

Low Carb/High Fat

What is a low carbohydrate diet?

When we consume carbohydrates our body breaks it down into glucose (as well as other sugars; see **box 1**). Our body releases insulin in order to rapidly clear this glucose out of our blood and into the cells where it can be converted into energy. Insulin also promotes the storage of fat, so when insulin levels are high our body is in fat storage rather than fat burning mode. Consuming fats does not directly affect blood glucose levels, and as a result does not lead to an elevation in insulin. So by replacing some of our carbohydrate intake with fat, we can reduce insulin levels and increase our body's ability to utilise its own fat stores for energy.

People are classified as having metabolic syndrome if they have elevated levels of three or more of the included risk factors (from elevated waist circumference, elevated triglycerides, low HDL-c, high blood pressure and elevated

glucose). The metabolic syndrome is a condition of insulin resistance and can lead to obesity, Type 2 diabetes, fatty liver and many other conditions (1). A LCHF dietary approach can be used to reduce insulin levels, and therefore can also be an effective method for treating or preventing the metabolic syndrome (2).

What foods are encouraged?

“Low” Carbohydrate is defined as less than 130g per day, whereas “very low” carbohydrate is less than 50g per day (3). You may also be familiar with the term nutritional ketosis. Ketones are a by-product of fat breakdown and become a primary energy source if people become fat adapted by adopting a very low carbohydrate diet. Different people will have different

Box 1. Some carbohydrates are made up of other sugars as well as glucose; for example table sugar (sucrose) and fruit contain a mix of glucose and fructose, whilst milk sugars (lactose) are made of glucose and galactose. Starchy carbohydrates such as potatoes, pasta and bread are made of chains of glucose.

Glucose goes straight into our blood, whereas the other sugars go to the liver to be metabolised. Although this means they don't affect our blood glucose levels as fast, they can still cause it to increase- so the amount of carbohydrate we have is important irrelevant of what form it is in.

Excess sugars in the liver can also be converted to fats (if we don't need more glucose elsewhere and our glycogen stores are full), which can increase our circulating triglyceride levels or be stored in the liver itself with potentially negative consequences.

tolerances to carbohydrate, so will be able to consume different amount whilst still achieving their goals.

Contrary to what many people think most LCHF diets are not high in protein. In fact, for every 100g of protein consumed 56g of glucose can be produced (4); thus having too much can affect our blood glucose and undermine what LCHF is trying to achieve. Protein can also directly stimulate insulin resistance. Moderate protein consumption, 2 to 3 portions per day, is therefore usually recommended. This is only a guideline however, and some people can tolerate more protein- especially if they are physically active. Protein can also increase satiety, i.e. it can help you to feel fuller.

When carbohydrate is restricted it is important to increase the levels of fat consumed. People often make the mistake of having a low carbohydrate AND low fat diet, which inevitably leads to hunger. Fat should be consumed to satiety, so eat as much as is required to make you feel full. You should however consider if you are actually hungry, and make sure you aren't simply eating due to stress or as an emotional response. Healthy natural sources of fat include olive oil, butter, grass-fed meats, eggs and dairy products. There is no need to be afraid of fats, including saturated fats and cholesterol; though trans-fats and hydrogenated or partly hydrogenated vegetable oils (often found in junk foods) should be avoided! There is an international effort on reducing trans-fats but the high levels of refined vegetable oils remains a concern.

A LCHF diet should also include a lot of green-leafy vegetables, though consumption of starchy vegetables (such as potatoes and other root vegetables) and fruit should be limited due to their higher carbohydrate content.

What does the research say?

Reviews of lower carbohydrate diets have demonstrated LCHF can reduce insulin resistance, improve glycaemic regulation and have positive effects on reducing risk factors for heart disease; including reducing serum triglyceride, increasing HDL cholesterol, increasing LDL particle size and reducing blood pressure (5-14). A substantial proportion of individuals have also been shown to discontinue one or more diabetes medication (15).

What's the downside?

As with any dietary approach there are some caveats to following a LCHF approach. It is always wise to discuss the pros and cons with a clinician before making radical changes to your diet. However, as the use of LCHF is relatively new not all GP's are fully familiar with it.

