1. Personal Health Profile

The human body generates heat, a process known as thermogenesis. This generation of heat is measurable and can be used to determine the amount of energy expended. A certain person’s energy requirements depend on a multitude of factors including the person’s gender, age, physical characteristics (body type, weight, height, body composition) or physical activity requirements (physical activity rate, training frequency and intensity). Also, one must take into consideration the person’s goals, which could be to maintain his/her weight or maybe loose or gain a certain amount of weight.

The formulas and computations used to determine energy consumption needs are many and various and they are not predetermined. However, no matter what tools and formulas we use, it is important to take into account a multitude of aspects and consider as many personal characteristics as possible when trying to determine whether a proper energy balance is being achieved or not.

* 1. Basal Metabolic Rate (BMR)

The human body uses about 60% of the daily calorie intake just to keep up with the natural processes at rets. Therefore, Basal Metabolic Rate (BMR) represents the amount of energy expended while the body is at rest in a neutrally temperate environment. The remainder portion of the energy intake is split between physical activity and digestion process. 30% of calories are burnt during physical activity while the remainder 10% is consumed in the process of digestion.

The energy consumption of a person can usually be measured according to his current weight. The BMR formula computes the Basal Metabolic Rate using the person’s weight, height, age and gender. Obviously, this computation is far more accurate than the one based on weight alone.

|  |  |
| --- | --- |
| English BMR Formula | |
| Men |  |
| Women |  |
| Metric BMR Formula | |
| Men |  |
| Women |  |

Table 1.1.1 Formulas for BMR computation

For example, for a male of 27 years having a height of 180 centimeters and a weight of 79 kilograms, the BMR formula gives a basal metabolic rate of 1864.7.

BMR generally decreases with age and with the loss in lean body mass which also occurs with aging. So, the only factor omitted by this formula is the human body’s muscle-to-fat ratio or lean body mass. Therefore, the equation might lose some of its accuracy in the case of a very muscular person, for which it will most likely underestimate the calorie needs, and also for very fat people it might overestimate the necessary energy intake. However, this can be compensated by taking into account the person’s Body Mass Indicator (BMI) which will be discussed and detailed later.

* 1. The Harris-Benedict Equation

We mentioned earlier the fact that a person’s daily energy intake needs are also affected by the amount of physical activity. However, the BMR formula does not take into account this factor. But, once a person’s BMR has been computed, one can calculate a person’s daily calorie needs based on activity level using the Harris-Benedict equation also known as the Harris-Benedict principle.

A certain person’s physical activity level can be quantified using the physical activity factor (PAF) which is a number in the range 1.2 – 1.9 representing the amount of daily exercise.

|  |  |
| --- | --- |
| Activity Level | Physical Activity Factor (PAF) |
| Sedentary | 1.2 |
| Mild activity | 1.375 |
| Moderate activity | 1.55 |
| Heavy activity | 1.725 |
| Very heavy (extreme) activity | 1.9 |

Table 2.1.1 Activity levels and their corresponding PAF

|  |  |
| --- | --- |
| Activity Level | Description |
| Sedentary | Little or no exercise. |
| Mild activity | Light exercise 1 to 3 times per week or intensive exercise for at least 20 minutes daily. Exercise may include activities such as swimming, skating, riding a bicycle or jogging. People who do not exercise regularly but maintain a busy and active lifestyle which includes frequent walks for a long period of time also meet the requirements of this level. |
| Moderate activity | Intensive exercise for at least 30 to 60 minutes 3 to 5 times per week. Exercises include activities such as those described in the level above. |
| Heavy activity | Intensive exercise for at least 60 minutes 5 to 7 days a week. If a person has a labor-intensive occupation (landscape worker, construction work or hospitality - hotels and restaurants), he also qualifies for this level. |
| Very heavy (extreme) activity | Very physical job or exceedingly active/very demanding activities such as hard exercise/training twice a day. Usually this level of physical activity is very hard to achieve. |

Table 2.1.2 Description of physical activity levels

In order to compute the daily kilocalorie requirements based on physical activity level, the estimated BMR value obtained using the formulas from Table 1.1.1 is multiplied with the PAF value from Table 2.1.1. The Harris-Benedict formula is shown below:

[1]

Consider the example from the previous section (male, 27 years, height of 180 centimeters, weight of 79 kilograms) having a BMR of 1864.7. If we assume ha has a moderate activity level and multiply his BMR with a physical activity factor of 1.375 we get that his daily calorie need is approximately 2564. This number represents the daily amount of calories needed in order for this person to maintain his current weight. From this value, one can easily compute the number of calories needed to gain or lose weight.

