Monoamine Oxidase Inhibitors (MAOI), Dietary Restrictions, Tyramine, Cheese and Drug Interactions (Abbreviated)

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[Full V. on application only]

Key Facts

• This review summarizes more research about tyramine than any previous or existing publication
• For people who already follow healthy eating (and drinking) amounts a low tyramine diet involves few, if any, changes
• Only those foods that are past their shelf-life or ‘off’, or those prepared using maturation and ‘fermenting’ techniques, can sometimes have high tyramine
• The increased blood pressure reaction that can result from excess tyramine ingestion is proportional to the amount of tyramine ingested
• Very few foods or drinks have tyramine levels sufficiently high that a small amount (i.e. 50 grams or ml [or less]) is likely to cause a serious or risky degree of hypertension
• Modern cheese is safe (in healthy-sized portions), only a few artisan/aged cheeses have higher tyramine concentrations, so care and awareness is needed
• If a reaction ever did occur, and provided you monitor your blood pressure, if and when you get symptoms, the chance of coming to harm is remote
• The symptoms of a reaction are: a thumping forceful heartbeat (usually a slower than normal pulse rate), paleness, severe headache, tightness in the chest. Pulse may drop as low as 40 beats per minute
• The risk of harm from blood pressure reactions with foods and MAOIs has previously been exaggerated
• The wide variability of sensitivity to tyramine means that a small percentage of people may notice reactions with smaller doses
• It is useful monitor your blood pressure while on MAOIs
• Remind your doctors to check, with the information in this document, the compatibility of any medications they recommended you to take, also check the info in this monograph yourself.
• There are few over-the-counter drugs that are a problem, because the pseudoephedrine type drugs (with indirect sympatho-mimetic activity [ISA]) have been taken off the market (in many western countries). Drugs with significant ISA activity may be risky.

General Summary

This is a greatly abbreviated version of the full monograph (12,000 words, 250 references, available on application).

The full version provides details of the tyramine content of a large range of foods and detailed explanations.

Interactions between monoamine oxidase inhibitors (MAOIs) and other drugs are now well understood (1) and there is more data on the tyramine in
foods, and also on how much is likely to constitute a problem (2). Concentrations are given as milligrams (mg) of tyramine per kilogram (kg) or litre (L).

For those who already follow healthy eating amounts and patterns an MAOI low tyramine diet involves almost no changes at all.

There is considerable variation of tyramine sensitivity between different people. Therefore, a small proportion of people may get a blood pressure increase with only 10 mg of tyramine, but most people need to have 25 - 50 mg (in a meal) to get a blood pressure reaction. For a detailed analysis of the evidence relating to tyramine dose and blood pressure see the full monograph, and (1).

Learn what 10 g or 100 g of cheese looks like. Healthy amounts of cheese are around what is safe tyramine-wise: few contain more than 25 mg/100 grams, so a 25 gram (i.e. a healthy) portion contains only 6 mg of tyramine and that is not a problem, even in tyramine-sensitive individuals.

Monitor blood pressure while on MAOIs: buy a $50 BP monitor.

Even if excessive tyramine is ingested and BP increase occurs, serious consequences are unlikely providing appropriate action is taken. That will usually mean nothing more than monitoring blood pressure for a 2-3 hours. Hasty treatment of high BP by inexperienced doctors risks doing more harm than good. it should only be undertaken in hospital (1, 3). There is a PDF on my website explaining blood pressure monitoring and MAOIs.

There are two reasons for BP monitoring:

1) variation in the population: some people will get more marked reactions of BP elevation with relatively smaller doses of tyramine. It will tell you if you are tyramine sensitive and alert you to the need to be extra careful about diet

2) BP drop on standing is the best measure of the effectiveness of a given dose and essential to optimal speed of adjustment to the final effective dose.

Introduction

These drugs are called Mono-Amine Oxidase Inhibitors (MAOIs). This covers diet (both food and drink) and drug interactions, for doctors and especially those taking MAOIs.

Keep some means of identifying the fact that people are on MAOIs, like with insulin/epilepsy.

Advice on MAOIs should ideally come from specialist psycho-pharmacologists, most general psychiatrist have insufficient knowledge to manage MAOIs optimally.

I have published various papers on the pharmacology of MAOIs and their interactions, see: (1, 4-11).

Tyramine

Tyramine formation in foods requires the presence of micro-organisms with amino acid decarboxylase enzyme activity. Modern food production techniques have mostly eliminated such bacteria from the food supply.
chain. Tyramine increase has a lot to do with ‘freshness’ (i.e. time and storage conditions).

**Symptoms of Blood Pressure Reactions?**
A reaction is an increase of BP over 30 - 60 minutes and usually shows first as a forceful thumping heartbeat. Pulse usually becomes slower (12). If blood pressure goes up to 180 mm Hg or more severe headache is usual. Tightness in the chest, paleness (pallor) may occur. Symptoms may last for about two hours.

**Tyramine in Foods and Beverages**
Few foods, except cheese, have high tyramine and any BP reaction is proportional to the amount that is consumed: it is a dose-related effect.

