

# 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  $\text{fat mass (kg)} * 100 / \text{total mass (kg)}$ . 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):
  - [Magnetic Resonance Imaging \(MRI\) and Computerized Tomography \(CT\)](#)
    - this is not available to the public
    - needs more refs
  - [Dual-energy X-ray absorptiometry \(DEXA / DXA\)](#)
    - this is an x-ray machine that scans your body
    - 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
    - can still have errors up to 10% compared to MRI scans - [1](#)
    - 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) and not body fat
 
$$13.7516m + 5.0033h - 6.7550a + 66.4730$$
  - [Revised Harris-Benedict](#) (1984)
 
$$13.397m + 4.799h - 5.677a + 88.362$$
  - [Mifflin St Jeor](#)

$$10m + 6.25h - 5a + 5 \quad (\text{for males})$$

$$10m + 6.25h - 5a - 161 \quad (\text{for females})$$
  - [Katch-McArdle](#) – takes body fat % (f) into account
 
$$370 + (21.6m * (1 - f/100))$$
- Total daily energy expenditure (TDEE) = BMR + movement. I assume this is 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/>
- It's also good to understand that it's impossible to calculate exactly how much energy you burn in a day, but it's good to have a starting point and adjust as you go along.
- 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. 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.
- 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. Not eating in the morning so your body uses fat deposits is sometimes used in [intermittent fasting](#). I would not recommend fasting if you want to build muscles. You need protein in the morning to support the muscle protein synthesis as described in this [video](#).
- 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 (however it's considered healthy to have a good balance). 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

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

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

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

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

This means

$$\text{grams of carbs} = (0.4 \cdot 2000) / 5.5 = 145.5$$

$$\text{grams of fat} = (0.3 \cdot 2000) / 5.5 = 109$$

$$\text{grams of protein} = (0.3 \cdot 2000) / 5.5 = 109$$

- At the end of the day you should use a macro split that works well with you and your body can take. Some people like carbs more, others like fat more. There's also articles and websites out there that give you advice on this – [1](#), [2](#), [3](#), [4](#).
- 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.
- For a “lean” bulk (gaining as little fat as possible) it's usually recommend to eat 10 – 20% more than your TDEE. For example, if your TDEE is 2,500 you should eat 2,750 – 3,000 kcal a day. The same holds true for a cutting phase where you keep most of your muscles, you should eat 10 – 20% less so 2,000 – 2,250 kcal. Refs – [1](#), [2](#), [3](#), [4](#).
- If you eat more than 10 – 20% then it's considered a “dirty” bulk. Dirty bulks also work (and a lot of people do them), in fact you usually gain strength faster on a dirty bulk than on a lean one, but you also gain more fat which will cover up the muscles. If looking good is your goal, you'll need to lose this fat at some point, which takes time and is not pleasant.
- A clear example where eating more = gain more strength are the strongman competitions. [Strongman](#) are people that compete to have the most strength (e.g. most weight to lift off the ground). Their purpose is to gain strength as fast as possible while not caring about their looks so they end up having these diets with 10,000+ kcal a day (for example [Brian Shaw](#), who won [World's Strongest Man](#) 4 times).
- The only problem I have with dirty bulks is that you stop looking good while on the bulk and this is one of the reasons I do bodybuilding in the first place. What point does it make to

only look good at the end of a cut for a few weeks when you can look good all the time? Also, gaining size too fast might give you [stretch marks](#). Another problem is that forcing myself to eat a huge amount of food every day makes me feel miserable.

