Web application
"Foodplate – how to make reasonable choices?"

Background paper

**Anne Aan, Liina Laumets, Eva-Liisa Orula,
Päivi Munne and Lauri Äystö**

Tartu 2013

Contents

Introduction

The web application "Foodplate" is compiled in cooperation with Finnish, Estonian and Latvian experts in the frame of the project "FOODWEB – Baltic environment, food and health: from habits to awareness". The aim of the project is to evaluate the relationship between food quality, human health and environmental impacts (Figure 1), more precisely:

1) how the environment influences our food and health;
2) how human activities influence the environment and food quality.
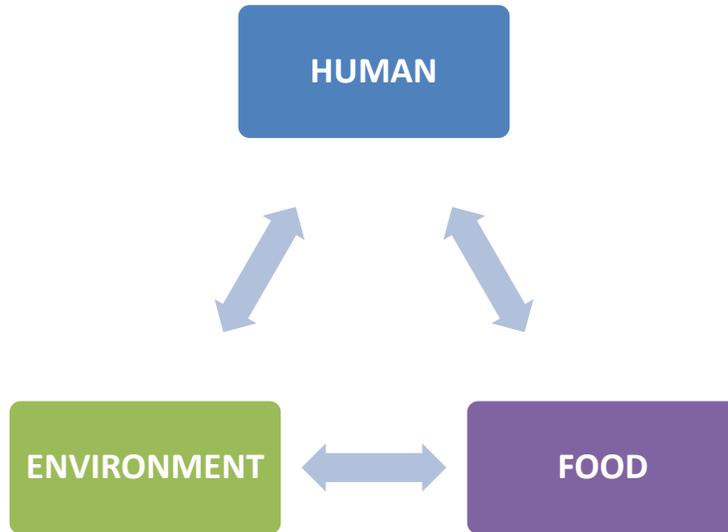
Figure 1. Relationships and impacts between food, human and environment.

Human activities influence both environment and food quality through production, processing, conservation etc. Environment affects human health via food quality and safety and the quality of food affects human health.

To raise people's awareness, several web-based educational materials have been compiled during the project FOODWEB. These materials cover the following subjects:
- contaminants in food,
- life cycle of food which covers the impacts of food production to the environment,
- health risks and benefits related to food.

In addition, recommendations concerning food, health and environment related choices are available. All materials are available on the project web page http://foodweb.ut.ee/.

The project FOODWEB has not studied how the environment is directly affecting human health, therefore we do not address this subject in more detail.

1. The purpose of web application "Foodplate"

The main goal of the web application "Foodplate" (http://foodweb.ut.ee/foodplate/) is to help people to evaluate their food (i.e. lunch) choices - energy content, nutritional quality, environmental impacts and possible contaminant exposure. The aim is to compile an ideal lunch plate: which has the right energy content and nutritional balance, low environmental impacts and human exposure to contaminants.

It is essential for our well-being to have a variable and balanced diet. A clean environment enables production of healthier food. Therefore, it is important to protect the surrounding environment, like the Baltic Sea area, and to prevent pollution.

The web application "Foodplate" helps to analyse the user's food choices: how they affect health and the environment. The user finds out how to combine various food items to decrease environmental impact and contaminant exposure and at the same time to increase nutritional quality.

The web application is available in four languages:
in English - http://foodweb.ut.ee/foodplate/,
in Estonian - http://foodweb.ut.ee/foodplate/?lang=et,
in Finnish - http://foodweb.ut.ee/foodplate/?lang=fi,
in Latvian - http://foodweb.ut.ee/foodplate/?lang=lv.

More information about the web application "Foodplate" can be found from the web page http://foodweb.ut.ee/Foodplate_244.htm.

Take a look also at the video guides:
in English - http://www.youtube.com/watch?v=Q0V2rmIoFvY,
in Estonian - http://www.youtube.com/watch?v=nOXOkT4BR2M.

Target groups for this application are mainly consumers, teachers and students. Teachers will also find more guidelines and examples for using the web application in lessons from the teacher's handbook "Baltic environment, food and health: from habits to awareness". Material is available on the web page http://foodweb.ut.ee/s2/209_280_139_Baltic_environment_food_and_health_from_habits_t.pdf.