* + 1. Calorie Needs to Gain Weight

The main principle behind weight gain is the fact that in order for a person to accumulate body mass he must consume more calories than he burns. However, besides this, we must take into consideration that the goal is to also keep a balance between muscle mass and fat mass gain. Because of this, the ideal caloric surplus must obey the following two rules:

1. The surplus needs to be high enough to build muscle effectively, and
2. The surplus must also be small enough in order to avoid gaining unnecessary fat.

There is an upper limit to the amount of muscle gain and to the rate at which the human body is capable of building muscle mass. Therefore there is also an upper limit to the number of calories one’s body is capable of using in order to build muscle. If the daily energy intake exceeds that level, the extra amount will be stored in the form of unhealthy fat. For an optimum and healthy weight gain, if the number of daily calories is increased with the intention of gaining weight, then the level of physical activity must also be gradually increased in order to maintain or increase a person’s lean body mass.

Generally, one pound of body weight is approximately equivalent to 3500 calories. So, eating an extra of 500 calories per day will result in a gain of one pound per week. The ideal daily caloric surplus varies from men to women and is shown in the table below:

|  |  |
| --- | --- |
| Gender | Ideal Daily Caloric Surplus |
| Male | 250 |
| Female | 125 |

Table 1.2.1.1 Ideal daily calorie surplus for healthy weight gain

Let us consider for our person from the previous example - a 27 year old male – that he wishes to gain weight. For his characteristics and physical activity level we computed a daily calorie need of approximately 2564 calories using Harris-Benedict equation. So, in order to gain weight, he should eat about 2813 calories per day. In general, whatever a person’s maintenance level is, if the goal is weight gain, for males it should be 250 or so calories above this level each day and for women approximately 125 calories above.

* + 1. Calorie Needs to Lose Weight

As mentioned earlier, there are approximately 3500 calories in a pound of stored body fat. So, imposing a 3500 calorie deficit to one’s diet will result in a loss of one pound of body weight. Generally this loss is composed of 75% fat and the rest of 25% is lean tissue. The calorie deficit is achievable in two ways: either by calorie restriction alone or by a combination of a controlled amount of calories consumed and more exercise and physical activity to burn more calories. This second approach is always preferable as it guarantees long-term weight loss.

There are no explicit formulas or equations stipulating the exact amount with which one must decrease his or her daily calorie intake in order to lose weight. This amount is highly dependent upon a person’s current weight and calorie maintenance needs and also upon the weight loss goals.

Generally speaking, if a person wishes to reduce his/her body weight, that person should lower the daily calorie intake by at least 500 calories, but not more than 1000 below his/her daily maintenance level depending upon the amount of weight loss desired. However, a safe minimum calorie-intake level must always be met. The American College of Sports Medicine (ACSM) recommends that minimum daily calorie levels never drop below 1200 calories per day for women and 1800 calories per day for men. Usually, reducing the amount of daily calorie-intake by 15-20% below the maintenance level is sufficient for weight loss and also represents a safe value.

* 1. Body Mass Index (BMI)

The Body Mass Index (BMI), also known as Body Mass Indicator, is a statistic which was developed by Adolphe Quetelet in the 1900’s for evaluating an individual’s body mass. It uses a formula which is independent of the person’s age or gender and relies only on an individual’s weight and height as shown below:

[2]

BMI is used as a screening tool to identify weight problems. According to the body mass index, people are categorized based on underweight, normal weight, overweight or obese. However, BMI cannot be used as a diagnostic tool. In order to determine if the surplus or deficiency in weight actually represent a health risk further medical examinations and tests are required.

|  |  |
| --- | --- |
| BMI | Meaning |
| 19 – 24.9 | Normal Weight |
| 25 – 29.9 | Overweight |
| 30 – 34.9 | Obesity Level 1 |
| 35 – 39.9 | Obesity Level 2 |
| ≥ 40 | Obesity Level 3 (Morbid Obesity) |

Table 1.3.1. World health Organization BMI Table

If we apply this formula to the individual considered in our previous examples - a 27 year old male having a weight of 79 kilograms and a height of 180 centimeters – we obtain that his body mass index is . From this value and from the interpretations given in Table 1.3.1 we can deduce the fact that our individual has a normal weight.

