Interventions for preventing or treating alcohol hangover: systematic review of randomised controlled trials
Max H Pittler, Joris C Verster, Edzard Ernst

Abstract
Objective To assess the clinical evidence on the effectiveness of any medical intervention for preventing or treating alcohol hangover.
Data sources Systematic searches on Medline, Embase, Amed, Cochrane Central, the National Research Register (UK), and ClinicalTrials.gov (USA); hand searches of conference proceedings and bibliographies; contact with experts and manufacturers of commercial preparations. Language of publication was not restricted.
Study selection and data extraction All randomised controlled trials of any medical intervention for preventing or treating alcohol hangover were included. Trials were considered if they were placebo controlled or controlled against a comparator intervention. Titles and abstracts of identified articles were read and hard copies were obtained. The selection of studies, data extraction, and validation were done independently by two reviewers. The Jadad score was used to evaluate methodological quality.
Results Fifteen potentially relevant trials were identified. Seven publications failed to meet all inclusion criteria. Eight randomised controlled trials assessing eight different interventions were reviewed. The agents tested were propranolol, tropisetron, tolfenamic acid, and the dietary supplements Cynara scolymus (artichoke), Opuntia ficus-indica (prickly pear), and a yeast based preparation. All studies were double blind. Significant intergroup differences for overall symptom scores and individual symptoms were reported only for tolfenamic acid, γ linolenic acid from B officinalis, and a yeast based preparation.
Conclusion No compelling evidence exists to suggest that any conventional or complementary intervention is effective for preventing or treating alcohol hangover. The most effective way to avoid the symptoms of alcohol induced hangover is to practise abstinence or moderation.

Introduction
The alcohol hangover has substantial economic and health consequences. In Britain, the associated problems have been estimated to account for about £2 billion in lost wages each year, mostly due to sickness absence. With binge drinking on the rise, these figures are likely to increase. In the United States, the total cost of alcohol use has been estimated at $12-30 billion per year, although other figures criticised for being inflated range as high as $148 billion per year. The rates of medically certified sickness absence seem to be higher in never drinkers, former drinkers, and current heavy drinkers than in current light drinkers. In the workplace, a person with a hangover may experience impaired memory and visual-spatial skills and may be at risk. Other symptoms in varying combinations may include lightheadedness, nausea, and concentration difficulties. The symptoms seem to be due to a combination of ethanol's main metabolic product acetaldehyde, congeners including methanol, endocrine and immune system disturbances, dehydration, and sleep disturbance. Substantially increased risks of all cause mortality can occur even in people drinking less than recommended maximums, particularly among younger adults. An increased risk of strokes has been observed in young adults, particularly on occasions when alcohol intake is higher than average. In addition, during celebrations at Christmas, for instance, alcohol consumption increases and may lead to a rise in fatal alcohol poisonings by 0.4% for every 1% increase in the sales of spirits.

These considerations emphasise the need for safe and effective preventive and therapeutic measures. A plethora of "hangover cures" is on offer. Searching the internet on Google.com (search term: hangover cure, accessed 20 Jan 2005) retrieved in excess of 325,000 hits. The box gives a flavour of what is on offer. The aim of this systematic review was to assess the clinical evidence on the effectiveness of any medical intervention for preventing or treating alcohol hangover.

Methods
Searching
We searched Medline (1951 to January 2005), Embase (1974 to January 2005), Amed (1985 to January 2005), the Cochrane Library (issue 1, 2005), the National Research Register, United Kingdom (www.update-software.com/projects/mrr/—accessed 20 Jan 2005), and ClinicalTrials.gov, United States (clinicaltrials.gov/—accessed 20 Jan 2005). We designed the search strategy to retrieve all articles on the topic (strategy: hangover, alcohol and hangover, hangover adj cure). In addition, we hand searched conference proceedings (FACT - Focus on Alternative and Complementary Therapies 1996-2005) and our own collection of papers and medical journals (Phytotherapy 1994-2005, Alternative and Complementary Therapies 1995-2005, Forschende Komplementärmedizin Klassische Naturheilkunde 1994-2005). We also hand searched the bibliographies of all retrieved articles. We contacted six manufacturers of commercial preparations for alcohol hangover and five experts on the subject and asked them to contribute further studies. We imposed no restrictions on the language of publication.
Interventions for alcohol hangover reported on the internet*

