# Calculation of the Healthy Eating Index-2015 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 macro, can be used to calculate Healthy Eating Index (HEI)-2015 scores from data collected using the DHQ II in conjunction with the most recent Diet\*Calc database, that includes values from the Food Patterns Equivalents Database (FPED).

This program calculates HEI-2015 component and total scores for each individual, and must be run in SAS version 9.4 or higher.

The total score and the 13 components of the HEI-2015 are:

Total HEI-2015 Score (HEI2015\_TOTAL\_SCORE)

Total Fruit (HEI2015C3\_TOTALFRUIT)

Whole Fruit (HEI2015C4\_WHOLEFRUIT)

Total Vegetables (HEI2015C1\_TOTALVEG)

Greens and Beans (HEI2015C2\_GREEN\_AND\_BEAN)

Whole Grains (HEI2015C5\_WHOLEGRAIN)

Dairy (HEI2015C6\_TOTALDAIRY)

Total Protein Foods (HEI2015C7\_TOTPROT)

Seafood and Plant Proteins (HEI2015C8\_SEAPLANT\_PROT)

Fatty Acids (HEI2015C9\_FATTYACID)

Refined Grains (HEI2015C11\_REFINEDGRAIN)

Sodium (HEI2015C10\_SODIUM)

Saturated fatty acids (HEI2015C12\_SFAT)

Added sugars (HEI2015C13\_ADDSUG)

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

HEI-2015 - Density of Total Vegetables per 1000 Kcal

HEI-2015 - Density of Greens and Beans per 1000 Kcal

HEI-2015 - Density of Total Fruits per 1000 Kcal

HEI-2015 - Density of Whole Fruits per 1000 Kcal

HEI-2015 - Density of Whole Grains per 1000 Kcal

HEI-2015 - Density of Dairy per 1000 Kcal

HEI-2015 - Density of Total Protein Foods per 1000 Kcal

HEI-2015 - Density of Seafood and Plant Proteins per 1000 Kcal

HEI-2015 - Fatty Acid Ratio

HEI-2015 - Density of Sodium per 1000 Kcal

HEI-2015 - Density of Refined Grains per 1000 Kcal

HEI-2015 - Percent of Calories from Saturated Fats

HEI-2015 - Percent of Calories from Added Sugars

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

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

This SAS program carries out 4 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, WHOLEFRT, VTOTALLEG, VDRKGRLEG, PFALLPROTLEG, PFSEAPLANTLEG.

*Calculation note for MONOPOLY*: Monounsaturated fatty acids and polyunsaturated fatty acids are summed together (MONOPOLY = TOTAL\_MONOUNSAT\_FA\_G\_USDA + TOTAL\_POLYUNSAT\_FA\_G\_USDA). 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 WHOLEFRT*: Citrus, Melons and Berries are summed with Other Fruits to generate the value for Whole Fruit (WHOLEFRT= FPED\_F\_CITMLB\_CP\_EQUIV\_USDA + FPED\_F\_OTHER\_CP\_EQUIV\_USDA). The total vegetable intake variable is renamed to have fewer characters (required by SAS) to allow the macros to run successfully.

*Calculation note for VTOTALLEG and VDRKGRLEG: VTOTALLEG sums together all vegetables and legumes (VTOTALLEG =* FPED\_V\_TOTAL\_CP\_EQUIV\_USDA *(cups) +* FPED\_V\_LEGUMES\_CP\_EQUIV\_USDA *(cups)); and VDRKGRLEG sums together dark green vegetables and legumes (VDRKGRLEG =* FPED\_V\_DRKGR\_CP\_EQUIV\_USDA *(cups) +* FPED\_V\_LEGUMES\_CP\_EQUIV\_USDA *(cups)). Note that legumes here are in cup equivalents (for vegetables), not in ounce equivalents (as they would be for protein foods).*