2. How to use web application "Foodplate"?

2.1. Instructions

1. Open the application "Foodplate" from the web page http://foodweb.ut.ee/foodplate/. Insert your gender, age and weight in the empty fields - all the calculations are based on this information (Figure 2). Click the button "Continue" to proceed.
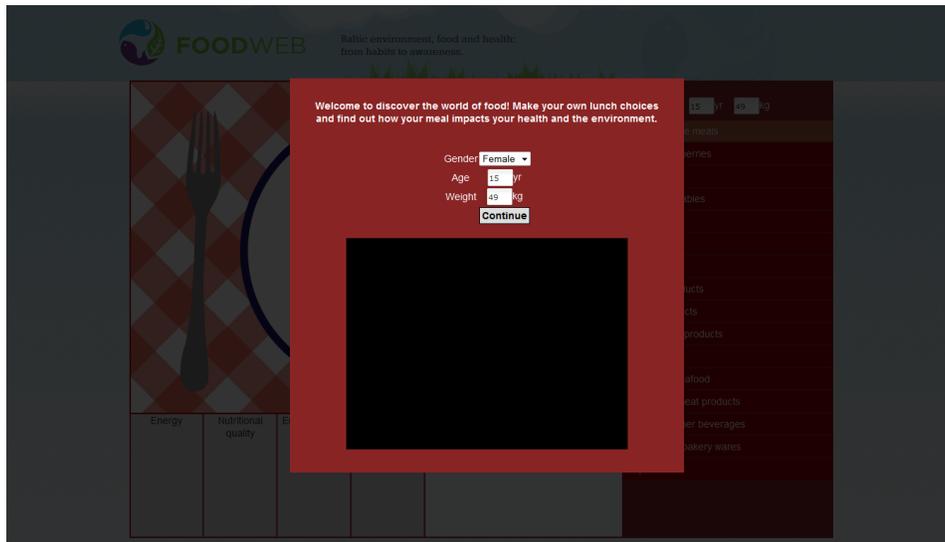

Figure 2. An example of inserted data.

2. On the next page you will find an empty lunch plate in the middle. Food item groups are on the right and indicator bars below the page. On the top of the food item groups you will find the user data, inserted earlier. It can be modified if needed.
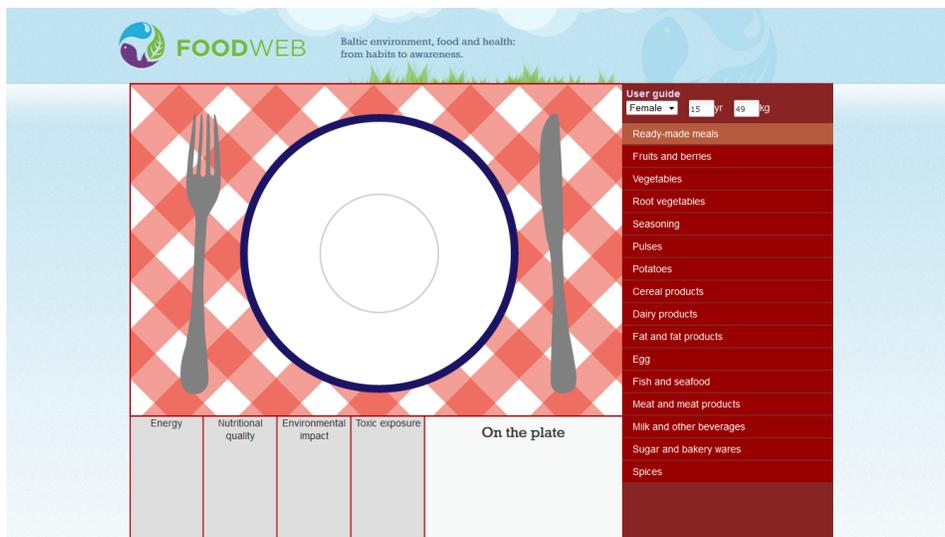
Figure 3. Location of empty plate, food items groups and indicator bars.

3. Food items are organized as drop-down menus. When you click a certain food item group, it opens up a list of various food items (Figure 4). Portion size in grams and energy content per portion expressed as kcal are shown next to the food item icon. In addition to the individual food items, you can also choose ready-made meals. Also those ready portions can be modified by changing the ingredients and the amounts of food items.

Figure 4. Selection of food items in certain food group with weight and energy values.

4. Choose food items and drag them onto the plate (Figure 5). You can compare individual food items or whole meals.

Figure 5. Example of lunch plate with selection of different food items, indicator bars and weight information of food items.