* 1. Recommended Daily Allowance (RDA)

The Recommended Daily Allowance (RDA) recommendations were developed by the Food and Nutrition Board of the National Academy of Sciences/National Research Council and they represent instructions regarding the necessary daily intake of nutrients in order to lead a healthy life. These recommendations basically represent values for intake of essential nutrients such that they meet the known needs of a generally healthy person. They vary among children and adults and are also depended upon a person’s gender.

In 1997 the Dietary Reference Intake (DRI) is introduced with the scope of broadening the already existing guidelines given by RDA. DRI represents a system of nutrition recommendations from the Institute of Medicine (IOM) of the U.S. National Academy of Sciences and it provides the following types of reference values used to plan and assess nutrient intakes of healthy people:

* Estimated Average Requirements (EAR), which is the intake level for a certain nutrient at which the needs of 50 percent of the population within that age group will be satisfied. EAR values are mostly based on studies of scientific literature.
* Recommended Daily Allowance (RDA) representing the average daily level of intake sufficient to meet the nutritional requirements of nearly all healthy people (approximately 97.5%) from a certain age group and having a certain gender. RDA is based on EAR and is computed as being approximately 20% higher than EAR.
* Adequate Intake (AI) which is used when an RDA cannot be determined. The AI amounts are mostly based on observed or experimentally determined estimates of nutrient intake by a group of apparently healthy people. Adequate Intake most likely will not satisfy the nutritional needs for most of the individuals.
* Tolerable Upper Intake Levels (UL) are used as warning against excessive intake of certain nutrients. They represent the highest acceptable daily levels for nutrients which will cause no harm or side effects. If the intake is increased above UL levels, there is a very high risk of adverse effects.
* Acceptable Macronutrient Distribution Ranges (AMDR) are intake levels expressed as a certain percentage of an individual’s total energy intake. AMDR recommendations are mostly used in case of sources of energy such as carbohydrates or fats.
  1. Nutritional Recommendations

Optimal recommended values for different nutrients can be deduced from the daily maintenance caloric intake. First, the person’s Basal Metabolic Rate (BMR) is calculated using the formulas presented in Table 1.1.1. This value relies on the individual’s weight, height, gender and age. Then, by taking into consideration the person’s physical activity level described in Table 1.2.2., the necessary daily caloric intake is computed using the Harris-Benedict equation [1] as being the product of BMR (Basal Metabolic Rate) and PAF (Physical Activity Factor). The values for different types of nutrients represent fractions of the daily necessary energy intake. So, by knowing an individual’s daily caloric maintenance level, these values can easily be found.

Nutrients are the substances found in foods that an organism utilizes for growth, metabolism, and for various other body functions. Organic nutrients are composed of carbohydrates, proteins, fats and vitamins. Other inorganic chemical compounds such as water, oxygen, minerals may also be considered nutrients. A nutrient is considered essential if the human body cannot produce sufficient quantities of it or cannot synthesize it and that specific nutrient must be obtained from an external source.

Nutrients can be classified according to the necessary intake amount into micro and macronutrients. Macronutrients are a type of nutrients that need to be consumed in large amounts and micronutrients are those of which the human body needs only very small amounts such as vitamins and minerals. Macronutrients provide calories or energy to the human body and micronutrients play an essential role in the metabolic process. Both macro and micronutrients are obtained from the environment and are used for tissue growth and repair, for energy consumption and in order to regulate different body processes.

* + 1. Estimated macronutrients requirements

Carbohydrates, proteins and fats classify as macronutrients and are the chemical elements that humans consume in the largest amounts and they provide the human body energy. There are three main macronutrient classes: carbohydrates, proteins and fats. All these provide calories in different amounts which are needed for the human body to build up energy. Besides these, alcohol is the only other substance that provides calories, but as it is not an essential element for survival, it is not considered to be a macronutrient.

* + - 1. Carbohydrates

Carbohydrates are made up of types of sugar and represent the body’s main source of energy. According to the Dietary Reference Intake (DRI) 45% - 65% of the daily calorie intake should come from carbohydrates. It plays various roles in different body processes being important for the central nervous system, for digestion and also for the muscles. They can also be stored in the liver or muscles for later energy use.

The Recommended Daily Intake (RDI) of carbohydrates is based on its function as the primary energy source for the human body and brain and the Acceptable Macronutrient Distribution Ranges (AMDR) are based on its role as a source of calories to maintain a healthy body weight.

