Drug interactions with complementary medicines

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Health professionals are expected to be familiar with common and clinically significant complementary medicine interactions or at least know where to look them up. Knowing the dynamic and kinetic interactions associated with commonly used complementary medicines helps to identify the risk of drug interactions. Although information on complementary medicine interactions is not readily provided by the manufacturers, evidence is available by way of case reports, independent research and web-based resources, which have increased in recent years. Collectively, these data make interactions with complementary medicines largely predictable and therefore preventable.

Key words: drug interactions, St John’s wort.

As with other drugs, complementary medicine interactions can be broadly classified by their mechanism, that is, pharmacodynamic and pharmacokinetic. The former are due to overlap of pharmacological actions, while the latter result from changes in absorption, distribution, metabolism or excretion. Risk factors for significant complementary medicine interactions are the same as for conventional medicines. These include patient characteristics (such as extremes of age, frailty, female gender, cognition, comorbidities and genetic disposition) and medication factors (such as high medication burden, recent changes in medicines, drugs with a low therapeutic index and limited elimination pathways).

Due to their complex chemical structure, herbal medicines are prone to interactions via the oxidative cytochrome P450 system or the efflux drug transporter P-glycoprotein. In vitro assays, using human tissue or cell lines, are frequently used to determine whether a herb affects these enzymes. However, in vitro findings do not necessarily correlate with what happens in the human body. As several herbal medicines and many prescription drugs are substrates, inducers or inhibitors of CYP isoenzymes or P-glycoprotein, interactions can ensue when they

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**Summary**

Health professionals are expected to be familiar with common and clinically significant complementary medicine interactions or at least know where to look them up. Knowing the dynamic and kinetic interactions associated with commonly used complementary medicines helps to identify the risk of drug interactions. Although information on complementary medicine interactions is not readily provided by the manufacturers, evidence is available by way of case reports, independent research and web-based resources, which have increased in recent years. Collectively, these data make interactions with complementary medicines largely predictable and therefore preventable.

**Key words:** drug interactions, St John’s wort.

**Introduction**

The Therapeutic Goods Administration refers to complementary medicines as ‘medicinal products containing herbs, vitamins, minerals, nutritional supplements, homoeopathic medicines, traditional medicines and certain aromatherapy products’. In Australia, complementary medicines are largely regulated as unscheduled medicines, and are usually self-selected.

Complementary medicines are very popular among Australians, with surveys indicating that up to 60% of people use at least one complementary medicine on a regular basis. However, about 50% of consumers also report using a conventional medicine on the same day as their complementary medicine. It is not surprising, therefore, that healthcare professionals and consumers alike are concerned about the potential for drug interactions between these medicines.

As so many Australians use complementary medicines, including children, the elderly, patients with chronic disease, mental health disorders and cancer, it is important that prescribers always ask what complementary products their patients are taking in addition to any conventional medicines. Knowing this, and extrapolating reported pharmacodynamic and pharmacokinetic outcomes, can help predict potential drug interactions.
are used concomitantly. A classic example is St John’s wort, which has kinetic interactions with a wide range of drugs via the induction of CYP1A2, CYP3A4, CYP2C9 and P-glycoprotein. This lowers the concentration of the concomitant drug.

Table 1 shows selected documented interactions which have been chosen based on a composite of:

- the most frequently used complementary medicines in Australia, from survey and sales data
- interactions with serious or clinically significant outcomes.

Table 1 categorises interactions by their possible outcome, severity, supporting evidence and proposed mechanism. Generic guidance on interaction management is given in the key, within the definitions of severity (major, moderate, minor). Certain therapeutic drug classes appear repeatedly in the table such as antiplatelet drugs, anticoagulants, antidepressants, antihypertensives, hypoglycaemics, immunosuppressants, antiretrovirals and hormones. Health professionals should monitor patients closely when a complementary medicine is taken concomitantly with these drugs.

### Table 1

**Evidence-based complementary medicine interactions**

This table shows complementary medicines with at least one ‘major’ interaction. For the full version of this table, see this article online at www.australianprescriber.com