5. You can change the amount of food item in the "On the plate" box (Figure 5). Amount may range from 1 gram to double the initial portion weight. In case you wish to increase the portion size even more, it is possible to drag several food items onto the plate.

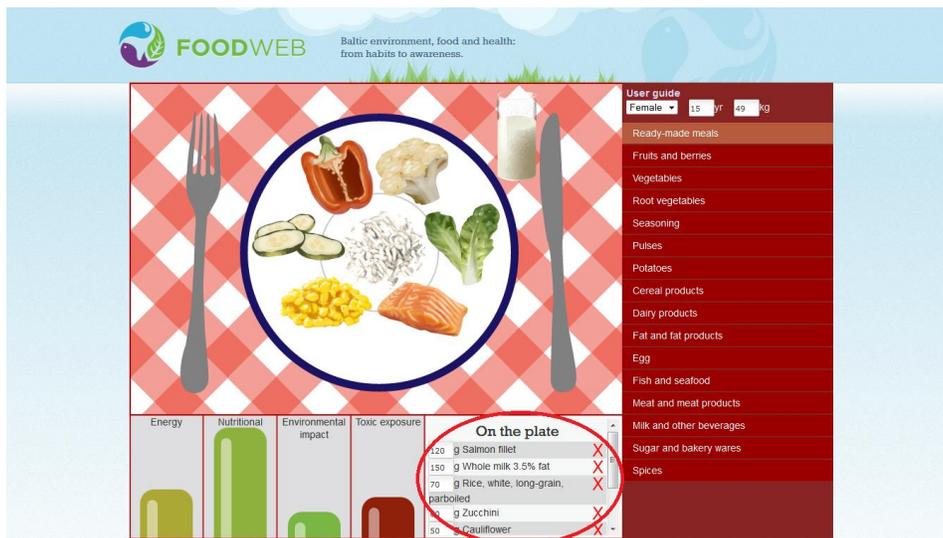6. It is possible to remove food items by dragging them away from the plate or clicking the red cross followed every single food item in the "On the plate" box (Figure 5).

7. You can choose freely what you wish to eat or drink, but it is recommended to follow the general nutritional recommendations and the food plate model. According to the food plate model, 50% of your plate should consist of vegetables, fruits or berries, 25% potatoes or cereal products (e.g. pasta, rice) and 25% proteins (e.g. meat, fish, eggs).

8. Every choice affects human health (indicator bars "Energy", "Nutritional quality" and "Toxic exposure", Figure 6) and surrounding environment (indicator bar "Environmental impact", Figure 6). Indicator bars show you the energy content, nutritional quality, possible human exposure to certain contaminants and environmental impact of individual food items or their combinations.
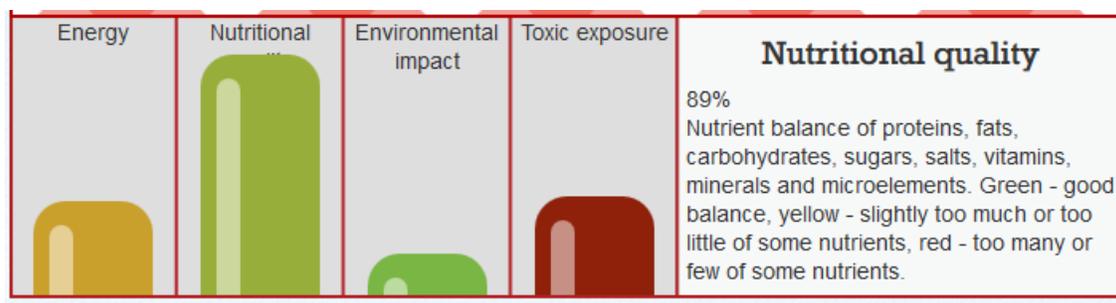
Figure 6. Indicator bars, explanation and results.

9. All the parameters are expressed as traffic lights, colour scale changing from green to yellow and red. Red expresses a negative impact and green indicates a positive one. The magnitude of the impact (low or high) is expressed as the height of the bars.

Meaning of the colours of indicator bars:
*   green – healthy, balanced or environmentally friendly choice, depending on the chart;
*   yellow – values are either slightly too low or slightly too high according to the chart;
*   red – unhealthy choice, or a choice that has a high environmental impact.

