



## Dietary management for trimethylaminuria (TMAU)

Trimethylaminuria (TMAU) is a build-up of trimethylamine (TMA) in the body. Trimethylamine can get into sweat, urine and saliva and in some cases cause a fish-like smell. Usually, the liver uses an enzyme to change trimethylamine into something that doesn't smell. This enzyme may be missing or not working because of an inherited genetic mutation. This is called primary TMAU.

A build-up of trimethylamine in the body can also be caused by an overgrowth of bacteria in the gut. This can produce excessive amounts of trimethylamine. This is known as secondary TMAU and can cause the same smell as primary TMAU.

Researchers have spoken to patients with TMAU about their experiences and the journey from first experiencing symptoms to gaining a diagnosis. From this research, we know that this can be a very frustrating and difficult process to go through. We hope to help you manage this condition as best we can.

### Dietary treatment

The aim of the diet is to try to reduce the presence of the odour caused by the build-up of trimethylamine.

This can be done by restricting trimethylamine from foods. Trimethylamine is found in sea fish and shellfish.

Trimethylamine is also produced naturally by bacteria in the gut. Bacteria make trimethylamine from a nutrient in some foods called choline.

Choline is absorbed into the body from the small intestine. Once absorbed into the body it cannot be turned into trimethylamine. Choline that doesn't get absorbed by the small intestine will move into the large intestine where gut bacteria turn it into trimethylamine.

**Choline is an essential nutrient for the nervous system and the function of the liver. Low levels of dietary choline can cause liver problems and overly restricting choline can be dangerous.**

Most people in Europe don't eat enough choline compared to what they need. This booklet talks about reducing choline in the diet to manage TMAU but it is important that the diet still contains some choline to maintain health.

It is important that the diet is right for you. Some people only need a mild restriction of choline and some people do not benefit from the diet at all. If the diet does not give you any benefit then it is important to lift restrictions and follow a healthy, balanced diet.

## Protein containing foods

Protein is needed for growth and repair so you will need a protein source in at least two meals per day. Meat and freshwater fish are good sources of protein and nutrients to include in your diet, but stick to small to medium sized portions (no bigger than your hand).

Including meat / fish two or three times a week will provide you with essential nutrients, such as vitamin B12, zinc and selenium. Vegetarian sources of protein are lower in choline. Using these two or three times a week instead of meat / fish will help to reduce your choline intake.

<b>Foods low in choline and trimethylamine (TMA)</b>	<b>Foods with small amounts of choline/ TMA</b>	<b>Foods high in Choline/ TMA</b>
Beans, lentils, chick peas,	Red meat such as beef or lamb	Sea fish such as tuna, swordfish, sea trout
Tofu	Lake or river-based trout or salmon	Crustaceans such as mussels, crab, lobster,
Nuts and seeds, nut butters	Pork	Offal- liver, pate, tripe,
Egg white	Quorn	Egg yolks
Cheese	Soya Beans	Venison
Meat substitutes made from wheat protein, soy protein and pea protein		
Chicken and turkey		
Hummus		
Tahini		
Seitan		

## Carbohydrates

Most foods high in starchy carbohydrate are low in choline and should be eaten with each meal. These include bread, crackers, pasta, rice, potatoes, cereals, oats. White, brown and wholemeal varieties are all low in choline.

## Calcium

Dairy foods (milk, cheese, yoghurt) are a good way to include calcium in your diet which is important for bone health. They are low in choline and two to three portions of dairy foods will not increase your choline intake greatly. If you would like to drink more milk than this, then the nut / rice / coconut milks are a low choline alternative. Choose options that are fortified with calcium, vitamin D and iodine if possible.

Non-dairy sources of calcium include tofu, nuts and seeds and fortified plant milks.

## Vitamin D

People living in the UK should take a vitamin D supplement between October and March.

## **Fruit and vegetables**

There is good evidence that eating plenty of fruit and vegetables can decrease your risk of heart disease, stroke and cancer. Therefore, aiming for at least five portions per day is important. All fruit and vegetables are very low in choline so can be eaten without restriction.

A group of vegetables called brassica vegetables are thought to inhibit the enzyme that converts trimethylamine into a non-smelly chemical in the liver. These include Brussels sprouts, cauliflower, broccoli and cabbage. This might not be the case for everyone, so check your tolerance to these vegetables.

