

1 Introduction

GNUtrition is a program designed to produce a detailed nutritional analysis of the human diet.

1.1 Downloading GNUtrition

GNUtrition is freely available at [www.gnu.org](http://www.gnu.org/software/gnutrition) (<http://www.gnu.org/software/gnutrition>). It is released under the GNU General Public Licence version 3 or later. See the file `LICENCE` for details.

1.1.1 Requirements

GNUtrition requires the following packages:

Build-time

- GNU Make
- C compiler with C99 support (e.g., GCC)
- ncurses development headers and library
- sqlite3 development headers and library
- libm (typically part of the C standard library on GNU/Linux)

Run-time

- ncurses library
- sqlite3 library
- A USDA food database (`food.db`) built with `build_db.sh`

This list looks daunting, but all of these packages should be standard on modern Linux systems, but you may have to install SQLite separately.

1.2 Running GNUtrition for the First Time

Install the database used for food information first:

```
$./build_db.sh
```

Then you can start GNUtrition for the command-line simply:

```
$gnutrition
```

1.2.1 Entering your Information

The profile options give you the option to enter your age in years, your current height, your current weight, and your activity level. This is subject to change prior to GNUtrition 1.0.

2 The Main Window

The main window shows you a daily budget based on USDA recommendations, along with the following options

- s Search
- l Log
- p Profile
- q Quit

The search tool lets you search by food names and descriptions.

The log lets you view foods you add, and lets you edit those entries.

3 The Main GUI Window

At the top of the new main window is Search, Profile, and About.

Under that, you have both a daily budget based on USDA recommendations, along a daily food log.

The search window lets you search by food names and descriptions.

4 The Nutrients in GNUtrition

This chapter contains some notes on the nutrients analysed by GNUtrition. They are not a definitive guide, for detailed information refer to a standard text of nutrition or dietetics.

4.1 Caveat

When Ian was researching the information for the Recommended Daily Intakes (RDIs), he found the information conflicting but incomplete, so for some nutrients there may be a European value, a US value, and a UN value. In general, he chose the US value, in the hope this will be compatible with the database.

If you know of a good reference for RDIs, we would be eager to hear from you, mail us at bug-gnutrition@gnu.org (<mailto:bug-gnutrition@gnu.org>)

It also should be noted that RDIs are a *guide* to nutrition, not the definition of it. Individuals may vary from the RDIs provided for many reasons. For example, active people need more energy and protein than inactive people, and illness increases the RDIs for almost everything.

In summary, just because the program spits out a nice column of “100%”, that doesn’t automatically mean you have a healthy diet. The old rules about balance and lots of green vegetables still apply, we’re afraid.

4.2 Macro nutrients

Macro nutrients constitute the bulk of the food we eat, they provide energy and chemical building-blocks for tissues.

Protein

Proteins consists of long chains of [#acids], page 7, , to which it is broken down to in the digestive system. Much of these amino acids are reconstituted by the body to form human proteins. Human proteins are universal in the body: as enzymes they regulate chemical reactions within cells and the blood, they form tendons and ligaments which hold the body together, and they provide muscle with its ability to contract. Excess protein can be converted to sugar by the liver.

Carbohydrate

consists of sugar, and chains of sugar molecules called starches. Starches are broken down in a similar manner to protein. In plants and bacteria, carbohydrates provide structure, but in animals they are used for energy.

Fat

consists of fatty acids ([#lipids], page 7), which are chain of carbon atoms with a acid group at the end. These fatty acids are linked in groups of three by glycerol. Once again,. this structure is broken down in the gut, only to be re-formed in fat cells. Some fatty acids have special functions, but mostly fat is a store of energy.

Alcohol

Rightfully a drug, but its energy component, between fat and protein, can be significant in some people. There is no recommended intake for alcohol, but there are recommended maximum intakes, these being 40g a day for men and 20g a day for women.¹

Energy

A total calculated from the above, which is expressed in both kilocalories (the traditional unit in chemistry), and kilojoules (the physicist's unit).

There is a base requirement for energy, which can be estimated by age and weight. However, muscle mass requires more energy to maintain than fat mass, so persons of the same weight can have widely different base energy requirements. In addition, active people will obviously need more energy.

Fibre

is indigestible by human enzymes, and is largely excreted, or digested by bacteria in the large intestine. Nevertheless, it is very important, and often deficient in first-world diets. It dilutes toxins that build up the gut and retains water. It softens faeces and increases its volume, making bowel motions more efficient. Deficiency causes constipation, and has been linked to bowel cancer.

Water

Arguably the most important nutrient, in terms of amount (two-thirds of the body), and essentiality (people die of thirst long before they starve).

4.3 Vitamins

Vitamins are cofactors – special molecules which support various biochemical reactions within the body – required only in very small amounts, and can be stored for extended periods. They are divided into two groups:

4.3.1 Fat-soluble vitamins

Vitamin A

is used for light-detecting chemicals in the retina of the eye, and maintaining proper skin moisture and softness. In deficiency, poor night vision, hard and rough skin, and anaemia can occur. Vitamin A is also an anti-oxidant and protects against cancer.

