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The Role of Monoamine Oxidase Inhibitors in Current Psychiatric Practice

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Abstract

The use of monoamine oxidase inhibitors (MAOIs) by psychiatrists has declined over the past several decades with the expansion of psychiatrists' pharmacologic armamentarium. This trend has also been driven by concern about food and drug interactions and side effects, as well as waning physician experience with these medications. Many psychiatrists, in fact, never prescribe MAOIs. Recent research has liberalized the MAOI diet and identified symptom presentations more likely to respond to these medications. Thus, clinicians must continue to familiarize themselves with the properties of and indications for prescribing MAOIs.

Keywords

psychopharmacology; drug response; monoamine oxidase inhibitors (MAOIs); phenelzine; isocarboxazid; tranylcypromine; moclobemide; selegiline; dosage; physician prescribing practices; major depression; bipolar depression; atypical depression; treatment-refractory depression

CURRENTLY AVAILABLE MONOAMINE OXIDASE INHIBITORS

The nonselective monoamine oxidase inhibitors (MAOIs) currently available in the United States include phenelzine (Nardil), isocarboxazid (Marplan), and tranylcypromine (Parnate). These medications are irreversible inhibitors of the enzyme monoamine oxidase (MAO).

Selegiline is a selective inhibitor of type B MAO (MAO_B) and is currently approved by the United States Food and Drug Administration for parkinsonism. Current studies using selegiline for depression are discussed at the end of this article in the section on "Future Directions."

Moclobemide is a reversible inhibitor of type A MAO (MAO_A) and is consequently believed to require fewer dietary restrictions. Reversible inhibitors of MAO have been well studied in the treatment of depression, but are not currently available in the United States. Moclobemide is available in Australia, Europe, and Canada.¹

CURRENT PRESCRIBING PRACTICES OF PHYSICIANS IN THE UNITED STATES

With the continuing increase in the number of available antidepressants, the use of MAOIs relative to other antidepressant medications has declined.^{2–6} Early reports of potentially fatal

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interactions tempered enthusiasm for MAOIs.⁷ Further decline in use was influenced by the 1965 release of the Medical Research Council trial, which demonstrated no difference from placebo in patients suitable for ECT.^{1,8} The Medical Research Council trial studied inpatients with severe endogenous depression, used a dose of phenelzine of 60 mg/day, and evaluated patients receiving treatment at 4 weeks.^{8,9} The trial has been criticized by some for using insufficient doses in high acuity patients.⁷

A 1999 survey of the Michigan Psychiatric Association found that 12% of practicing psychiatrists never prescribed an MAOI, while another 27% had not prescribed an MAOI in the prior 3 years. Only 2% of respondents reported frequent use of MAOIs compared with reports of approximately 25% a decade earlier.^{10,11} The most common reasons for not prescribing an MAOI included drug interactions, side effects, preference for other treatments, and dietary restrictions.^{3,10,12,13} Despite the availability of alternative antidepressants, some psychiatrists specializing in affective disorders maintain that MAOIs are underutilized.¹⁴ In fact, reports of efficacy in the management of treatment-resistant and bipolar depression, along with low rates of induction of mania, have led to increased use of these agents at some centers.^{3,15–18}

When they are prescribed, MAOIs are often given at inadequate doses.^{7,19–22} Like most other antidepressants, the dose should be titrated upward for therapeutic response. The commonly cited maximum daily dose of isocarboxazid and tranylcypromine is 60 mg/day (six 10 mg tablets). The reported maximum daily dose of phenelzine is 90 mg/day (six 15 mg tablets). Generally, doses of 40–60 mg/day of isocarboxazid and tranylcypromine and 60–90 mg/day of phenelzine are most effective, when tolerated.^{7,17} Table 1 summarizes desirable target doses of the MAOIs that are available in the United States and approved for the treatment of depression.^{4,23–25}

GENERAL THEORY AND MECHANISM

The antidepressant effects of MAO inhibition were discovered serendipitously when patients with tuberculosis were treated with iproniazid.^{26,27} Following this discovery, scientists began to hypothesize that a deficiency in catecholamines, specifically norepinephrine and dopamine, and possibly the indolamine serotonin, may result in depression.²⁸ This hypothesis was substantiated by correlations between MAOI inhibition and mood improvement in depressed patients.²⁹ While this is surely an overly simplistic hypothesis, the monoamine hypothesis is supported by depletion studies of neurotransmitter precursors such as tryptophan and by the known mechanisms of antidepressant medications.^{30–32}