## **Miscellaneous foods**

The following foods are low in choline:

- Butter, margarine, olive oil, sunflower oil
- Jam, marmalade, honey
- Boiled sweets, biscuits, chocolate,
- Herbs and spices, salt and pepper,
- Salad dressings, mayonnaise, tomato ketchup,
- White and brown flour

Foods higher in choline to be restricted:

- Soy flour (only if main ingredient)
- Cod liver oil.

## **Drinks**

Ensure an adequate fluid intake, aiming for six to eight glasses per day. Low choline drinks include water, tea, coffee, fruit juice, squash and fizzy drinks.

## **Alcohol**

Wine and spirits are low in choline, beer does contain some choline, so just have one pint or less at one time. Ensure you stick to healthy alcohol guidelines. This is no more than 14 units per week, spread out over the week, with a couple of alcohol-free days.

## **Carnitine**

Research has suggested that high intakes of carnitine may contribute to an accumulation of trimethylamine, but this has not been sufficiently studied in people with TMAU to make recommendations.

Foods high in carnitine include red meat, such as beef. If you find that these foods make your symptoms worse, following the same principles of using vegetarian sources of protein in meals two to three times a week will help to reduce your carnitine intake.

## **Lecithin**

Lecithin is a naturally occurring compound that contains choline. It is used by the food industry and added to foods to improve the texture and extend shelf life. Lecithin is usually only used in very small amounts in this way.

## **Multivitamins**

It is important to have a varied diet to ensure you get all the vitamins and minerals you need. If you think your diet is not adequate, then discuss the use of a multivitamin and mineral supplement with your dietitian.

## **Weight**

If you are losing weight unintentionally, then your diet may be too restrictive. Please speak with your dietitian.

## **Pregnancy**

During pregnancy and breastfeeding choline should not be restricted as the baby needs choline for growth.

It is thought that a large amount of choline is transported into the placenta during pregnancy increasing the mother's need for choline. During pregnancy, choline is thought to be very important for neurocognitive development and reducing risk of neural tube defects.

## **How long to follow the diet for?**

Trial the diet for 3-6 months to see if it helps your symptoms. It may not work for everyone and other treatment options can be tried (speak to your doctor). If it does not help, then you can go back to a normal healthy diet.

Keeping a food and symptom diary may be helpful to start with. If you have a food you are worried about, then introduce a small amount at a time and monitor your symptoms. If you do not notice any difference, try increasing it a bit more until you find your tolerance.

If you find the diet helpful, then continue with it, ensuring it is adequate by having a review with your specialist dietitian.

The diet is only to control your symptoms, so if you are having a quiet weekend in you can relax your diet and eat the foods that you like.

People have reported an increase in symptom severity during periods of infection, emotional upset, exercise and menstruation, Stricter dietary adherence during these times may be beneficial.

## **Example meal plans**

### **Low choline diet**

Breakfast: cereal and milk, two slices of toast with butter and jam,

Mid morning: piece of fruit

Lunch: cheese / meat salad sandwich with two slices of bread, fruit, yoghurt and two biscuits  
Dinner: chicken breast, mashed potato, carrots and sweetcorn, stewed fruit and cream / chicken curry and chapati or naan bread

### **Very low choline diet**

Breakfast: two slices of toast with butter and jam or cereal and rice milk (fortified with calcium)

Mid am: piece of fruit

Lunch: cheese salad sandwich with two slices of bread, fruit, yoghurt and two biscuits

Dinner: kidney bean and vegetable casserole or curry with rice / tofu stir fry and rice, cake

### **Accessibility**

To view this information in a different language or use text-to-speech reader visit [www.uhb.nhs.uk](http://www.uhb.nhs.uk), click the yellow and black circular icon in the bottom right of the web page to open the ReachDeck toolbar and then use the search bar to search by the name of the leaflet. If you require this information in another format such as braille, please email [interpreting.service@uhb.nhs.uk](mailto:interpreting.service@uhb.nhs.uk).



### **How did we do?** 😊 😐 😞

If you have recently used our services we'd love to hear about your experience. Please scan the QR code or follow the link to share your feedback to help us improve our services. **Thank you.** [www.uhb.nhs.uk/fft](http://www.uhb.nhs.uk/fft)

