from Diet\*Calc output but others must be created.

The list below includes FPED and other variables available from Diet\*Calc output that are used directly or as part of a calculation to create the HEI components listed above:

Total Fruit (FPED\_F\_TOTAL\_CP\_EQUIV\_USDA) in cup equivalents

Whole Fruit (FPED\_F\_CITMLB\_CP\_EQUIV\_USDA + FPED\_F\_OTHER\_CP\_EQUIV\_USDA) in cup equivalents

Total Vegetables (FPED\_V\_TOTAL\_CP\_EQUIV\_USDA) in cup equivalents

Dark Green Vegetables (FPED\_V\_DRKGR\_CP\_EQUIV\_USDA) in cup equivalents

Legumes (FPED\_V\_LEGUMES\_CP\_EQUIV\_USDA) in cup equivalents

Whole Grains (FPED\_G\_WHOLE\_OZ\_EQUIV\_USDA) in ounce equivalents

Refined Grains (FPED\_G\_REFINED\_OZ\_EQUIV\_USDA) in ounce equivalents

Total Milk (FPED\_D\_TOTAL\_CP\_EQUIV\_USDA) in cup equivalents

Meat, Poultry, Fish (FPED\_PF\_MPS\_TOTAL\_OZ\_EQUIV\_USDA) in ounce equivalents

Eggs (FPED\_PF\_EGGS\_OZ\_EQUIV\_USDA) in ounce equivalents

Nut and Seeds (FPED\_PF\_NUTSDS\_OZ\_EQUIV\_USDA) in ounce equivalents

Soybean Products (FPED\_PF\_SOY\_OZ\_EQUIV\_USDA) in ounce equivalents

High-fat Fish (FPED\_PF\_SEAFD\_HI\_OZ\_EQUIV\_USDA) in ounce equivalents

Low-fat Fish (FPED\_PF\_SEAFD\_LOW\_OZ\_EQUIV\_USDA) in ounce equivalents

Discretionary Solid Fat (FPED\_SOLID\_FATS\_G\_EQUIV\_USDA) in grams

Added Sugars (FPED\_ADD\_SUGARS\_TSP\_EQUIV\_USDA) in teaspoon equivalents

Energy (ENERGY\_KCAL\_USDA) in kcal

Saturated Fat (TOTAL\_SAT\_FA\_G\_USDA) in grams

Monounsaturated Fat (TOTAL\_MONOUNSAT\_FA\_G\_USDA) in grams

Polyunsaturated Fat (TOTAL\_POLYUNSAT\_FA\_G\_USDA) in grams

Sodium (SODIUM\_MG\_USDA) in milligrams

Alcohol (ALCOHOL\_G\_USDA) in grams

This SAS program carries out 5 steps:

1. Reads in the original Diet\*Calc results in two parts: First, it reads in the variable names, then it reads in the variable values.

*Note:* This two-part process is necessary because some of the variable names in the Diet\*Calc results file are not compatible with SAS variable name requirements.

1. Creates six required variables: MONOPOLY, FPED\_WHOLE\_FRT, FPED\_V\_TOTAL, ALLMEAT, SEAPLANT and EMPTYCAL10.

*Calculation note for MONOPOLY*: Monounsaturated fatty acids and polyunsaturated fatty acids are summed together (TOTAL\_MONOUNSAT\_FA\_G\_USDA + TOTAL\_POLYUNSAT\_FA\_G\_USDA = MONOPOLY). To estimate the fatty acid ratio of unsaturated fatty acids to saturated fatty acids, this value is then divided by saturated fatty acids (MONOPOLY/TOTAL\_SAT\_FA\_G\_USDA).

*Calculation note for FPED\_WHOLE\_FRT and FPED\_V\_TOTAL*: Citrus, Melons and Berries are summed with Other Fruits to generate the value for Whole Fruit. The total vegetable intake variable is renamed to have fewer characters (required by SAS) to allow the macros to run successfully.