MAOs represent a family of enzymes that metabolize and subsequently inactivate monoamine and indolamine neurotransmitters, including dopamine, epinephrine, norepinephrine, serotonin, and tyramine.^{21,33} MAO is present in the nervous system, liver, gastrointestinal tract, mitochondrial membranes, and platelets, and it consists of two subtypes, MAO_A and MAO_B. Inhibition of MAO_A, which most specifically catabolizes serotonin, norepinephrine, and tyramine, is thought to be most directly linked with the antidepressant activity of MAOIs.²¹ The mechanism of action of antidepressants such as the MAOIs was once thought to be the direct result of increased neurotransmitter amines at nerve terminals. However, such increases occur within days of initiation of treatment, while the treatment effects are not seen for weeks. More recent hypotheses have focused on receptor-mediated pre-synaptic and postsynaptic events.^{7,34}

The MAOIs phenelzine, isocarboxazid, and tranylcypromine irreversibly inhibit the activity of MAO. This subsequently increases the neural concentration of amine neurotransmitters such as serotonin, norepinephrine, and dopamine. Because the enzyme is irreversibly inhibited, the

body must regenerate MAO to resume previous levels of enzymatic activity. This process of regeneration can take weeks, so that the effects of the MAOI can persist long after the drug has been cleared from the body. Thus, plasma levels of MAOIs are not necessarily correlated with the degree of MAO inhibition.³⁵ It has been suggested that platelet MAO enzyme inhibition may be measured as a surrogate for central nervous system MAO inhibition, with at least 85% (80%–90%) platelet inhibition believed to be required for antidepressant efficacy.^{9,36–38}

SAFETY AND TOLERABILITY

Side-Effect Profile

The most common early side effects of MAOIs include orthostatic hypotension, dizziness, drowsiness, insomnia, and nausea.^{39–43} Orthostatic hypotension can typically be managed with slow titration of the drug, divided dosing, or increased fluid intake. Insomnia associated with the MAOI must be differentiated from that resulting from the depression itself. Adjustments in time of dosing often prove beneficial in relieving insomnia. Patients may be more likely to experience sedation with phenelzine than with the other MAOIs, and the dosing schedule may need to be adjusted accordingly.

Late side effects of weight gain, edema, muscle pains, myoclonus, paresthesias, and sexual dysfunction have also been reported with MAOIs.^{42,44} Although generally found with all MAOIs, weight gain may be worse with phenelzine.⁴⁵ Paresthesias are thought to be the result of pyridoxine deficiency and are amenable to pyridoxine supplementation.⁴² In addition, hepatotoxicity is rarely observed with MAOIs.^{33,46,47}

There have been several reports of transient increases in blood pressure shortly (30 minutes to 2 hours) after ingestion of MAOIs.^{48,49} These reactions may vary from transient, asymptomatic increases in blood pressure to frank hypertensive crisis.⁵⁰ These reactions do not appear to be related to dietary or drug interactions and have been documented in both inpatient and outpatient settings. Such reactions can be clinically significant, resulting in up to a doubling of average blood pressure.⁴⁸ These transient elevations in blood pressure appear to be rare events; typically they are self-limited and without serious consequences.⁵⁰

Cases of serotonin syndrome, which are discussed in more detail in the following section on drug interactions, have been reported on MAOI monotherapy.⁵¹ However, serotonin syndrome has been more frequently reported as a result of interactions with serotonergic agents.^{51–53} Overdoses of MAOIs may result in severe CNS excitation and increased sympathetic outflow, which can be manifested by neuromuscular irritability, hyperthermia, hypertension or hypotension, and arrhythmias. Overdose is potentially fatal and requires close observation and supportive care.⁵⁴

Drug Interactions

Despite decades of use, the pharmacokinetic interactions of MAOIs are still not well understood.^{35,55} It is known that phenothiazine antipsychotics, such as fluphenazine, may increase concentrations of tranylcypromine. Tranylcypromine is also an inhibitor of CYP2C19, which metabolizes proton pump inhibitors such as omeprazole.^{55,56} Cimetidine has been shown to diminish the clearance of moclobemide and it is therefore recommended that doses of moclobemide be cut in half when using this combination.⁵⁵