- When going from a cutting phase to a bulking phase (e.g. going from 2,000kcal to 4,000kcal) there should be a transition period where you slowly increase your intake, otherwise your body might end up storing a lot of fat, not to mention it will feel bad to force yourself to eat this much. **This needs more documentation on how to increase intake.** There are several articles about this – [1](#), [2](#).
- A common rule I saw is that for each 4 months of lean bulk, you'd need 1 month of cutting to get in shape. This obviously depends on a lot of factors and not always true, I would use it just for time estimates. You will obviously cut until you reach the body fat % you desire.
- There are opinions that just eating your TDEE you can still gain muscles and burn fat at the same time ([body recomposition](#), [video 1](#), [video 2](#)), however these are highly controversial and not considered optimal for building muscles. Since the body can't turn fat deposits into muscle deposits this would mean that some of the food you eat gets stored as muscle while fat from deposits is used for other things such as heat. I did experience strength increase while cutting myself, but this happened after a time off of gym. **These needs refs.**
- If you just want to lose weight without building muscles, I would recommend to still hit your BMR value and do extra cardio to be at a deficit (your TDEE will be higher than your intake). This is so you don't mess up your thermogenesis. It also felt like the only sustainable solution to me, not eating enough makes you feel tired and dizzy throughout the day, while a diet where I was eating 2,000kcal a day and doing extra cardio didn't make my life harder and I could've done it forever.
- From experience it's really important to track everything – estimating caloric intake could lead to big errors and tracking weight is a huge motivation boost for me. This is what makes the difference for me between sticking to my diet and not.
- Supplements: if you just want to stay fit you don't need any. If you want to build and maintain muscles, some supplements are believed to make a difference. Many bodybuilders believe you can do just fine without any supplements, these will give you just a small advantage. In some cases you might start experiencing problems, for example a lot of people struggle with recovery or joint pain after workouts. In this case you might want to look into supplements that help you with this like [glutamine](#), [glucosamine chondroitin](#), [omega 3](#) etc. Normally people recommend using [branched-chain amino acids](#) (BCAA), [creatine](#) and maybe [glutamine](#) supplements – [1](#), [2](#), [3](#), [4](#), [5](#).
- Protein powder – this is powder that you normally mix with water or milk to make a protein shake. It has a high protein content and it's useful if you struggle to reach your protein goal from normal food. It also gives you the freedom to cook foods that are high in protein (e.g. [protein pancakes](#)). There's a lot of types of protein powders (e.g. whey, casein etc). Whey protein is fastest one to be absorbed by your body and I find this useful to consume in the morning to support muscle protein synthesis – since you wake up on empty stomach your body doesn't have any protein to keep repairing muscles, so you should eat proteins that are absorbed relatively fast. Depending on what type of protein powder you purchase, it may contain certain types of proteins such as BCAA or glutamine, make sure to read the label.

- BCAAs are a type of protein that helps with muscle growth. Some people say they are the best type of protein for muscle repair – for [example](#). You can find BCAA in foods such as eggs, milk, beef etc. Having more BCAAs, for example from protein powder might help with better muscle recovery. The amount of BCAA you should take depends on how much protein you already get in a day. Normally you buy protein powder (e.g. from [Optimum Nutrition](#)) that has BCAA and you take 1 scoop every day in your protein shake, for example after workout. This protein powder will also contain glutamine so you don't have to worry about that either.
- Creatine – this is a supplement that comes either in powder or pills form. It helps you perform better in the gym, having more strength and gaining more muscles – [1](#). You can get it from various types of meats such as tuna, steak etc. However it is believed that the amount you get from food is too low and supplements are needed. The amount of creatine you need in a day is 3 – 5g. I would take it after exercise with my protein shake – see [this](#) for more info on when to take it. It is also believed it takes around 2 weeks to see the effect of creatine, and since people want to see the effects faster they do something called [creatine loading](#) – taking 20g of creatine every day for 5-7 days, then going back to 3g. Working out without creatine is perfectly fine, the extra advantage you get is really small but people do whatever it takes to gain even a small advantage.
- As a side note, creatine was linked to hair loss in a [research paper](#). There's also research papers stating it has nothing to do with hair loss (directly or indirectly) – e.g. see [video](#). However, bodybuilding in general increases the amount of testosterone (the male hormone) the body produces, which increases hair loss for men. [Dihydrotestosterone](#) (DHT) which is produced in the body from testosterone is known to bind to hair follicles which ultimately leads to their deaths. There are different solutions to this, like [Minoxidil](#) which is applied on the scalp to fight DHT, or [Finasteride](#) which is a pill you take. You can read more about DHT and possible solutions in this [article](#). I would suggest visiting a hair loss specialist before taking anything.
- There is a bunch of other supplements that people use (like multivitamins), not sure which ones work or not. There is a website that claims to help with info on supplements – [examine.com](#).
- I haven't noticed supplements having big impact on me but I've never tested this properly. I personally take [whey protein powder](#) in the morning and after gym. After gym I mix it with [creatine powder](#), milk and sometimes frozen raspberries/blueberries to make [protein fluff](#) – this is similar to ice cream and high in proteins. I normally have salmon in my every day diet, but if I don't I take [omega 3 capsules](#) as well. Finally I also take [multivitamins](#) since I'm pretty sure I'm not getting everything I need in a day from what I eat.
- Some people also take “pre-workout” drinks. This usually contains caffeine to give you energy and a bunch of other stuff, like small amounts of creatine and some carbs. I personally don't feel the need for pre-workout drinks but if you struggle finding energy to do your exercises maybe this is something for you. One thing I would pay attention to is that some pre-workout drinks have insane amount of caffeine (like 10+ cups of coffee) which will mess you up, I would never drink such pre-workouts.
- One thing to note: if you sweat a lot like me (I sweat crazy amounts, especially when doing my cardio) you probably lose a lot of sodium. I noticed that if I drink water with sodium as opposed to plain water it helps my endurance a bit in the gym. I just dissolve a bit of stock cube in water and slowly drink it throughout my workout.