In order to determine the necessary daily amount of carbohydrates from the amount of daily maintenance energy requirements, we compute 45% to 65% of the total calorie intake and then divide this number by 4. However, if the goal would be weight loss, then the percentage of carbohydrates should not exceed 50%. In this case the upper limit is bound to 50% of the amount of daily kilocalories.

|  |  |
| --- | --- |
| Value | Formula |
| Lower daily carbohydrate intake limit |  |
| Upper daily carbohydrate intake limit |  |
| Upper daily carbohydrate intake limit for weight loss |  |

Table 1.5.1.1.1 Daily carbohydrate intake values

If we consider once again the example used in the previous sections for which we computed an estimated daily energy intake need of 2564 kcal we can easily find the amount of carbohydrates that he should consume. We calculate the lower limit as being and similarly the upper limit gives . Hence, this particular individual should consume somewhere between 288 and 4126 grams of carbohydrates daily. However, if his goal would be weight loss the upper limit changes into

* + - 1. Proteins

Proteins are a type of organic nutrients which have as building blocks amino acids, a substance which must be supplied through diet as the human body is not able to produce all types of it. According to the Dietary Reference Intakes (DRI), proteins should represent about 10%-35% of the total calorie intake amount. The recommended daily protein intake can also be computed as 0.8 grams per body kilogram. Proteins are mostly important for young individuals as they play an essential role in human body growth and the development of the immune system. They are also able to provide the body with energy when carbohydrates are not available.

|  |  |
| --- | --- |
| Value | Formula |
| Lower daily protein intake limit |  |
| Upper daily protein intake limit |  |
| Estimated average daily protein intake value |  |

Table 1.5.1.2.1 Daily protein intake values

Let us consider again our example with the individual having a daily kilocalories need of 2564 and a weight of 79 kg. Using the formulas above we get the following values for daily proteins intake: , and . Therefore, the person from our example should consume somewhere between 66.35 and 232.225 grams of protein per day with an estimated average value of 63.2 grams.

* + - 1. Fats

Even though some fats are considered to be the cause of unwanted and unhealthy weight gain, some types of fats are essential for the human body. According to the Dietary Reference Intakes (DRI) 20% - 35% of calories should come from fat. Besides being an important source of energy, fats also help human body growth and development and play an important role in vitamin absorption. There exist three main types of fats: saturated, unsaturated and trans fats. Saturated and trans fat are well known for increasing an individual’s risk for developing heart disease, so they should be mostly replaced by unsaturated fats.

|  |  |
| --- | --- |
| Value | Formula |
| Lower daily fats intake limit |  |
| Upper daily fats intake limit |  |

Table 1.5.1.1.1 Daily fats intake values

Once again, for the individual in our example, the lower fats intake limit will be computed as and the upper limit will be given by . Hence, this person can consume between 132.7 and 232.225 grams of fats per day.

* + 1. Vitamins

Vitamins are organic compounds and they represent nutrients needed by the human body in limited amounts. Vitamins must be obtained through diet as the human organism cannot synthesize them in sufficient quantities.

* + - 1. Vitamin A

Vitamin A is an important nutrient for the immune system , vision and also helps the correct functioning of some organs such as the heart, lung or kidneys. It is found in naturally many foods (liver, fish, leafy vegetables and darkly colored fruits) or is added to some foods such as milk and other dairy products or fortified cereals.

High intakes of vitamin A can be harmful for the human body as it can cause nausea, headaches, dizziness or even birth defects in the case of pregnant women. Therefore, the diet recommendation should not exceed the upper intake levels.

|  |  |
| --- | --- |
| Recommended Daily Allowance (RDA)/Adequate Intake (AI) | |
| Male | 900 micrograms (0.9 milligrams) |
| Female | 700 micrograms (0.7 milligrams) |
| Tolerable Upper Intake Levels (UL) | |
| 3000 micrograms (3 milligrams) | |

Table 1.5.2.1.1 Vitamin A daily intake levels

* + - 1. Vitamin C

Vitamin C is a very powerful antioxidant and is used by the human body to help heal wounds and by the immune system to protect against different types of diseases. The most well known sources of vitamin C are fruits (citrus fruits, kiwi, strawberries) and vegetables (tomatoes, potatoes, broccoli, cabbage and spinach). However, they should be consumed fresh and raw because prolonged storage and cooking will reduce vitamin C content.

