Fitness Notes

Nutrition

- The human body = energy convertor. It takes food (food energy) → chemical reaction → chemical energy. This chemical energy will be turned into heat (type of energy), kinetic energy (movement) or electric energy. The process is called cellular respiration – 1, 2.

- Fun fact: for the average human, most of the energy the body produces is heat, the average value of 2,000 kcals you need in a day comes from this. **This needs refs**.

- Energy for body without movement = basal metabolic rate (BMR). It depends on muscle mass, fat mass, height (h) and age (a). It is normally measured in kcal/day.

- The proportion of fat you have in your body is called body fat percentage (body fat %). It's fat mass (kg) * 100 / total mass (kg). Body fat % dictates certain features on your body. For example, for guys, the abs muscles will start showing somewhere in the range 10 – 14%.

- The BMR does depend on body fat %, muscles will require more calories to maintain than fat, even at rest (e.g. to heat up) – 10 pounds of muscle would burn 50 kcal in a day at rest, while 10 pounds of fat will only burn 20 kcal (less than half).

- Computing body fat % is not easy. One way would be to take a picture of you in the mirror and then look at how well defined your muscles are compared to people with known body fat % (for example). There are better ways to compute body fat %, for example (going from most accurate to less accurate):
  - Dual-energy X-ray absorptiometry (DEXA / DXA)
    - this is an x-ray machine that scans your body
    - most accurate & detailed (e.g. body fat % in left/right arm, around organs)
    - also measures bone density
    - it's expensive
    - not possible anywhere in the world
    - in London you can do it at bodyscan for £100+
  - Hydrostatic weighing
    - you step on a scale underwater
    - you look at the amount of water displaced
    - you compute body density (fat has different density than muscle)
    - finally you estimate body fat %
  - Whole-body air displacement plethysmography
    - similar to hydrostatic weighing, but this time with air
    - you step inside a small capsule
    - apparently accuracy gets bad at the extremes – obese or very lean subjects
    - example of such a capsule - Bod Pod
  - Skinfold methods
    - use calipers or plicometer at various spots on the body
    - it tries to determine the thickness of the fat layer under the skin
    - based on measurements – you look at a table which tells you what body fat % you have

        - it’s best if you use a personal trainer (or someone with experience) to perform the calipers readings
    - Bioelectrical impedance analysis
        - less accurate
        - a small electric current is sent through the body
        - the resistance is computed, which depends on body fat %
    - Near-infrared interactance
        - **this needs more research**
    - Some scales claim to compute body fat % - they might be accurate if you don’t train for muscles as they only take into account age, sex, height & weight. I would not consider this a proper method to determine body fat %.

- Several formulas for computing BMR
    - Harris-Benedict (1919) – only takes total mass into account (m)
      $13.7516\,m + 5.0033\,h - 6.7550\,a + 66.4730$
    - Revised Harris-Benedict (1984)
      $13.397\,m + 4.799\,h - 5.677\,a + 88.362$
    - Mifflin St Jeor
      $10\,m + 6.25\,h - 5\,a + 5$ (for males)
      $10\,m + 6.25\,h - 5\,a - 161$ (for females)
    - Katch-McArdle – takes body fat % (f) into account
      $370 + (21.6\,m * (1 - f/100))$

- Total daily energy expenditure (TDEE) = BMR + movement. I assume this the entire energy you need, as the name suggests.

- Online calculators for BMR (if you are too lazy to plug your values above)
    - https://www.myfitnesspal.com/tools/bmr-calculator
    - https://www.omnicalculator.com/health/bmr-katch-mcardle
    - https://www.bodyscanuk.com/body-composition-calculators.html
    - https://www.iifym.com/bmr-calculator/

- You can think of TDEE as the amount of energy your body needs from food every day to be able to function properly and do everything else (movements). If you eat more than this value, the excess energy will be (partly) stored on your body either as fat or muscles. If you eat less than this, your body will have to go to fat and muscle deposits to get the energy from there.

- Fat deposits: this is just food to be used in the days when you eat less than you should to be able to perform everything you do

- Muscle deposits: food is stored as muscles when you damage them by performing tasks that require a lot of strength, when you almost fail to perform these tasks. This happens so next time you will perform the same tasks without coming close to failure. However, if you eat less than you should the body will go to muscle deposits as well to get energy, making them smaller.

- Question: how does the body decide if it should go to fat or muscle stores, if you eat less than your TDEE? Intuition: if you keep damaging muscles while you eat less than you should, it will go mostly to fat stores (survival), otherwise it takes equally from both.