The irreversible MAOIs are rapidly absorbed and generally quickly eliminated, with plasma elimination half-lives of 1.5–4 hours.^{35,43} However, because of their irreversible inhibition of MAO, the physiological effects of phenelzine, isocarboxazid, and tranylcypromine persist for up to 2–3 weeks.¹³ Thus, their pharmacodynamic half-life is greater than the

pharmacokinetic half-life alone would suggest. A 14-day washout period before beginning another antidepressant is therefore recommended to prevent potentially serious pharmacodynamic interactions.^{55,57} While it is generally safe to begin a different antidepressant after a 14-day washout, patients should be monitored closely after the washout period since there have been case reports of interactions, including serotonin syndrome, following 14-day washout periods.⁵⁸ Similar caution should be exercised when switching from one MAOI to another, although more rapid switches (1–8 days) have been safely performed.^{57,59} A washout period of five half-lives for an antidepressant and its active metabolites should be provided before initiating an MAOI.⁵⁷ This would require approximately a 4–5 week washout period for fluoxetine.

Combining serotonergic antidepressants and other serotonergic medications with MAOIs involves the risk of serotonin syndrome. The syndrome typically presents as mental status changes, restlessness, myoclonus, hyperreflexia, diaphoresis, and/or evidence of autonomic overactivity.^{52,60,61} These symptoms can be generally divided into three categories: mental status changes, motor symptoms, and autonomic instability.⁶⁰ This potentially fatal syndrome is thought to represent a toxic state and is treated with supportive care such as intravenous hydration and removal of the offending agent or agents.⁵²

Because of the risk of serotonin syndrome, serotonergic antidepressants and other serotonergic medications should be avoided in patients taking MAOIs. Narcotic medications at anesthetic doses and meperidine at any dose may exert serotonergic effects and could potentially result in the serotonin syndrome when combined with MAOIs. Volatile anesthetics are preferred for elective surgery in patients on MAOIs. However, certain surgeries, such as those involving cardiopulmonary bypass, may demand narcotic adjunct and thus entail increased risk.⁶² Patients on MAOIs should be specifically instructed to inform all clinicians that they are taking an MAOI and to advertise this fact in some way (e.g., through use of a medic alert bracelet) should emergent surgery be required when they are unable to verbally communicate their MAOI status. Interactions have been reported when combining pharmacologic doses (1–6 gm) of L-tryptophan with tranylcypromine.^{52,63} There is no evidence, however, that dietary tryptophan is unsafe. The common over-the-counter medication dextromethorphan has also been associated with the serotonin syndrome in patients taking MAOIs.⁵² Pseudoephedrine, an over-the-counter decongestant and sympathomimetic amine, has been associated with hypertensive crises in patients on MAOIs.⁶⁴ Other sympathomimetic and stimulant drugs are also contraindicated including ephedrine, phenylephedrine, amphetamines, and cocaine.³³ The antibiotic linezolid has been shown to display some monoamine inhibition, although, to date, there have been no reports of serotonin syndrome or other interactions with this medication.⁶⁵

The MAOI Diet

Many of the traditional MAOI diets, which remain standard at numerous hospitals, are unnecessarily restrictive.⁶⁶ Reports of food interactions with MAOIs published in the early 1960s led to the development of stringent dietary restrictions.^{67,68} Consumption of numerous foods, principally cheese, by patients on MAOIs was associated with potentially fatal hypertensive crises. The clinical syndrome associated with the hypertensive crisis has been described as a sudden onset of a severe, pulsating headache, palpitations, diaphoresis, stiff neck, and nausea.⁶⁸ The crisis may culminate in stroke.⁶⁸ These potentially fatal hypertensive crises on MAOIs were eventually linked to a specific interaction with tyramine.