Once again, the recommended daily values should be respected, as exceeding the upper limit of vitamin C intake can cause kidney stones and may produce gastrointestinal disturbances.

|  |  |
| --- | --- |
| Recommended Daily Allowance (RDA)/Adequate Intake (AI) | |
| Male | 90 milligrams |
| Female | 75 milligrams |
| Tolerable Upper Intake Levels (UL) | |
| 2000 milligrams | |

Table 1.5.2.2.1 Vitamin C daily intake levels

* + - 1. Vitamin B

As opposed to vitamins A and C which are fat-soluble, meaning that they bind to fat in the stomach and are stored in the body for later user, vitamin B is water-soluble. While extreme consumption of fat-soluble vitamins may cause unwanted side effects, there are no adverse effects associated with the consumption of vitamin B. However, this does not guarantee that there is absolutely no potential for adverse reactions in case of high intakes.

|  |
| --- |
| Recommended Daily Allowance (RDA)/Adequate Intake (AI) |
| 1.3 milligrams |
| Tolerable Upper Intake Levels (UL) |
| 100 milligrams |

Table 1.5.2.3.1 Vitamin B daily intake levels

* + - 1. Vitamin D

Vitamin D is a fat-soluble vitamin that is naturally present in very few foods, added to others, and available as a dietary supplement. Vitamin D promotes [calcium](http://ods.od.nih.gov/factsheets/Calcium/) absorption in the gut and has other roles in the body, including modulation of cell growth, neuromuscular and immune function, and reduction of inflammation. Very few foods in nature contain vitamin D. The flesh of fatty fish (such as salmon, tuna, and mackerel) and fish liver oils are among the best sources. Sun exposure also helps as most people meet at least some of their vitamin D needs through exposure to sunlight. Long-term intakes above the UL increase the risk of adverse health effects. Vitamin D toxicity can cause non-specific symptoms such as anorexia, weight loss, polyuria, and heart arrhythmias.

|  |  |
| --- | --- |
| Age (years) | Value (milligrams) |
| < 1 | 0.01 |
| 1 – 70 | 0.015 |
| > 70 | 0.02 |
| Tolerable Upper Intake Levels (UL) | |
| < 1 | 0.038 |
| 1 – 3 | 0.063 |
| 4 – 8 | 0.075 |
| > 9 | 0.1 |

Table 1.5.2.4.1 Vitamin D daily intake levels

* + 1. Calcium

Calcium is a mineral important for muscle and bones. The human body stores calcium in teeth and bones and it helps ensure their hardness and structure. It also provides for muscle function and nerve transmission. The main food sources of calcium are represented by dairy products such as yogurt, milk or cheese. Other nondairy sources include some vegetables such as cabbage, broccoli or spinach.

|  |  |
| --- | --- |
| Recommended Daily Allowance (RDA)/Adequate Intake (AI) | |
| Age < 50 | 1000 milligrams |
| Age 50 and above | 1200 milligrams |
| Tolerable Upper Intake Levels (UL) | |
| 2000 milligrams | |

Table 1.5.3.1 Calcium daily intake levels

* + 1. Iron

Iron is an essential mineral which helps transport oxygen through the body. Besides this, iron also helps maintain the health of human body cells, skin, hair and nails. It can be found in foods such as lean meat and seafood. Other rich sources of iron include nuts, beans and fortified grain products. The Recommended Daily Intake levels depend both on gender and age. Excessive iron intakes can have side effects such as gastrointestinal distress, so the upper intake levels should not be exceeded.

|  |  |
| --- | --- |
| Age (years) | Value (milligrams) |
| <1 | 11 |
| 1 – 3 | 7 |
| 4 – 8 | 10 |
| 9 – 13 | 8 |
| 14 – 18 | Male: 11; Female: 15 |
| 19 – 50 | Male: 8; Female: 18 |
| > 50 | 8 |
| Tolerable Upper Intake Levels (UL) | |
| < 19 | 40 |
| ≥ 19 | 45 |

Table 1.5.4.1 Iron daily intake levels

* + 1. Sodium

The human body requires some small amounts of sodium in order to maintain the right balance of fluids in the organism. Sodium also helps transmit nerve impulses and influences the contraction and relaxation of muscles. The kidneys are the organs responsible for storing an optimal amount of sodium in the body in order to maintain a proper health. The main sources of sodium are processed and prepared foods while some natural sources include vegetables, certain types of dairy, meat and shellfish.

In the case of sodium,, an excessive intake determines the blood pressure to rise which can cause many adverse health effects.

|  |  |
| --- | --- |
| Recommended Daily Allowance (RDA)/Adequate Intake (AI) | |
| Age < 51 | 2300 milligrams |
| Age 51 and above | 1500 milligrams |

Table 1.5.5.1 Sodium daily intake levels