The web calculator "Foodplate" is based on a more detailed excel-based calculation model programmed by Tuomas Mattila (Finnish Environment Institute SYKE). If you want more detailed information with precise numerical values, use the calculation model "Foodplate evaluation tool 1.08 beta". The calculation model is available on the web page http://foodweb.ut.ee/Web_applications_194.htm.

2.2. What do the indicator bars show?

Energy bar shows the amount of energy the selected food items or meal contains in relation to the recommended energy intake. Calculations are based on the Finnish nutritional recommendations and depend on the user's age, gender and bodyweight. Moderate physical activity is assumed. You can find the numerical values for the energy content of the meal and recommended intake from the box "Energy". It is shown when you move the mouse over the energy bar. The recommended energy intake from one meal is assumed to be one third of the recommendation for the whole day. The chosen unit is kcals, which is widely used in nutritional and dietary calculations.

- Green – right amount of energy (average lunch plate should provide 1/3 of the days energy need).
- Yellow – slightly too much or not enough energy.
- Red – too little or too much energy.

Nutritional quality shows the nutrient balance of proteins, carbohydrates, fats, sugars, salts, vitamins, minerals and microelements in the food. The intake of each nutrient is divided by the nutrient-specific recommendations. Different nutrients have different impacts and relevance on human health and therefore the intake/recommendation-ratio is corrected with weighting factors. The weighted results are then expressed as a single number that is shown in the bar "Nutritional quality". For instance, concerning sodium (Na) the nutritional quality of a meal is considered good as long as the amount of sodium on the plate does not exceed recommendations.

The "neutral" value for nutritional quality is set to 50%. A nutritional quality value of 50% basically means that the intake of harmful nutrients, such as sodium, is in balance with the intake of beneficial nutrients. Values above 50% mean that the meal contains too much harmful nutrients in relation to the beneficial nutrients it contains. High percentages indicate a good and balanced result.

- Green – a good balance between different nutrients.
- Yellow – not a balanced choice (too little or too much of some component).
- Red – too little or too much of some nutrients.

Environmental impact indicates the impact of food production on the environment. The value is calculated as the weighted and normalized of three factors (weighting in parenthesis):
1) CO_2 - the carbon footprint (61%),
2) eutrophication impact (PO_4) on the Baltic sea (28%) and
3) pesticides (MCPA) used during food production (11%)

MCPA is an indicator of Freshwater ecotoxicity. Each pesticide used is converted to kg MCPA eq, the most commonly used pesticide.

Usually a vegetarian diet has a smaller carbon footprint than a diet which contains a lot of beef and other animal-based products. However, even a vegetarian diet may have significant PO_4- and MCPA-emissions. The emissions of the meal are compared to the average Finnish diet, which is set to 100%.

- Green – the environmental impact is less than or similar to the Finnish average.
- Yellow – the environmental impact is roughly 50 % higher than the Finnish average
- Red – the environmental impact is twice as high as the Finnish average or even higher.

Toxic exposure indicates whether the food plate or individual food items contain certain contaminants. Calculations are based on the contaminant-specific concentration data in different food items, tolerable weekly intakes (TWI) and the user's bodyweight.

Toxic exposure contains the concentrations of the 17 contaminants included in this project. The total intake of each contaminant is calculated based on the selected meal. This amount is then divided by the tolerable weekly intake given for each contaminant. The "HEI"-value (Human Exposure Index) is then derived by summing up the exposure quotients for each contaminant and dividing the total by the square root of the number of contaminants.

Because TWIs are given as µg/kg b.w., the resulting HEI-value depends on the bodyweight given by the user. Since TWI is based on the overall intake during a person's whole lifetime, occasional over-exposures, concerning at least most of the contaminants, are not too severe.

Contaminants taken into account in the calculator are dioxins, polychlorinated biphenyls, furans, benzo(a)pyrene, acrylamide, mercury, cadmium, lead, arcenic, organotins, perfluorooctane sulfonate (PFOS), perfluorooctanoic acid (PFOA), nitrates and the toxins aflatoxin, ocratoxin, deoxynivalenol and T2-HT2.

- Green – low toxic exposure (HEI <5, the intake of each contaminant is significantly less than its TWI).
- Yellow – medium toxic exposure (HEI 5-25, the intake of each contaminant is less than its TWI).
- Red – high toxic exposure (HEI >25 one or more contaminants may be exceeding their TWI).