**Cheeses**
Most cheeses now have quite low tyramine levels (< 100 mg/kg), (13-18). Almost all commercial lower priced “processed” and “supermarket” cheeses are low in tyramine (always <200 mg/kg, usually in the range of 0 – 50 mg/kg) because budget prices do not pay for long warehouse ageing (i.e. more than 3 months).

**Brie and Camembert styles**
Normally these are only matured for 4 weeks before release, so low tyramine levels are expected. Mayer et al looked at examples from Austria, Holland and France and found maximum tyramine levels of 85 mg/kg with undetectable levels in some examples (14).

**Matured Cheeses**
Parmigiano Reggiano, aged 30 months, 20 – 150 mg/kg (16).
Cheddar (19) < 50 mg/kg, at 36 weeks maturation all samples < 160 mg/kg.
Gouda 100 – 250 mg/kg (14).
Gruyere < 100 mg/kg (16).
Emmental (14) tyramine 0 - 68 mg/kg.

**Non-Matured Cheeses, Yogurt**
Unripened cheese styles: no tyramine, e.g. curd styles, fromage frais, mascarpone, cream, ricotta, mozzarella, cottage cheeses, bocconcini.
Mozzarella, Ricotta. Multiple samples, tyramine, 0 mg/kg (16). Milk and yoghurt: no tyramine.

**Marmite, Bovril, Promite, Vegemite etc.**
It is likely that changes in the way these products are prepared in recent years have lowered the tyramine content; level ~ 320 mg/kg of tyramine (20). A teaspoon of “Marmite” would have at most 5/1000 x 300 mg of tyramine, i.e. only a couple of milligrams.

**Soy sauce**
Most supermarket Soy sauces actually have only around 100 mg/L.
Yongmeia (21), 40 samples of Chinese soy, mostly less than 200 mg litre (20 of the 40 were < 100 mg/kg). Normal quantities (10 – 20 mls) are safe.
**Meat and Fish Products**

Fresh and frozen meat and meat products are safe. Fresh liver has no tyramine (22). Similarly, liver pate (and similar meat or fish pastes) are safe if freshly made and properly refrigerated.

**Meats, Preserved**

Dry cured products: Parma ham, prosciutto etc are safe. Papavergou (23) max 15 mg/kg.

**Fermented sausages**

Improved starter cultures result in much diminished tyramine content (24-27).

Most salami types are < 100 mg/kg.

**Pizza**

It depends what you put on it. It is clear from the data (see full monograph) that commercial pizzas are likely to be safe (mozzarella has no tyramine), as found by Shulman (28). Gourmet pizzas may contain mature salami and cheese with higher tyramine concentrations, but the quantities are likely to be small so the total tyramine load is unlikely to be problematic.

**Wine and Beer**

Wine is safe. Modern hygienic production methods have made excessive tyramine concentrations rare (in both wine and beer). A little caution is warranted with 'boutique' and open fermented beers, rare examples can be high.

**MAOIs: Interactions with Other Drugs**

Deaths from tyramine/MAOI induced hypertension are extremely rare, probably rarer than serious reactions to many modern drugs, or bleeding secondary to SSRIs (NB mortality from Upper GI bleeds is still > 5% (29) and the evidence that SSRIs cause bleeds is pretty strong (30, 31).

The potentially risky interactions with MAOIs are:

1. Serotonin syndrome, caused by (S)SRIs + MAOIs
2. Blood pressure elevation, caused by tyramine in food, or by the other ‘indirectly acting sympatho-mimetic amines (ISAs)’ (releasers) like pseudoephedrine and phenylephrine.

**Anti-Depressant Drugs**

MAOI interactions are clearly understood and are straightforward to avoid. Any drug that works as a serotonin reuptake inhibitor (SRI) is potentially dangerous (possibly fatal) if combined with an MAOI (5, 32) including: sertraline, fluoxetine, paroxetine, fluvoxamine, citalopram, escitalopram, clomipramine or imipramine, or SNRIs like milnacipran, venlafaxine, desvenlafaxine, duloxetine or sibutramine.

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NB It is usually stated that all TCAs pose a risk, but that is definitely not correct, it is **only clomipramine and imipramine**.

On ceasing other antidepressants to start MAOIs, washout intervals varying between one and five weeks may be required. No washout is required for TCAs (other than clomipramine and imipramine), or mirtazapine, mianserin, trazodone or reboxetine, because they are safe taken together with MAOIs.

**Risky Analgesics**

The risk is that of serotonin toxicity (ST) or 'serotonin syndrome' (because some act as SRIs), explained in detail in my review (11), pethidine (aka meperidine) and tramadol, especially, are a significant risk for anyone on MAOIs. Dextromethorphan, (dextro)propoxyphene and pentazocine are also best avoided.

Safe: codeine, oxycodone, buprenorphine, fentanyl and morphine.

**Ceasing Treatment**

This advice on diet and possible interacting drugs should be followed for a minimum of two weeks (six weeks in some situations) after ceasing MAOIs (between one and three days in the case of moclobemide).

**References**