However, many of the foods once thought to be dangerous for patients on MAOIs are now considered to be safe. Although the cautious clinician's initial temptation may be to choose the more conservative diet, an excessively stringent diet may actually be detrimental, since clinicians and patients may be deterred from considering a potentially effective treatment. In

addition, patients may become dangerously lax with their diet after accidentally discovering that certain diet items are actually not harmful.^{69,70}

Numerous studies, most notably those conducted by Shulman's group at the University of Toronto, have attempted to quantify the tyramine content of food.^{69,71–74} A tyramine content of less than 6 mg per serving is generally considered safe.^{69,72,75} Gardner et al. have identified the following foods as “absolutely restricted:” aged cheeses and meats, banana peels, broad bean (such as fava) pods, spoiled meats, Marmite, sauerkraut, soybean products such as soy sauce, and tap beer.⁶⁹ Tap beers may contain variable levels of tyramine, which can become dangerously high; thus tap beer should be universally avoided by patients taking MAOIs.^{69,73} Wines and bottled/canned beer should be used in moderation, not to exceed two drinks/day.⁶⁹

Foods considered to have been unnecessarily restricted include “avocados; bananas; beef/chicken bouillon; chocolate; fresh and mild cheeses, e.g., ricotta, cottage, cream cheese, processed slices; fresh meat, poultry, or fish; gravy (fresh); monosodium glutamate; peanuts; properly stored pickled or smoked fish, e.g., herring; raspberries...yeast extracts (except Marmite).”⁶⁹ Parmesan cheese is estimated to have a safe tyramine content of 0.2 mg/serving.⁷⁶ Although technically an aged cheese, mozzarella has relatively low levels of tyramine.^{72,76} Pizzas with other aged cheeses should be avoided. Several pizzas from large chain outlets (e.g., Pizza Hut, Domino's) have been analyzed and deemed “safe for consumption” by patients taking MAOIs.⁷²

Previous MAOI diets were overinclusive due to a healthy concern for patient safety. Many of the earlier restrictions had been based on unsubstantiated case reports and limited scientific understanding of the mechanism underlying the interaction.⁷⁷ With the development of evidence-based dietary restrictions, the MAOI diet has become less burdensome. Table 2 details the most recent revision of the MAOI diet at Sunnybrook & Women's College Health Sciences Centre, a University of Toronto affiliate that has been at the forefront of such research. This revised diet should serve to improve patient compliance and quality of life. However, dietary compliance should continue to be routinely assessed with patients, since they may tend to follow the diet less carefully over time.^{78,79} Clinicians should conduct an ongoing diet survey and provide targeted dietary recommendations for patients taking MAOIs.⁷⁹

ROLE OF MAOIs IN THE CLINICIAN'S ARMAMENTARIUM

Atypical Depression

There have been several proposals to subtype clinical depression. Of the more recent proposals, the concept of atypical depression has been somewhat enduring in the literature and is currently included in the *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition, Text Revision* (DSM-IV-TR).⁸⁰ The term atypical depression has evolved from depressions resembling “anxiety hysteria” to its current DSM-IV-TR definition.²⁷ The DSM-IV-TR operationally defines atypical features as consisting of mood reactivity and two of the following: weight gain or increased appetite, hypersomnia, leaden paralysis, and an enduring pattern of sensitivity to perceived interpersonal rejection.^{80,81} This definition was largely modeled after the Columbia Criteria developed based on years of research by a group at Columbia University that included Liebowitz, Quitkin, and others.^{82,83}

There is controversy as to whether or not such a subtype suggests a different pathophysiology and thus represents a valid clinical entity.^{84,85} The atypical depression subtype has been criticized for characterizing any symptoms that are not classic, “typical” symptoms of a melancholic or endogenous depression as a distinct subtype. Atypical depression therefore becomes a disjunctive category. For instance, premorbid personality characteristics or

“atypical” presenting symptoms may lead to a diagnosis of atypical depression. Additional criticism comes from the lack of internal consistency among the defining criteria for this subtype.⁸⁴ Observations of individuals who progress from typical to atypical features within a single depressive episode or from one episode to another also challenge the validity of this subtype as a distinct illness.

Regardless of whether depression with atypical features represents a distinct and valid subtype, a number of studies suggest that certain symptom presentations may be more likely to respond to MAOIs.⁸² These studies have examined a number of patient features suggesting atypical presentation, including a histrionic need for attention, interpersonal sensitivity, vulnerability to rejection, early onset of chronic dysphoria, association with panic attacks, association with anxiety, increased appetite, weight gain, hypersomnia or initial insomnia, and increased libido.^{81,83,86–94} In other trials, patients with atypical or nonendogenous features did not show a preferential response to an MAOI over a tricyclic antidepressant (TCA), although in a study by Paykel et al. those with additional anxiety did show a better response to the MAOI.⁹⁵ In a 4-week study comparing patients with nonendogenous depression who received tranylcypromine (27 patients, dose of 30–60 mg/day), nortriptyline (34 patients, dose of 75–150 mg/day), or placebo (37 patients), White et al. did not demonstrate significant differences between the MAOI and TCA.⁹⁶ While many studies of depressed patients with atypical features have demonstrated greater response to MAOIs than TCAs, evidence that MAOIs are superior to selective serotonin reuptake inhibitors (SSRIs) in this population is lacking.^{82,97}