*Calculation note for ALLMEAT and SEAPLANT:* ALLMEAT sums together all animal and plant proteins, including meat, poultry, fish, eggs, nuts, seeds, and soy (FPED\_PF\_MPS\_TOTAL\_OZ\_EQUIV\_USDA + FPED\_PF\_EGGS\_OZ\_EQUIV\_USDA + FPED\_PF\_NUTSDS\_OZ\_EQUIV\_USDA + FPED\_PF\_SOY\_OZ\_EQUIV\_USDA = ALLMEAT); while SEAPLANT sums together all fish and plant proteins, including fish, soy, nuts, and seeds (FPED\_PF\_SEAFD\_HI\_OZ\_EQUIV\_USDA + FPED\_PF\_SEAFD\_LOW\_OZ\_EQUIV\_USDA + FPED\_PF\_SOY\_OZ\_EQUIV\_USDAFPED\_PF\_SOY\_OZ\_EQUIV\_USDA + FPED\_PF\_NUTSDS\_OZ\_EQUIV\_USDA= SEAPLANT). An additional step is then required to determine how to include FPED\_V\_LEGUMES\_CP\_EQUIV\_USDA in ALLMEAT and SEAPLANT (see Step 3). Please note that there are two versions of ‘legumes’ from the file. The correct variable to use is FPED\_V\_LEGUMES\_CP\_EQUIV\_USDA (in cup equivalents). The other version, FPED\_PF\_LEGUMES\_OZ\_EQUIV\_USDA has different units (in ounce equivalents) not intended for the macro.

*Calculation note for EMPTYCAL10*: Empty Calories (EMPTYCAL10) is calculated using data on Discretionary Solid Fat (FPED\_SOLID\_FATS\_G\_EQUIV\_USDA), Added Sugars (FPED\_ADD\_SUGARS\_TSP\_EQUIV\_USDA), and Alcohol (ALCOHOL\_G\_USDA). In the HEI-2010, energy from alcohol is considered to be empty calories, but only when alcohol is consumed beyond moderate amounts. The least restrictive of the two levels defined as moderate drinking in the Dietary Guidelines, 2 drinks per day (converted to 28 grams of ethanol), was used to set the threshold for counting alcohol as empty calories. A value of 2150 calories was used to energy-adjust the alcohol threshold, based on the estimated median energy intake of adults. Because 28 grams ethanol/2150 calories equals 13 grams ethanol/1000 calories, only amounts greater than 13 grams of ethanol/1000 calories are counted towards Empty Calories.

1. Runs the macro to properly allocate the intakes of the FPED variable Legumes (FPED\_V\_LEGUMES\_CP\_EQUIV\_USDA) to either Total Protein Foods and Seafood and Plant Proteins (ALLMEAT and SEAPLANT) or Total Vegetables and Greens and Beans (FPED\_V\_TOTAL and FPED\_V\_DRKGR\_CP\_EQUIV\_USDA). The four resulting variables from this step, named LEGUME\_ADDED\_FPED\_V\_TOTAL, LEGUME\_ADDED\_BEANGRN, LEGUME\_ADDED\_ALLMEAT, and LEGUME\_ADDED\_SEAPLANT are all used in the next step.

*Calculation notes for Total Protein Foods; Seafood and Plant Proteins; Total Vegetables; and Greens and Beans:* Intake of the FPED variable, Legumes, counts toward meeting the standard for the Total Protein Foods (and Seafood and Plant Proteins) components first. Once the Total Protein Foods standard is met, any additional amount of Legumes counts toward the Total Vegetables and the Greens and Beans components. Units for FPED variable Legumes as well as for the HEI components Total Vegetables and Greens and Beans are in cup equivalents. However, the units for Total Protein Foods and Seafood and Plant Proteins are in ounce equivalents. Therefore, when Legumes are counted toward meeting the requirement for Total Protein Foods (and Seafood and Plant Proteins), the cup equivalents are converted to ounce equivalents. Once the Total Protein Foods standard is met, they are then converted back to cup equivalents and counted as Total Vegetables (and Greens and Beans).

*Calculation note regarding conversion of cup equivalents to ounce equivalents:* A one-fourth cup equivalent of Legumes is equal to a 1 ounce equivalent of Total Protein Foods and Seafood and Plant Proteins. Thus, the number of cup equivalents of Legumes is multiplied by 4 to convert to ounce equivalents of Total Protein Foods and Seafood and Plant Proteins.

1. Runs the HEI-2010 scoring macro which calculates intake density amounts and HEI scores.

The HEI-2010 scoring macro is called to calculate densities for each HEI-2010 component and then apply the scoring algorithm.

1. Saves the results for each individual in a comma delimited text file with a name provided by the user that ends with: withhei.results.txt.

This code was written by Lisa Kahle of Information Management Services, Inc.