- Steroids: testosterone plays an important part in muscle growth. It is believed that taking external testosterone – also referred to as [anabolic steroid](#) (e.g. by injecting it into your muscles) speeds up the muscle growth process by a big factor (some people say up to 10 times faster). However, this has serious side effects and could be lethal. Some of the side effects of injecting testosterone are infertility and shrunk testicles for men (your body will produce less testosterone since you are injecting external one). Since the body will stop growing muscles naturally at some point (**this needs refs**) e.g. after 15 years of training, one of the few options you have to keep growing size is to start taking steroids. It's really up to you what size you want to get to, you can get a decent physique without steroids and I would recommend against them.
- PEDs: TODO

## Nutrition – Example

- I will give nutrition examples for the following cases – you are overweight and just want to lose weight (1) and you want to become muscular like a bodybuilder (2).
- You need a way to track calories intake. I see two ways of doing this – either cook in advance or try to track everything you eat with an app like myfitnesspal ([android](#) & [iOS](#)). Myfitnesspal is great because you can scan barcodes from items you buy in the supermarket and it will automatically add the kcal for them. However, sometimes you might buy cooked food which is harder to track. For best results I recommend cooking – it's more accurate, gives better results and even healthier & much cheaper than buying cooked food all the time. I find it even easier to do than tracking every item you eat with an app, you only need to spend time once to plan meals and then cook once or twice a week (meal prep). Cooking can be super easy to do and doesn't require skill, unless you want to be fancy with your meals. I normally spend 30min – 1h on a Sunday to cook for Monday – Friday just because I'm too lazy to cook and I've never had an issue with it. If you want to invest more than that you can cook for 2 – 3 days only and repeat. I'll go more into cooking and meal prep in the cooking section. If you end up using the app, make sure you track everything – even fruits, veggies, oil etc, they all add up. I used to make big errors (500+ kcal) just by not adding these up!
- You also need a way to track your weight. Any good scale should do, one that shows the same weight if you step on it several times. I track my weights in a spreadsheet like this one for example – [link](#) (feel free to make a copy and adjust it to your needs). I weight myself every morning at roughly the same time and use the android google sheets app to add my weight fast.
- First step is to find your TDEE. If you have time I would do this experimentally: start with an online calculator (links above) to estimate your TDEE (basically your BMR and the movement you have to do every day, like going to work and back). Do not include physical exercise in this TDEE calculator for now. Take the value you get from the calculator and assume it's right, then try to eat exactly that amount of kcal for 1 – 2 weeks, either by tracking with an app or cooking in advance. Weight yourself every day (try to ignore the small fluctuations from day to day). At the end of the 2 weeks see if your weight stayed within the same limits the entire 2 weeks – if yes, then you found your TDEE value. If not, then look at how much weight you gained or lost. The theory is that [you lose 1lb of mass at the total deficit of 3500kcal](#). The same is true if you gain 1lb of mass, you are at a surplus of 3500kcal. Take the weight you gained/lost in lbs and multiply by 3500 – this is your caloric

surplus/deficit. Now divide by 14 and you can find your actual TDEE. For example you gained 1lb in these 2 weeks eating 2,000kcal every day. This means you had a total surplus of 3,500kcal, divided by 14 → 250kcal surplus every day. This means your actual TDEE is  $2,000 - 250 = 1,750\text{kcal}$ . However, I found this to not work for me very well, I assume this 1lb/3500kcal rule depends on each individual. If the same happens to you, this experiment is still not a waste of time, at least you know roughly how to adjust calories (e.g. you can keep adjusting until your weight doesn't change anymore).