- Another interesting thing: if you eat less than you should for multiple days in a row, your body will start producing less heat, so your BMR will drop as well. This is called adaptive thermogenesis. The same happens if you eat more than you should, your body will produce more heat. This is what's also referred to as fast/slow metabolism.

- Question: if your body keeps adjusting the BMR based on how you eat, how do you manage to lose/gain weight? Intuition: this adjustment is far from perfect and it needs time (was it 2 weeks to adjust metabolism?). Eating 1,000 kcals less than you need will maybe make your body drop by 500 kcal of heat, so it will still need to go to fat/muscle deposits.

- Interesting fact: doing movement forces your body to use energy, either from what you just ate or food deposits. Doing exercises, especially on empty stomach will force your body to use food deposits no matter what your BMR is. This is why it's recommended to keep your kcal intake above your normal BMR even if you want to lose weight, and just do more movement/cardio to burn the fat/muscle stores. Not eating in the morning so your body uses fat deposits is sometimes used in intermittent fasting.

- Food usually consists of 3 main nutrients (also called macronutrients): fats, proteins and carbohydrates. These will dictate how many kcal a type of food has. For example, 100g of brown cooked rice will have 0.9g of fat (8.1 kcal), 23g of carbohydrate (92 kcal) and 2.6g of protein (10.4) resulting in 110.5 kcal. For reference, 1g of carbs has 4kcal, 1g of protein 4kcal and 1g of fat 9kcal.

- Normally it doesn't matter how you get your kcal every day (e.g. from fat/carbs/protein) as long as you hit your kcal goal (it's considered healthy to have a good balance). However, if you train to build muscles you will need to hit a certain value for the protein intake, since they are needed for muscle growth. A common recommendation for building muscles is to eat 1g of protein per pound of body weight, or 2.2g per kg. For example, if you weight 70kg you should eat 154g of protein every day.

- There are several popular macro splits that people use, for example the zone diet – 40% carbs, 30% fat and 30% protein. As far as I know the splits are based on mass and not on kcal (**this needs research**). For example if you need to eat 2,000kcal a day and want to follow the zone diet, this would mean 145.5g of carbs (582kcal), 109g of fat (981kcal) and 109g of protein (436kcal).

- If you use a calculator or app to track grams and proportions of carbs/fat/protein then you should be good to go. However, if you want to use your own custom values and plan ahead (e.g. meal prep) then it's easy to compute how many grams you need from the split and total calorie intake. Assuming c is the percentage of carbs, f of fat and p of protein (e.g. c = 40% = 0.4, f = 0.3, p = 0.3) and T is the total calorie intake (e.g. 2,000), then you have

$$grams\,of\,carbs = c\,\frac{T}{4c+9f+4p}$$

$$grams\,of\,fat = f\,\frac{T}{4c+9f+4p}$$

$$grams\ of\ protein = p\frac{T}{4c+9f+4p}$$

So for our previous example $4c+9f+4p = 4\cdot 0.4+9\cdot 0.3+4\cdot 0.3 = 5.5$
This means

$grams\ of\ carbs = (0.4\cdot 2000)/5.5 = 145.5$
$grams\ of\ fat = (0.3\cdot 2000)/5.5 = 109$
$grams\ of\ fat = (0.3\cdot 2000)/5.5 = 109$

- I personally call all the movement you do in a day (like walking, running, cycling, basically any kinetic energy) cardio. These type of exercises are also referred to as aerobic exercises.

- To lose weight you need to eat less than your TDEE / BMR + cardio in a day. To gain weight you need to eat more than your TDEE. This is true for both fat and muscles, the excess food you eat will end up storing on your body as muscles, given you damage your muscles by doing exercise and eat enough protein. This phase is usually called the bulking phase in bodybuilding. However, since the body is not optimal at storing muscles only, you will end up storing fat as well. That's why there is also a cutting phase, when you eat less than your TDEE, trying to maintain as much muscle mass as possible, while losing all the fat. For this to happen you have to keep exercising and damaging your muscles while cutting, with the proper nutrition.

- There are opinions that just eating your TDEE you can still gain muscles and burn fat at the same time (body recomposition), however these are highly controversial and not considered optimal. **These needs refs**.

Cooking

Workout

Sources

- https://www.wikipedia.org/
- https://www.ncbi.nlm.nih.gov/pubmed/
- https://www.youtube.com/user/VitruvianPhysique
- https://www.youtube.com/user/JDCav24/videos
- https://scholar.google.co.uk

Books

- Starting Strength – 1
- Practical Programming for Strength Training – 1
- Health/Fitness Instructor's Handbook – 1, 2
- Bodybuilding: A Scientific Approach – 1
- Biochemistry for Sport and Exercise Metabolism – 1