A list of practitioners who can provide guidance regarding this approach can be found [here](#)). Some of the criticisms of LCHF are false however, or can easily be addressed (see [here](#)). The following are some of the common concerns:

- **Hunger:** Some people experience increased hunger on a LCHF diet. As stated above, this shouldn't be the case if people actually follow the "high fat" part of the diet; i.e. they eat fat to true fullness as suggested. Lowering insulin levels and reducing insulin resistance can reduce hunger (see figure 1). Including a portion of protein and some high-fibre green leafy vegetables with meals can also increase feelings of fullness (16).
- **Lack of variety:** This is a concern in terms of enjoyment, i.e. people think they'll be eating the same thing all the time. This does not have to be true however, as there are a wide variety of meals and foods suitable for a LCHF approach (there are links to some recipes in the "further reading" section below).
- **Nutritional deficiencies:** It's also been suggested that following a LCHF approach can lead to deficiencies of certain vitamins and minerals. Intervention trials have found no evidence of this however (3). This is likely in part because "real" foods are more nutrient dense than processed ones.
- **"Low carb flu":** Some people report feelings of lethargy, headaches and genuinely feeling unwell when starting a LCHF diet. This is simply because your body is used to using glucose as a primary fuel source, and needs some time to adapt to using fats. For most people in 7-10 days these symptoms pass as they become more fat adapted, whilst ensuring sufficient fluid and salt is consumed can help to prevent these symptoms.
- **Cramping:** As many foods high in carbohydrates also contain relatively high levels of salt it is not uncommon for cramping to occur when you eliminate them. Insulin causes sodium (salt) to be retained in the blood, so when insulin levels drop you also excrete more salt from your body in your urine. So as well as taking salt less in we also lose more. This problem is rectified simply by adding some salt to your food.

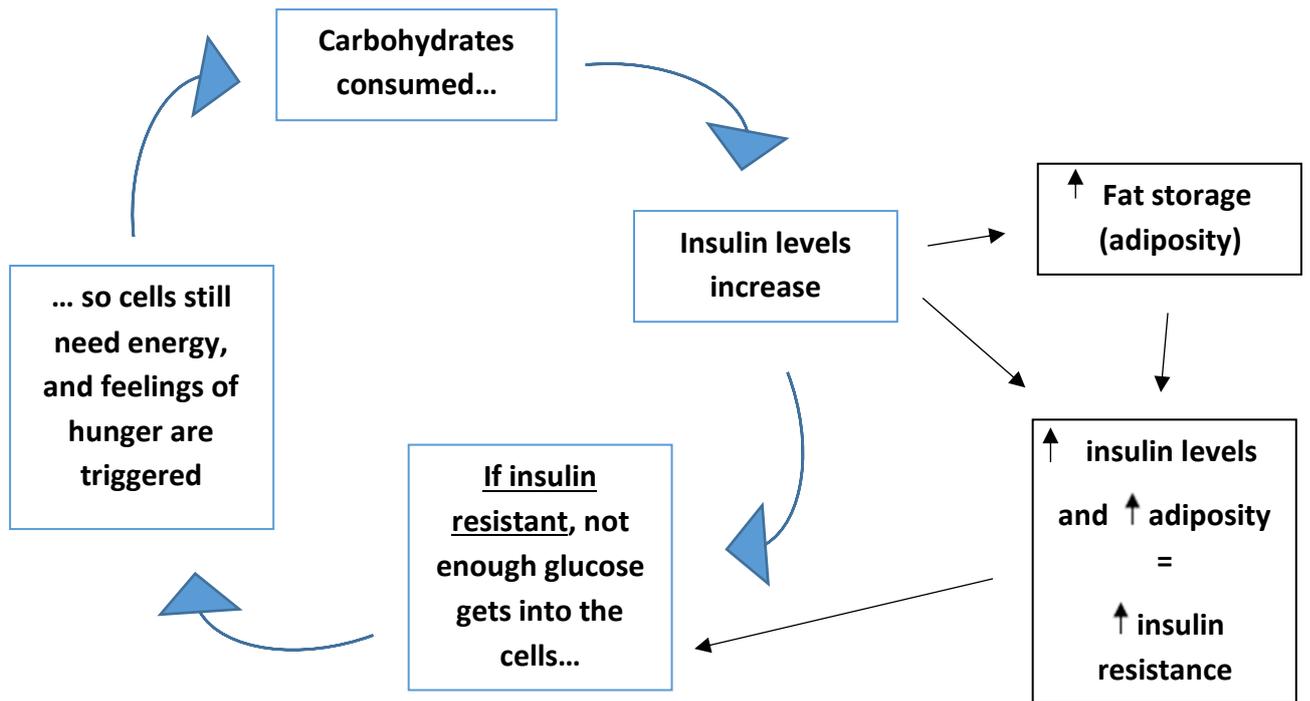


Figure 1. The (possible) effect of eating carbohydrates if resistant to insulin

Some further reading/resources

X-PERT Position Statement (2020): Low Carbohydrate Dietary Approaches and Type 2 Diabetes (available [here](#)).