- If you just want to lose weight (1) then the next step is easy: now that you know your TDEE I would personally keep the caloric intake at this value to not mess with the BMR. To get to a caloric deficit of 10 – 20% I would just add more cardio to reach that value. For example, if your TDEE is 2,000kcal and you want to do a more aggressive 20% decrease, then I would keep eating 2,000kcal every day and do 400kcal (20%) of extra cardio every day. This is probably around 1h of walking for the average person, but it's better if you actually track this (e.g. treadmills show you how many calories you burn, there are watches with this feature too, even online calculators – but less accurate).
- If you want to build muscles (2) it's more complicated. I would start with a bulking phase for 4 months, followed by a cutting phase of 1 month. Let's say your TDEE is 2,000kcal. For the bulking phase I would go 20% up, to 2,400kcal. To build muscles you don't need to do any extra cardio. However, some people enjoy eating, even more than 2,400kcal a day, so I would compensate any extra kcal I eat with cardio (e.g. I eat 2,700kcal a day and do extra 300kcal on the treadmill). You must also make sure you get enough proteins a day and enough sleep (more on this later). If I weight 70kg I would get 154g of proteins every day. After each workout, when I get home I get a protein shake with BCAA, creatine and glutamine in it. You should notice your weight increasing slightly and your strength increasing as well in the gym (more about this in the workout section). This is the way I track I'm doing the right thing.
- For the cutting phase you need to get at a deficit of 20%. With the same TDEE of 2,000kcal, I would keep this as my intake and do 400kcal on the treadmill every day (this means you go from 2,400kcal a day and no cardio to 2,000kcal with 400kcal of cardio). This is a difference of 800kcal in diet, while not that big and usually people don't recommend going slowly into cutting, I would personally drop by increments of 10% every week, first to 400kcal deficit and then to 800kcal. Otherwise it might be harder to do, feeling hungry and tired all the time. While you cut you should keep the same workout routine and damage muscles, take the same amount of proteins and supplements (if you already do). The only difference is the caloric intake. You should notice your weight going down and your strength staying the same in the gym (maybe you feel less energy or your strength might go down a bit if you cut for several months in a row). Also, you should notice you get better muscle definition from week to week.
- There are debates whether or not the exercises you do to build muscles (e.g. weight training) burn or not calories. Personally I don't consider weight training to burn that many calories – there is not a lot of movement involved (kinetic energy) and even if your heart rate increases I don't think this means you burn more calories. The movements you do are slow and you just try to damage your muscles. This is why I don't include kcal from weight lifting when computing how much you should eat for cutting/bulking. However, I do agree that building muscle will make you burn more calories every day for your movement and even at rest, as stated above muscles burn more calories than fat. **This needs refs and proper sources.** Articles related to this – [1](#).



- If at any point you just want to maintain your physique you just need to eat your TDEE. If you built muscles I think you need to keep doing the same exercises to maintain them (although I would personally drop time spent in the gym as well).
- Since your TDEE increases as you gain size, you will always have to keep an eye on it and update it as you go along. After a while this should become natural.

## Nutrition – Planning, Cooking, Meal Prep

- If you decide you don't want to track everything you eat with an app (or something else, like a notebook) then you can plan in advance! The way I do it (and I've seen others using this method as well) is to have a spreadsheet with the food I normally like to eat and all the nutritional values for it (like kcal, carbs, fat & protein in 100g for example). I have a section called "playground" where I play with the amounts for foods until I reach my kcal & macro goals for the day. After that I save the values in a new sheet (e.g. Day 1 of the week) and start from scratch again to create multiple custom days. You have a full example [here](#). The sheet "Food" has all the food I normally eat. In the Playground table, I adjust units column and the kcal & macros are added automatically for that item at the end of the table. I keep playing with values like this (based on previous experience and what I like to eat) until I get close to my goals. Then you can see the stored values in "Day 1" sheet. If you don't mind eating the same thing every day then you can eat Day 1 food every day (Monday, Tuesday etc). If you want to have some diversity you can create multiple Day sheets (Day 2, Day 3 etc) and plan them however you want during a week. Feel free to copy the spreadsheet, fill it with your food of choice and plan your days!

## Workout

## Sources

- <https://www.wikipedia.org/>
- <https://www.healthline.com/>
- <https://www.ncbi.nlm.nih.gov/pubmed/>
- <https://www.youtube.com/user/VitruvianPhysique>
- <https://www.youtube.com/user/gregdoucette>
- <https://www.youtube.com/user/JDCav24/>
- <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](#)