*Calculation note for PFALLPROTLEG and PFSEAPLANTLEG: PFALLPROTLEG sums together all animal and plant proteins, including meat, poultry, fish, eggs, nuts, seeds, soy, and legumes (PFALLPROTLEG =* FPED\_PF\_MPS\_TOTAL\_OZ\_EQUIV\_USDA (oz)*+* FPED\_PF\_EGGS\_OZ\_EQUIV\_USDA *(oz) +* FPED\_PF\_NUTSDS\_OZ\_EQUIV\_USDA *(oz) +* FPED\_PF\_SOY\_OZ\_EQUIV\_USDA *(oz) +* FPED\_PF\_LEGUMES\_OZ\_EQUIV\_USDA *(oz) ); while PFSEAPLANTLEG sums together all fish and plant proteins, including fish, nuts, seeds, soy, and legumes (PFSEAPLANTLEG =* FPED\_PF\_SEAFD\_HI\_OZ\_EQUIV\_USDA *(oz) +* FPED\_PF\_SEAFD\_LOW\_OZ\_EQUIV\_USDA *(oz) +* FPED\_PF\_NUTSDS\_OZ\_EQUIV\_USDA *(oz) +* FPED\_PF\_SOY\_OZ\_EQUIV\_USDA *(oz) +* FPED\_PF\_LEGUMES\_OZ\_EQUIV\_USDA *(in ounces)). Note that legumes here are in ounce equivalents (for protein foods), not in cup equivalents (as they would be for vegetables).*

Calculation note regarding conversion of cup equivalents to ounce equivalents:One-fourth cup of legumes is equal to 1-ounce equivalent of meat. Thus, the number of cup equivalents of legumes is multiplied by 4 to convert to ounce equivalents of meat.

1. Runs the HEI-2015 scoring macro which calculates intake density amounts and HEI scores. These macros need to be saved in your home folder.

The HEI-2015 scoring macro is called to calculate densities for each HEI-2015 component and then apply the scoring algorithm.

**HEI–2015**[**1**](http://epi.grants.cancer.gov/hei/developing.html#f1) **Components & Scoring Standards**

|  |  |  |  |
| --- | --- | --- | --- |
| **Component** | **Max points** | **Standard for maximum score** | **Standard for minimum score of zero** |
| **Adequacy:** |  |  |  |
| **Total Fruits**[**2**](http://epi.grants.cancer.gov/hei/developing.html#f2) | 5 | ≥0.8 cup equiv. per 1,000 kcal | No Fruits |
| **Whole Fruits**[**3**](http://epi.grants.cancer.gov/hei/developing.html#f3) | 5 | ≥0.4 cup equiv. per 1,000 kcal | No Whole Fruits |
| **Total Vegetables**[**4**](http://epi.grants.cancer.gov/hei/developing.html#f4) | 5 | ≥1.1 cup equiv. per 1,000 kcal | No Vegetables |
| **Greens and Beans**[**4**](http://epi.grants.cancer.gov/hei/developing.html#f4) | 5 | ≥0.2 cup equiv. per 1,000 kcal | No Greens and Beans |
| **Whole Grains** | 10 | ≥1.5 oz equiv. per 1,000 kcal | No Whole Grains |
| **Dairy**[**5**](http://epi.grants.cancer.gov/hei/developing.html#f5) | 10 | ≥1.3 cup equiv. per 1,000 kcal | No Dairy |
| **Total Protein Foods**[**4**](http://epi.grants.cancer.gov/hei/developing.html#f6) | 5 | ≥2.5 oz equiv. per 1,000 kcal | No Protein Foods |
| **Seafood and Plant Proteins**[**6**](http://epi.grants.cancer.gov/hei/developing.html#f6) | 5 | ≥0.8 oz equiv. per 1,000 kcal | No Seafood or Plant Proteins |
| **Fatty Acids**[**7**](http://epi.grants.cancer.gov/hei/developing.html#f7) | 10 | (PUFAs + MUFAs)/SFAs ≥2.5 | (PUFAs + MUFAs)/SFAs ≤1.2 |
| **Moderation:** |  |  |  |
| **Refined Grains** | 10 | ≤1.8 oz equiv. per 1,000 kcal | ≥4.3 oz equiv. per 1,000 kcal |
| **Sodium** | 10 | ≤1.1 gram per 1,000 kcal | ≥2.0 grams per 1,000 kcal |
| **Added Sugars** | 10 | ≤6.5% of energy | ≥26% of energy |
| **Saturated Fats** | 10 | ≤8% of energy | ≥16% of energy |

**1:** Intakes between the minimum and maximum standards are scored proportionately.

**2:** Includes 100% fruit juice.

**3:** Includes all forms except juice.

**4:** Includes legumes (beans and peas).

**5:** Includes all milk products, such as fluid milk, yogurt, and cheese, and fortified soy beverages.

**6:** Includes seafood, nuts, seeds, soy products (other than beverages), and legumes (beans and peas).

**7:** Ratio of poly- and monounsaturated fatty acids (PUFAs and MUFAs) to saturated fatty acids (SFAs).

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. The output cannot be saved as an xlsx file, but you may choose to convert to xlsx after it is saved in your output folder. To maintain the original variable names in the output, we do not recommend the use of a direct export function in SAS.

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