Step-by-Step Guide to Low Carb Living, a LCHF handbook written by Dr Trudi Deakin (the founder and CEO of X-PERT Health) is available to purchase [here](#).

The Art and Science of Low Carb Living - [Link](#)

Good Calories Bad Calories – [Link](#)

There are a number of websites and blogs with useful information regarding LCHF. For example (the first three include recipes too):

- www.diabetes.co.uk
- <https://www.dietdoctor.com/>
- <https://www.healthline.com/nutrition/low-carb-diet-meal-plan-and-menu>
- <http://foodmed.net/2016/04/18/noakes-the-idiots-guide-to-lchf-and-banting/>

References

1. Roberts CK, Hevener AL, Barnard RJ. Metabolic syndrome and insulin resistance: underlying causes and modification by exercise training. *Compr Physiol*. 2013;3(1):1-58.
2. Volek JS, Feinman RD. Carbohydrate restriction improves the features of Metabolic Syndrome. Metabolic Syndrome may be defined by the response to carbohydrate restriction. *Nutrition & metabolism*. 2005;2:31.
3. Feinman RD, Pogozelski WK, Astrup A, Bernstein RK, Fine EJ, Westman EC, et al. Dietary Carbohydrate restriction as the first approach in diabetes management. Critical review and evidence base. *Nutrition (Burbank, Los Angeles County, Calif)*. 2014.
4. Institute of Medicine of the National Academies. *Dietary Reference Intakes for Energy, Carbohydrate, Fiber, Fat, Fatty Acids, Cholesterol, Protein, and Amino Acids (Macronutrients)*. Washington, DC: National Academy Press; 2005.
5. Nordmann A, Nordmann A, Briel M, Keller U, Yancy W, Brehm B, et al. Effects of low-carbohydrate vs low-fat diets on weight loss and cardiovascular risk factors: a meta-analysis of randomized controlled trials. *Archives of internal medicine*. 2006;166:285 - 93.
6. Layman D, Clifton P, Gannon M, Krauss R, Nuttall F. Protein in optimal health: heart disease and type 2 diabetes. *Am J Clin Nutr*. 2008;87:1571S - 5S.
7. Kirk JK, Graves DE, Craven TE, Lipkin EW, Austin M, Margolis KL. Restricted-carbohydrate diets in patients with type 2 diabetes: a meta-analysis. *J Am Diet Assoc*. 2008;108(1):91-100.
8. Dyson PA. A review of low and reduced carbohydrate diets and weight loss in type 2 diabetes. *J Hum Nutr Diet*. 2008;21(6):530-8.
9. Shikany JM, Desmond R, McCubrey R, Allison DB. Meta-analysis of studies of a specific delivery mode for a modified-carbohydrate diet. *J Hum Nutr Diet*. 2011;24(6):525-35.
10. Hu T, Mills KT, Yao L, Demanelis K, Eloustaz M, Yancy WS, Jr., et al. Effects of low-carbohydrate diets versus low-fat diets on metabolic risk factors: a meta-analysis of randomized controlled clinical trials. *Am J Epidemiol*. 2012;176 Suppl 7:S44-54.
11. Paoli A, Rubini A, Volek JS, Grimaldi KA. Beyond weight loss: a review of the therapeutic uses of very-low-carbohydrate (ketogenic) diets. *Eur J Clin Nutr*. 2013;67(8):789-96.
12. Sackner-Bernstein J, Kanter D, Kaul S. Dietary Intervention for Overweight and Obese Adults: Comparison of Low-Carbohydrate and Low-Fat Diets. A Meta-Analysis. *PLoS ONE*. 2015;10(10):e0139817.
13. Mansoor N, Vinknes KJ, Veierød MB, Retterstøl K. Effects of low-carbohydrate diets v. low-fat diets on body weight and cardiovascular risk factors: a meta-analysis of randomised controlled trials. *British Journal of Nutrition*. 2016;115(03):466-79.
14. Hashimoto Y, Fukuda T, Oyabu C, Tanaka M, Asano M, Yamazaki M, et al. Impact of low-carbohydrate diet on body composition: meta-analysis of randomized controlled studies. *Obesity Reviews*. 2016:n/a-n/a.
15. Saslow LR, Kim S, Daubenmier JJ, Moskowitz JT, Phinney SD, Goldman V, et al. A Randomized Pilot Trial of a Moderate Carbohydrate Diet Compared to a Very Low Carbohydrate Diet in Overweight or Obese Individuals with Type 2 Diabetes Mellitus or Prediabetes. *PLoS ONE*. 2014;9(4):e91027.
16. Chambers L, McCrickerd K, Yeomans MR. Optimising foods for satiety. *Trends in Food Science & Technology*. 2015;41(2):149-60.