<table>
<thead>
<tr>
<th>Complementary medicine</th>
<th>Interacting drug</th>
<th>Possible outcome</th>
<th>Severity and level of evidence</th>
<th>Proposed mechanisms/comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Evening primrose oil</td>
<td>Antiplatelet drugs, warfarin</td>
<td>↑ drug effect</td>
<td>Major, level B</td>
<td>Contains gamma-linolenic acid, probable anticoagulant</td>
</tr>
<tr>
<td>Garlic</td>
<td>Contraceptives, oral</td>
<td>↓ drug effect</td>
<td>Moderate, level D</td>
<td>Induces CYP3A4</td>
</tr>
<tr>
<td></td>
<td>Saquinavir/non-nucleoside reverse transcriptase inhibitors</td>
<td>↓ drug levels and effect</td>
<td>Major, level B</td>
<td>Induces CYP3A4</td>
</tr>
<tr>
<td></td>
<td>Antiplatelet drugs, warfarin</td>
<td>↑ bleeding risk</td>
<td>Moderate, level D</td>
<td>Theoretical antiplatelet activity</td>
</tr>
<tr>
<td>Ginkgo</td>
<td>Anticonvulsants</td>
<td>↑ seizure risk</td>
<td>Moderate, level D</td>
<td>Large amounts of ginkgotoxin can cause neurotoxicity</td>
</tr>
<tr>
<td></td>
<td>Warfarin, antiplatelet drugs</td>
<td>↑ bleeding risk</td>
<td>Major, level D</td>
<td>Antiplatelet activity after several weeks</td>
</tr>
<tr>
<td></td>
<td>CYP2C9 substrates e.g. glipizide, warfarin, celecoxib</td>
<td>↑ substrate levels</td>
<td>Moderate, level D</td>
<td>Inhibits CYP2C9 activity</td>
</tr>
<tr>
<td></td>
<td>CYP1A2, CYP2C19, CYP2D6 and CYP3A4 substrates</td>
<td>↑ substrate levels</td>
<td>Moderate, level B</td>
<td>Potentially inhibits these enzymes</td>
</tr>
<tr>
<td></td>
<td>Hypoglycaemic drugs</td>
<td>↑ ↓ drug effect</td>
<td>Moderate, level B</td>
<td>Variably affects blood glucose concentrations</td>
</tr>
<tr>
<td>Glucosamine</td>
<td>Warfarin</td>
<td>↑ bleeding risk</td>
<td>Major, level D</td>
<td>Several case reports of increased INR</td>
</tr>
<tr>
<td>Hawthorn</td>
<td>Calcium channel blockers, nitrates, phosphodiesterase inhibitors</td>
<td>↑ drug effect</td>
<td>Major, level D</td>
<td>Additive vasodilator effects</td>
</tr>
<tr>
<td></td>
<td>Digoxin, beta blockers</td>
<td>↑ drug effect</td>
<td>Major, level D</td>
<td>Additive effects on heart rate and/or blood pressure. Hawthorn has cardiotonic effects.</td>
</tr>
<tr>
<td>Kava</td>
<td>CNS depressants</td>
<td>↑ drug effect</td>
<td>Major, level A</td>
<td>Additive somnolence</td>
</tr>
<tr>
<td></td>
<td>CYP1A2, CYP2D6, CYP2C9, CYP2E1, CYP3A4 substrates</td>
<td>↑ substrate levels</td>
<td>Moderate, level B</td>
<td>Kava potentially inhibits these enzymes</td>
</tr>
<tr>
<td></td>
<td>P-glycoprotein substrates</td>
<td>↑ substrate levels</td>
<td>Moderate, level D</td>
<td></td>
</tr>
<tr>
<td>St John’s wort</td>
<td>Alprazolam</td>
<td>↓ drug levels and effect</td>
<td>Major, level B</td>
<td>Increased clearance; half-life reduced by 50%</td>
</tr>
<tr>
<td></td>
<td>Amitriptyline</td>
<td>↑ drug effect</td>
<td>Major, level B</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Antidepressants, tramadol</td>
<td>↑ drug effect</td>
<td>Major, level D</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pethidine</td>
<td>↑ drug effect</td>
<td>Major, level D</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Triptans</td>
<td>↑ drug effect</td>
<td>Moderate, level D</td>
<td></td>
</tr>
</tbody>
</table>

Table continued...
**Complementary medicine**
**Interacting drug**
**Possible outcome**
**Severity and level of evidence**
**Proposed mechanisms/comment**