- Aspirin
- Bananas
- Barley grass
- Berocca containing vitamin B complex, vitamin C, calcium
- Blend containing cardamom, aniseed, tangerine peel, citrus peel, ginseng, atractylodes, poria, massa fermenata, dried ginger, polypporus
- Bloody Mary (that is, alcoholic drinks)
- Cabbage
- Calcium carbonate
- Charcoal tablets
- Chaser (that is, alcoholic drinks)
- Coffee
- Cysteine
- Eggs
- Exercise
- Fresh air
- Fruit juice
- Ginseng
- Glutamine
- Green tea
- Hair of the dog (that is, alcoholic drinks)
- Honey
- Hot bath
- Ibuprofen
- Ice pack
- Kidney dialysis
- Milkshake
- Multivitamins
- Paracetamol
- Pizza
- RU 21
- Russia Party
- Shower
- Sleep
- Sob'r-K HangoverStopper
- Succinic acid
- Various recipes containing ingredients such as olive oil, raw egg yolks, tomato, ketchup, Tabasco sauce, Worcester sauce, lemon juice, buttermilk
- Vegemite on toast
- Water

*Results from the first 20 websites retrieved by Google.com with the search term "hangover cure" (accessed 20 Jan 2005).
Discussion

The paucity of randomised controlled trials is in stark contrast to the plethora of “hangover cures” marketed on the internet. This confirms the unreliability of the internet in healthcare matters. Our findings show that no compelling evidence exists to suggest that any conventional or complementary intervention is effective for preventing or treating alcohol hangover. Encouraging findings for their main outcome measures exist for γ linolenic acid from *B. officinalis*, a yeast based combination preparation, and tolfenamic acid. However, only single randomised controlled trials for each of the tested interventions were available, most were of small sample size, and all used unvalidated symptom scores. Independent replications of these studies are therefore necessary. The lack of a sensitive standard outcome measure to assess the physiological and subjective effects of alcohol hangover may be one of the reasons for the small body of evidence. Independent replications of these studies are therefore necessary. The lack of a sensitive standard outcome measure to assess the physiological and subjective effects of alcohol hangover may be one of the reasons for the small body of evidence. The development and initial validation of the hangover symptoms scale will hopefully encourage further systematic research and will aid the integration of trial data.

Future studies should also investigate the biological changes that occur during alcohol hangover. The trial of *O. ficus-indica* reported that the extract had some effects on individual symptoms, which received some media attention. The authors suggested that *O. ficus-indica* exerts its action by acting on prostaglandin synthesis and cytokines that are deregulated during alcohol hangover. This view is supported by the improvement reported for tolfenamic acid, a potent inhibitor of prostaglandin synthesis. However, other data also reported beneficial effects for pyritinol, a nootropin agent that seems to enhance cognitive performance, and Liv.52, an Ayurvedic herbal preparation containing eight extracts with possible effects on prostaglandin synthesis and cytokines that are deregulated during alcohol hangover. These agents seem not to act directly on the prostaglandin system. Future studies should disentangle the mechanism of action responsible for these effects.

Ethical concerns may relate to research in this area. It is conceivable that positive trials might lead to considerable media interest and industry marketing, which ultimately might lead to an increase in alcohol consumption. However, little evidence exists to show that alleviation of hangover symptoms results in increased alcohol consumption. Conversely, no conclusive evidence shows that hangover effectively deters alcohol consumption.

Limitations of our review pertain to the potential incompleteness of the reviewed evidence. We aimed to identify all randomised controlled trials on the topic. The distorting
The alcohol hangover has substantial economic and health consequences
Compliance with moderation to prevent alcohol hangover is poor

What this study adds
Eight randomised controlled trials assessing eight different medical interventions for preventing or treating the symptoms of alcohol hangover were reviewed

No compelling evidence exists to suggest that any conventional or complementary intervention is effective for preventing or treating alcohol hangover

Effects on systematic reviews arising from publication bias and location bias are well documented. For this study we searched databases with a focus on the American and European literature and those that specialise in complementary medicine, and we included hand searches. We imposed no restrictions on language of publication, and the two reviewers independently appraised the clinical evidence. We are therefore confident that our search strategy located the published trials on the subject. However, whether we identified all unpublished trials has to remain uncertain.

Conclusions
Our findings show that no compelling evidence exists to suggest that any complementary or conventional intervention is effective for treating or preventing the alcohol hangover. Future studies should investigate the biological changes that occur during alcohol hangover. Until the pathalogy of alcohol hangover is understood in more detail, an effective intervention is likely to remain elusive. The most effective way to avoid the symptoms of alcohol induced hangover is thus to practise abstinence or moderation.

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**Correspondence to:** M H Pfitzer MHL.Pfitzer@exeter.ac.uk

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