It has also been suggested that the preferential response to MAOIs seen in depressed patients with anxiety or panic symptoms may simply be a reflection of the demonstrated efficacy of MAOIs in patients with anxiety and panic.⁸⁴ In any case, MAOIs should remain at least a second or third-line treatment option in depressed patients with anxiety or panic as well as in patients who present with atypical features.

Bipolar Depression

MAOIs have not been as extensively studied in bipolar depression as in unipolar depression with or without atypical features. This likely reflects a general tendency of investigators to exclude patients with bipolar depression from clinical trials.⁹⁸ However, there is some evidence from controlled trials that MAOIs may be more effective than TCAs in the treatment of anergic bipolar depression, which has been defined as fatigue, psychomotor retardation, and at least one reversed neurovegetative symptom in patients with bipolar disorder meeting criteria for a major depressive episode.^{16,99} Furthermore, there is some suggestion from chart reviews that MAOIs may induce milder manic states than other antidepressants.¹⁰⁰ Based on this limited experience, some clinicians have become more likely to prescribe MAOIs for patients with bipolar depression.¹⁵

Treatment-Refractory Depression

Many psychiatrists are reluctant to prescribe MAOIs for treatment-refractory depression because of concern about having to use a washout period or an unfounded perception that MAOIs possess weaker antidepressant properties than newer agents.^{4,14} MAOIs certainly have demonstrated efficacy in the routine treatment of depression.^{17,39,40,86,96,101–104} Their efficacy and safety has also been demonstrated in elderly populations, although more study in this population is needed.^{61,105}

While comparative studies of treatment options for treatment-refractory depression are limited, switching to an MAOI remains an evidence-based and often overlooked option.^{14,17,19} A number of studies have demonstrated the effectiveness of MAOIs in treatment-refractory, particularly tricyclic-refractory, depression.^{17,90,99,106–109}

Concern about the need to use a washout period is certainly reasonable, and this requirement can be especially burdensome when switching from a serotonergic medication with a long half-life such as fluoxetine. In other situations, however, a washout period can have certain clinical advantages. Clinicians can use this period as an opportunity to “clear the slate,” particularly for patients who are on complex psychopharmacologic regimens. In certain situations, a washout period may not even be warranted. With appropriate precautions, MAOIs have safely been initiated in patients who have discontinued TCAs less than 4 days earlier.^{57,110}

With the expansion of the antidepressant repertoire available to clinicians, MAOIs have understandably become a less popular choice for patients who fail a full trial of an antidepressant medication. However, while newer agents undoubtedly have more attractive risk profiles, MAOIs should not be ruled out as a therapeutic option and should continue to play a role in the management of patients with treatment-refractory depression.^{2,12,21} Patients with treatment-refractory depression require long-term antidepressant treatment, and, although there are limited long-term studies, MAOIs do appear to have long-term efficacy.¹

FUTURE DIRECTIONS

Newer reversible and selective inhibitors of MAO have been developed and purport to improve the safety and acceptability of MAOIs.⁴⁷ As previously mentioned, these agents are not yet available in the United States. Reversible inhibitors of MAO (RIMAs) such as moclobemide require fewer dietary restriction. Nonetheless, the level of dietary restriction required with RIMAs remains a question and a prudent level of caution is advised.³³ RIMAs have also been safely and effectively combined with SSRIs, suggesting that they have a lower potential for drug interactions than traditional MAOIs.¹¹¹ A meta-analysis of RIMA studies suggests that they may be slightly less effective than the traditional MAOIs phenelzine and tranylcypromine.¹¹² Furthermore, they have not yet been demonstrated to be more effective than other types of antidepressants for atypical depression.¹¹²

A transdermal selegiline system is under study. This method of drug delivery limits enterohepatic MAO inhibition, presumably eliminating the need for dietary tyramine restriction.^{113,114} Because the transdermal delivery system essentially bypasses the MAO_A rich intestinal mucosa, intestinal MAO is not significantly inhibited, so that orally ingested tyramines can be metabolized.⁴⁷ The selegiline transdermal system also does not appear to interact with over-the-counter decongestants.⁴⁷ Furthermore, the overall side-effect profile is believed to be more favorable than that of traditional MAOIs.¹¹⁴ The clinical effect demonstrated in these studies remains modest, although the potential for targeted MAO inhibition is encouraging.