3. Background of web application "Foodplate"

3.1. Compilers

The web application "Foodplate" is compiled by specialists from Finland and Estonia.
- Finnish Environment Institute SYKE (http://www.syke.fi): Lauri Äystö, Petri Porvari, Päivi Munne, Tuomas Mattila and Matti Verta.
- MTT Agrifood Research Finland (https://portal.mtt.fi/portal/page/portal/mtt): SBE-team.
- University of Tartu (http://natmuseum.ut.ee/): Anne Aan, Liina Laumets, Eva-Liisa Orula, Tiit Paabo and Veljo Runnel.
- Science Centre AHHAA (http://www.ahhaa.ee/): Jaanus Kalde.
- The Martha organisation compiled ready-made meals.

3.2. Origin of the data

The portion sizes and nutritional values are taken from Finnish National Institute for Health and Welfare's (THL, http://www.thl.fi) database called Fineli (http://www.fineli.fi/). Finnish national recommendations for nutritional values have been also used.

The contaminant data comes mainly from Finnish national data (Finnish Food Safety Authority EVIRA – http://www.evira.fi, and THL) and from EFSA (http://www.efsa.europa.eu/) publications (all-European level). Some individual studies from Sweden, Estonia, the Netherlands, Switzerland and Spain have also been used. If the exact contaminant concentration data was missing for some food items, then the contaminant concentrations were evaluated by using the items' fat content or by using a value given for a similar product. Fat contents were received from the Fineli database.

The environmental impact data has been compiled from various Finnish Life Cycle Assessment (LCA) studies. Therefore the temporal, geographic and production system contexts of the data are different. Thus, the data are exemplary mean data that can be used in rough estimations of the differences between main groups of raw food materials, but not for the exact comparison of various process based chains of one raw material, or for comparing differences between food brands. For example, data is good enough for comparing environmental impacts of milk and tea, but with this data we cannot compare environmental impacts of various type of yoghurts and similar soured milk products.

3.3. About the data

The data is valid for Finland, Sweden, Estonia and Latvia. The basic idea has been to use **mainly** the data collected from the countries mentioned above.

There are data gaps, like missing TDI/TWI (Tolerable Daily Intake/Tolerable Weekly Intake) values for some contaminants. For some of them it was possible to use TWI values from the

United States Environmental Protection Agency (US EPA), the French Food Safety Agency (AFSSA) and the Dutch National Institute for Public Health and the Environment (RIVM).

While contaminant data from e.g. Evira were mostly food item-specific, data from EFSA often contained large categories consisting of a great variety of different food items (e.g. fruits, vegetables, mushrooms and cereals). In these cases every single food item under this large category gets the same contaminant value. Partly because of this, more specific Finnish data was emphasized in collecting the contaminant database. Data from EFSA was used only when more specific data was not available.

Some important contaminants were also missing from the list studies in the project, like plant protection products (pesticides, plant growth regulators etc.), radiation and pharmaceuticals for people and animals (different antibiotics, hormones, antidepressants, painkillers etc.). The available data for these substances were too scarce which is why they were not included in the project.

When considering the environmental impact, the exemplary mean data has been used. Data can be used only in rough estimations of the differences between main groups of raw food materials. The data should not be used for comparisons of different food chains, or to compare differences between various food brands.

4. Related links

You can find more information and suggestions about healthy diet from the following sites.

Finland
- Finnish National Nutrition Council: http://www.ravitsemusneuvottelukunta.fi/portal/en/
- Healthy Nordic diet improved lipid profile and had a beneficial effect on low-grade inflammation: http://www.vtt.fi/news/2013/itameren_ruokavalio.jsp?lang=en
- FINELI food items list: http://www.fineli.fi/foodlist.php?lang=en
- Healthy diet: http://www.thl.fi/fi_FI/web/fi/aiheet/tietopaketit/ravitsemustietoa/terveys/terveellinen_ruokavalio
- Finnish Food Safety Authority: http://www.evira.fi/portal/en

Estonia
- About nutrition: http://www.toitumine.ee
- Databases about nutrition: http://www.nutridata.ee
- Food composition database: http://tka.nutridata.ee/index.action
- Diet program: http://tap.nutridata.ee/
- Nutritional studies database: http://uab.nutridata.ee/uab/Tutvustus.html
- The National Institute for Health Development: http://www.tai.ee/en

Visit our web page also http://foodweb.ut.ee/!