

MC4R GENE VARIANT



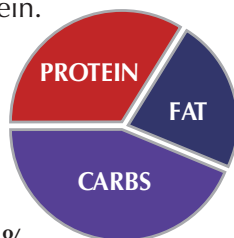
MC4R, also known as the **Melanocortin 4 Receptor**, refers to a gene found on chromosome 18 and the receptor that this gene creates. A receptor is a place inside or on the surface of a cell that is activated by the molecules it recognizes. The MC4R receptor is located in the hypothalamus, a region in the brain that is related to many different body functions, but in the case of MC4R it is related to appetite and metabolism regulation. A variation in this gene causes individuals (referred to here as MC4R carriers), to have a tendency towards obesity and increased appetite. This is shown in a lowered basal metabolic rate, increased insulin levels, increased hunger, followed by a tendency to snack often.

DETAILED DIETARY RECOMMENDATIONS

- 1. Limit fat intake.** High fat diets cause MC4R carriers to be more likely to overeat. When a meal has a high fat content MC4R carriers will eat more of that meal. But wait, there's more. After consuming a high fat meal **even once**, this can rewire diet habits to overeat for up to **TWO WEEKS** after returning to a controlled fat diet.
- 2. Eat a higher amount of calories from protein and a lower amount of calories from fat.** For the best results 35% of daily calories should be from protein and 20% should come from fat, leaving 45% of your daily calories from carbohydrates.

Protein 35%

1200 calorie per day diet:
105 grams of protein.



Fat 20%

1200 calorie per day diet:
26 grams of fat.

Carbohydrates 45%

1200 calorie per day diet: 135 grams of carbohydrates.

Top Tips:

Living With The MC4R Gene Variant

- *Limit fat in the diet. High fat diets stimulate overeating even after returning to a normal fat diet. Low fat diets reduce the risk of overeating.*
- *Control carbohydrate intake, higher levels of carbohydrates lead to greater obesity.*
- *Eat a high fiber diet to promote feelings of fullness that lasts longer and thus reduces the actual amount eaten.*
- *Eat five or more small meals a day. MC4R gene variant can create a tendency to snack continually which increases the overall intake of calories; plan for these tendencies and spread out calories over many small meals.*
- *Exercise daily, 50-60 minutes daily at 65-75% Maximum Heart Rate reduces the influence of the variant.*
- *Aim for this allocation of calories across daily food consumption:
45% Carbohydrates, 35% Protein, 20% Fat*

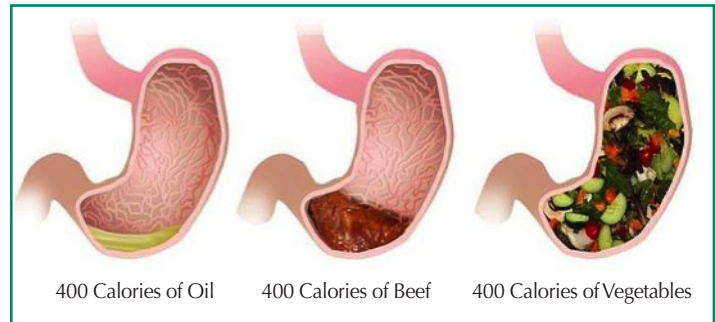


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3. **Control carbohydrate intake.** A higher level of carbohydrates frequently leads to greater obesity. MC4R carriers also have a tendency to experience higher insulin levels. Controlling carbohydrate intake helps to control food cravings, prevent excess carbohydrates from being stored as fat, and to help prevent development of insulin resistance and diabetes.

4. **Eat a high fiber diet.** A high fiber diet full of vegetables is important to maintain the feeling of fullness as well as providing nutrients for overall health. Aim for 25-35 grams of fiber daily from vegetables and whole grains. For people with the MC4R variant high fiber is even more important because the variant allele can cause the stomach to release food into the intestines too fast which causes problems in two ways:



1. Food in the stomach presses on fullness receptors along the walls of the stomach that tell the brain to stop eating. If the food empties too quickly then that signal is not communicated properly and there is a risk of eating again too soon, or eating more.
2. When food enters the intestines rapidly it causes blood sugar levels to rise too quickly. The pancreas pumps out a surge of insulin to manage this increased blood sugar. As insulin moves blood sugar off to the liver to be converted to fat, blood sugar levels drop again quickly. This instability in blood sugar leads to higher levels of hunger and hence over eating.

5. **Eat five or more small meals daily.** MC4R carriers have a tendency to snack outside of meal times and also show a lower ability to restrict food intake. To support a healthy metabolism and to prevent overeating, eat five or more small, evenly spaced meals a day.

PHYSICAL ACTIVITY RECOMMENDATIONS

Exercise daily. Daily exercise helps to reduce the effect that MC4R has on the inability to lose weight. It also helps to expend calories and improve overall health. Aim for 50-60 minutes of daily exercise at 65-75% maximum heart rate.

Perceived Level of Exertion: “Feels like” light to moderate effort similar to a brisk walk.

Maximum Heart Rate: Exercise at a light to moderate intensity for the majority of the workout. If 50-60 minutes is too large of a time frame to set aside to exercise it is okay to break this amount into 2-6 smaller intervals over the course of the day, but make sure to get the full 50-60 minutes into the daily schedule. Research has shown that there is some benefit to smaller intervals of exercise the happen more frequently in the day, but the most important thing is that the body moves for at least an hour a day to best reduce the effects of the MC4R variant on weight loss efforts.

Ideas for getting 50-60 minutes a day:

- Use work breaks to get 10 minute fast walk around the parking lot or up and down the street.
 - Park at the back of the grocery store parking lot and walk to the front door.
 - When possible, carry groceries to the car rather than push the cart.
 - When waiting for kids to be done with activities – get there early and walk around for 10 minutes.
 - Walk up and down stairs for 5 minutes twice a day.
 - Stretch and walk in place while watching a TV show.
 - Clean. Cleaning burns calories and any household with pets, or kids or both, always something to clean, even 10 minutes of vigorous cleaning can be part of a daily work out.
 - Do jumping jacks, or do arm curls with the laundry detergent while waiting for everyone to get ready.
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