<table>
<thead>
<tr>
<th>Complementary medicine</th>
<th>Interacting drug</th>
<th>Possible outcome</th>
<th>Severity and level of evidence*</th>
<th>Proposed mechanisms/comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clopidogrel</td>
<td>↑ bleeding risk</td>
<td>Moderate, level B</td>
<td>Increased conversion to active metabolite</td>
<td></td>
</tr>
<tr>
<td>CYP1A2, CYP2C9, CYP3A4 substrates e.g. imatinib, indinavir, tacrolimus, carbamazepine, phenytoin</td>
<td>↓ drug levels and effect</td>
<td>CYP3A4 = Major, level B, CYP1A2, CYP2C9 = Moderate, level B</td>
<td>Induces CYP enzymes</td>
<td></td>
</tr>
<tr>
<td>Non-nucleoside reverse transcriptase inhibitors, protease inhibitors</td>
<td>↓ drug levels and effect</td>
<td>Major, level B</td>
<td>Induces CYP3A4</td>
<td></td>
</tr>
<tr>
<td>Oral contraceptives</td>
<td>↓ drug levels</td>
<td>Major, level B</td>
<td>Risk of breakthrough bleeding/contraceptive failure</td>
<td></td>
</tr>
<tr>
<td>P-glycoprotein substrates e.g. digoxin, fexofenadine, irinotecan</td>
<td>↓ drug levels and effect</td>
<td>Major, level B</td>
<td>Induces intestinal P-glycoprotein</td>
<td></td>
</tr>
<tr>
<td>Simvastatin</td>
<td>↓ drug levels</td>
<td>Moderate, level B</td>
<td>Statin levels reduced by up to 28%</td>
<td></td>
</tr>
<tr>
<td>Warfarin</td>
<td>↓ drug effect</td>
<td>Major, level B</td>
<td>Induces CYP1A2, CYP2C9 and CYP3A4</td>
<td></td>
</tr>
<tr>
<td>Valerian</td>
<td>↑ drug levels</td>
<td>Major, level B</td>
<td>CYP3A4 inhibitor. Valerian increased by 19% in one study.</td>
<td></td>
</tr>
<tr>
<td>Alprazolam</td>
<td>↑ drug levels</td>
<td>Major, level B</td>
<td>Pharmacodynamic effect</td>
<td></td>
</tr>
<tr>
<td>CNS depressants</td>
<td>↑ drug effect</td>
<td>Major, level D</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CYP3A4 substrates</td>
<td>↑ substrate effect</td>
<td>Moderate, level D</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*C Interaction rating adapted from Natural Medicines Comprehensive Database. The level of severity (major, moderate, minor) has been calculated using the evidence and probability of harm. This rating is linked with a generic recommendation for management.

**Major**
- Strongly discourage patients from using this combination as a serious adverse outcome could occur. If used, patient should be monitored closely for potential adverse outcomes.

**Moderate**
- Use cautiously or avoid combination as a significant adverse outcome could occur. If used, monitor for potential adverse outcomes.

**Minor**
- Be aware that there is a chance of an interaction. Advise patients of symptoms that may occur and an action plan to follow.

**Level of evidence ratings:**
- A High-quality randomised controlled trial or meta-analysis
- B Non-randomised clinical trial, literature review, clinical cohort or case-control study, historical control or epidemiologic study
- C Consensus or expert opinion
- D Anecdotal evidence; in vitro or animal study or theoretical based on pharmacology

**Finding information about complementary medicine interactions**

Most complementary medicines are listed (AUST L) medicines, which are not subjected to the same rigorous premarketing safety and efficacy trials as registered (AUST R) medicines. Thus evidence of their interaction potential is often not available. In addition, manufacturers are not obliged to provide a consumer medicine information leaflet with advice or warnings regarding complementary medicine interactions.

Despite the lack of hard data, health professionals still need to make reasonable recommendations to patients about potential interactions. With a view to helping Australians make more informed decisions about using complementary medicines, an independent consortium from Mater Health Services Brisbane, Bond University and University of Queensland, with funding from the National Prescribing Service, evaluated complementary medicines information resources in 2008. Specific criteria were used to identify 52 resources – 26 of these...
were shortlisted and assessed for technical quality, content and clinical utility. The quality of drug interaction information was also assessed in the review, specifically whether mechanisms were outlined, degree of severity was stated, and whether the absence of known drug interactions was disclosed.

While many resources (free or subscription) had technical strengths, few had comprehensive interaction coverage. Those with some detail are included for further reading. Two of the highest ranked resources were online subscription databases, both of which contained reasonably comprehensive complementary medicine–drug interaction checkers. These were:

- Natural Standard (www.naturalstandard.com), which provides detailed monographs and brief summaries (‘bottom line’)
- Natural Medicines Comprehensive Database (www.naturaldatabase.com).

**Conclusion**

Consumers frequently use complementary medicines in combination with conventional medicines. For this reason, health professionals should always consider the potential for pharmacodynamic and pharmacokinetic interactions between them. High quality evidence is increasingly available for identification and prevention of these interactions.

**References**


**Further reading**


**Conflict of interest:** none declared

**Self-test questions**

The following statements are either true or false (answers on page 198)

3. St John’s wort can decrease phenytoin concentrations via its induction of cytochrome P450 3A4.
4. Ginkgo can increase the bleeding risk when given with warfarin.