High-dose selegiline (60 mg/day) has been shown to be safe and effective in a small group of elderly patients with treatment-resistant depression (i.e., who have failed to respond to at least two trials of antidepressants).¹¹⁵ At this dose, selegiline may not be as MAO_B selective, although it does appear to have a better side-effect profile than nonselective MAOIs. Previous studies of high-dose selegiline have also had promising results.^{116,117} Subjects in these high-dose selegiline trials were maintained on low tyramine or strict MAOI diets.^{115–117}

Case reports and studies have also described the use of MAOIs in combination with other antidepressants, including bupropion with tranylcypromine, RIMAs with SSRIs, and irreversible MAOIs with TCAs.^{118–120} The current safety data concerning such combinations are limited and clinicians must exercise appropriate caution.

CONCLUSIONS

Over the decades since their introduction, MAOIs have lost favor among clinicians. This was initially driven by concerns over side effects, effectiveness, and drug and diet interactions. More recently, the increasing number of available antidepressants has limited the use of MAOIs. In fact, MAOIs are so seldom used that many clinicians have little or no experience with them and are thus unlikely to use them even when indicated. Nevertheless, research suggests that MAOIs may be particularly effective in the treatment of depressions with atypical features such as those with anxious or nonendogenous presentations. MAOIs have also been well established as an effective option for patients with treatment-resistant depression.

While the risk of serotonin syndrome due to drug interactions remains a serious concern, dietary restrictions should be less of a concern than previously believed. More detailed study of the tyramine content of foods and an enhanced understanding of the mechanism of food interactions have lessened the burden of dietary restriction. Unfortunately, many currently used formulations of the MAOI diet have not yet been updated.

Given the lack of a rational method for choosing antidepressants, it is important to maximize treatment options available for patients with depression, particularly treatment-refractory depression. The MAOIs, a distinct class of antidepressant medications with a distinct mechanism of action, represent a treatment option that is often overlooked and arguably underutilized. In addition, when they are used, MAOIs are often prescribed at insufficient doses. MAOIs should be considered for patients with atypical depression, bipolar depression, and treatment-refractory depression. Psychiatrists must familiarize themselves with this important class of anti-depressants, because MAOIs should and likely will continue to play a part in the management of depression in select patients.

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Table 1

MAOIs currently available in the United States

Generic name	Trade name	Tablet strength	Target dosing range
Isocarboxazid	Marplan	10 mg	40–60 mg/day (4–6 tabs)
Phenelzine	Nardil	15 mg	60–90 mg/day (4–6 tabs)
Tranylcypromine	Parnate	10 mg	40–60 mg/day (4–6 tabs)

Table 2

MAOI diet

Food type	Foods to be avoided	Foods allowed
Cheese	All matured or aged cheese	Fresh cottage cheese, cream cheese, ricotta cheese, and processed cheese slices
	Casseroles made with these cheeses (e.g., lasagna). (Cheese should be considered aged unless known safe)	Fresh milk products. (e.g., sour cream, yogurt, ice cream)
Meat	Fermented/dry sausage (e.g., pepperoni, salami, mortadella, summer sausage)	All fresh packaged or processed meat such as hot dogs, fish, or poultry: store in refrigerator immediately and eat as soon as possible.
	Improperly stored meat, fish, or poultry	
	Improperly stored pickled herring	
Fruits & vegetables	Fava or broad bean pods (not beans)	Banana pulp
	Banana peels	All other fruits and vegetables
Beverages	All tap (draft) beer	Alcohol: no more than two bottled or canned beers or two 4-ounce glasses of wine per day
Miscellaneous	Marmite concentrated yeast extract	Other yeast extract (e.g., Brewer's yeast)
	Sauerkraut	Pizzas without aged cheeses
	Soy sauce or other soy bean condiments	Soy milk, tofu

Adapted from the Sunnybrook & Women's College Health Sciences Centre MAOI Diet, courtesy of Dr. Kenneth I. Shulman and Dr. Thomas W. Paton.