Vitamin D

regulates calcium. Deficiency leads to rickets (soft, malformed bones) in children. With adequate sunlight, the body can make its own vitamin D, so little or none is required by the diet. It is not included in the USDA database, and so not analysed by GNUtrition.

Vitamin E

is a strong anti-oxidant: it destroys cancer-causing chemicals called @emph{free radicals}. No deficiency syndrome has been described.

¹ according to the Drug and Alcohol Centre, St. Vincent's Hospital, Melbourne, Australia.

Vitamin K

is used by the liver to make special proteins, which circulate in the blood. When a person is injured, these proteins help to form a clot. Intestinal bacteria can make vitamin K, however, it is also required in the diet, but in low amounts. It is not included in the database.

4.3.2 Water-soluble vitamins

Vitamin C

is used in making collagen, a tough protein that provides a “glue” holding cells together. Vitamin C deficiency, known as *scurvy*, leads to easy bruising and bleeding, as lack of collagen weakens blood vessels. It also aids the absorption of iron, and may be an anti-oxidant.

It is not a cure for the common cold.

Vitamin B-1 (Thiamine)

is used in the biochemical processes by which cells obtain energy from sugar. Deficiency causes mental disturbance, clumsiness, and double-vision, which can occur in alcoholics, and in third-world countries.

Riboflavin; Niacin; Pantothenic acid

are also important in energy utilisation by cells, by forming parts of different enzymes. Niacin deficiency causes *pellagra*, characterised by dermatitis, diarrhoea, and dementia.

Vitamin B-6 (pyridoxine)

is used for processing of amino acids, deficiency causes a type of anaemia.

Folate

is used for the synthesis of DNA. Deficiency leads to anaemia. In pregnant women, higher intakes protect against neural tube defects in their children.

Vitamin B-12

is also used for DNA synthesis, also leads to anaemia when deficient. Only available in animal sources, so strict vegans require supplementation.

4.4 Metals

Iron

is used mainly in haemoglobin, a chemical that binds oxygen in the blood, giving it its red colour. Deficiency, more common in women, leads to mild anaemia.

Calcium

is used mainly in bones, to provide mechanical strength. Low calcium intake has been linked to osteoporosis (weakening of the bones) in old people.

Selenium

is essential to an anti-oxidant enzyme, which works in a similar manner to Vitamin E.

Potassium; Sodium

are used to provide electrical potentials across nerve and muscle cell membranes, also to provide the necessary osmotic force in body fluids. Excess sodium was once linked to high blood pressure, but this not emphasised today.

Magnesium

is used in controlling nerve impulses, deficiency causes weakness and tremors.

Copper; Manganese; Zinc

combine with specific proteins to form various different enzymes.

4.5 Amino acids

Amino acids are the breakdown products of proteins. They are divided into two groups, essential and non-essential:

Essential	Non-essential
Histidine	Glycine
Isoleucine	Glutamate
Leucine	Aspartate
Lysine	Proline
Methionine	Serine
Phenylalanine	Alanine
Threonine	Tryptophan
Tryptophan	Arginine
Valine	

Table: The Amino Acids

Deficiency of any of the nine leads to wasting as proteins cannot be made without them. This usually only occurs with a very monotonous vegan diet, where the chief food is a plant that does not have one or more essential amino acid. A varied vegetarian diet solves the problem.

The other amino acids can be synthesised by the liver. The liver can also interchange two pairs: cysteine and methionine, and tyrosine and phenylalanine. This means a shortage of one can be made up from the other, so total as the total requirement is met.

Amino acid supplements are of no proven benefit over proteins containing the amino acids (but are much more expensive).

4.6 Lipids

Lipids include fatty acids (breakdown products of fat) and cholesterol.

Fatty acids

can be divided into three main groups: saturated², mono-unsaturated and polyunsaturated. With these three the key is the *ratio* – lots of saturated fatty acids, relative to the others leads to atherosclerosis (hardening of the arteries).

² 'saturation' in this sense refers to hydrogen. Ask an organic chemist.

Their specific chemical structures are available in organic chemistry or biochemistry textbooks, in general they consists of a vary chain of carbon-atoms, with a carboxylic acid group at one end.

Fatty acids are used to make certain types of hormones, as well as to store energy. Two fatty acids, linoleic and alpha-linoleic acid, are essential for humans.

Omega-3, and -6

Some fatty acids are referred as "omega-3" and "omega-6". This refers to the location of a double bond from the final (omega) carbon atom in the fatty acid.

It is believed that omega-3 fatty acids, found in fish oil, may have beneficial health effects, but there is little hard evidence for this.

Cholesterol

can be made by the liver, so there is little dietary need. When we eat cholesterol, the liver compensates by making less. Contrary to popular belief, dietary cholesterol seems to have little effect on blood-cholesterol levels, instead saturated fatty acids seem to be more important.

Phytosterols

Not sure about these. Many be one and the same as phyto-oestrogens, plant mimics of the female sex hormone. Intake is believed to control symptoms of menopause.

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