

Kombucha: A Systematic Review of the Clinical Evidence

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Key Words

Kombucha (risk, benefit, contamination, infection)

Summary

Aim: Kombucha has become a popular complementary remedy. The aim of this systematic review was to critically evaluate the evidence related to its efficacy and safety. **Methods:** Computerised literature searches were carried out to locate all human medical investigations of kombucha regardless of study design. Data were extracted and validated by the present author and are reported in narrative form. **Results:** No clinical studies were found relating to the efficacy of this remedy. Several case reports and case series raise doubts about the safety of kombucha. They include suspected liver damage, metabolic acidosis and cutaneous anthrax infections. One fatality is on record. **Conclusions:** On the basis of these data it was concluded that the largely undetermined benefits do not outweigh the documented risks of kombucha. It can therefore not be recommended for therapeutic use.

Schlüsselwörter

Kombucha (Risiko, Nutzen, Kontamination, Infektion)

Zusammenfassung

Ziel: Kombucha ist ein häufig eingesetztes komplementärmedizinisches Mittel. Das Ziel dieses systematischen Reviews ist es, die klinischen Daten zur Wirksamkeit und Sicherheit kritisch zu evaluieren. **Methoden:** Computerisierte Literaturrecherchen wurden durchgeführt, um alle humanmedizinischen Untersuchungen zu diesem Thema zu identifizieren. Es wurden alle derartigen Studien aufgenommen, ungeachtet ihres Designs. Der Autor extrahierte und validierte die dort angegebenen Daten und fasste sie in narrativer Form zusammen. **Ergebnisse:** Es fanden sich keine klinischen Studien zur Wirksamkeit. Einige Fallberichte und Fallserien stellen die Nebenwirkungsfreiheit von Kombucha in Zweifel. Sie beziehen sich auf Verdachtsfälle von Leberschäden, metabolischer Azidose und kutaner Anthrax-Infektion. Ein Todesfall wurde dokumentiert. **Schlussfolgerung:** Auf der Basis dieser Daten wird geschlossen, dass der weitgehend unbekannt Nutzen die dokumentierten Risiken von Kombucha nicht aufwiegt. Kombucha kann somit nicht als Therapeutikum empfohlen werden.

Introduction

Kombucha has been used in China since 220 BC [1]. Later its use spread to Europe, particularly Russia and Germany, and today it is becoming increasingly popular in the UK and US. The name 'Kombucha' is derived from the Japanese words seaweed (Kombu) and tea (cha). Kombucha, sometimes called 'Tea Fungus', Kargasok Tea, Manchurian Mushroom or Haipao, is often marketed as 'Kombucha Mushroom' or 'Fungus Japonicus' but is, in fact, not a fungus. It is a yeast-bacte-

ria-fungal aggregate surrounded by a semipermeable membrane containing a variable range of microorganisms, e.g. *Bacterium xylinum*, *Bacterium gluconicum*, *Acetobacter heterogenum* and *Pichia fermentans* [2].

The 'mushroom' consists of a patty-like substance which is placed in a mixture of tea and sugar to ferment. During this process, the mycelium doubles in size every week and can be divided to make more tea [2]. In this manner it can be propagated for commercial distribution – one unit sells for around US \$50 [3]. The fermented tea is recommended for oral con-

sumption or topical use. It contains sugar, glucuronic acid, acetic acid, hyaluronic acid, chondroitin sulphate, mukoinin sulphate, heparin, lactic acid, usnic acid and alcohol [4, 5]. Kombucha is recommended for a wide range of indications including AIDS, ageing, anorexia, arthritis, atherosclerosis, cancer, constipation, diabetes, elimination of wrinkles, gallbladder diseases, gout, haemorrhoids, hair growth, headache, hypertension, indigestion, increase of vitality, restoration of hair colour [6, 7].

Because many patients use Kombucha, it is necessary, perhaps even mandatory, to ask: does it do more good than harm? This systematic review was aimed at critically evaluating the clinical evidence related to efficacy and safety.

Methods

Systematic literature searches were conducted in the following electronic databases to locate papers with information relating to the efficacy and safety of kombucha tea in humans: Medline Embase, Cinahl, CISCOP, Amed, Napralert and The Cochrane Library (all from their respective inception to December 2001). The search terms were: kombucha, fungus japonicus, tea fungus, Manchurian mushroom, Haipao, and Kargasok tea. Further relevant publications were located by checking the reference lists of all papers, contacting colleagues with interest in alternative medicine and searching departmental files.

All data from post-marketing surveillance studies, clinical trials, case reports, spontaneous reporting schemes and pre-clinical studies were included in the review. Animal experiments [e.g. 8] were excluded. No formal assessment of the validity of evidence was possible. No language restrictions were applied. The various forms of evidence obtained were described in the text but, due to their diverse nature, no statistical analysis was feasible.

Results

Efficacy

No clinical trials or case series testing or suggesting the efficacy of kombucha tea were found.

Toxicity

Adverse effects were reported by 4 patients after taking Kombucha tea [9]. A 53-year-old woman with a history of heavy alcohol consumption developed jaundice two weeks after she began drinking two glasses of Kombucha tea per day. Liver function tests were abnormal and hepatitis serology was negative. Seven weeks after discontinuation of the tea, her liver function tests had normalised. The second patient, a 51-year-old woman concomitantly taking thyroid hormone and oestrogen replacement therapy, complained of xerostomia, dizziness, nausea, vomiting, headache and neck pain. She had consumed half a glass of Kombucha tea per day for several months. The tea was discontinued, she was treated symptomatically, and her symptoms abated. After taking the tea again, her symptoms recurred (positive re-challenge). The only abnormal

finding was a caffeine concentration of 3.8 mg/l. Analysis of the 'mushroom' showed that it contained caffeine. The third patient presented with shaking, shortness of breath and akathisia after consumption of tea and no concomitant medication. The fourth complained of shortness of breath and throat tightness one hour after drinking tea. Both of the latter patients had hypotension, tachycardia and tachypnea. In both cases an allergic reaction was assumed, symptomatic treatment was successful, and the patients could be discharged the same day.

A 53-year-old college professor was seen with abdominal cramping, chest tightness, dry cough and a rash on his thorax [10]. He had taken half a cup of Kombucha tea twice daily for two weeks. Toxic hepatitis was diagnosed after excluding hepatitis A, B or C infections. No cause of the liver damage could be found other than Kombucha. The patient made a full recovery after discontinuation of the tea. This case report lacks most details that are a precondition for critical evaluation.

Two Iowa citizens who had daily consumed Kombucha tea originating from the same 'parent mushroom' for about two months experienced serious adverse effects [11]. The first patient was a 59-year-old woman who was found unconscious in her home. She had metabolic acidosis (blood pH = 6.9) and developed disseminated intravascular coagulopathy. She subsequently suffered cardiac arrest, was resuscitated but died two days after the start of the symptoms. A cardiogenic cause was excluded at autopsy. The second patient, a 48-year-old woman, was admitted to the same hospital only 9 days later. On admission, she was suffering from respiratory distress, pulmonary oedema and metabolic acidosis (blood pH = 6.7). This patient also had cardiac arrest but was successfully resuscitated and made a full recovery. Microbiological analyses of the two Kombucha tea samples revealed no known human pathogens.

A 64-year-old US farmer was seen for dizziness of recent onset [12]. He had consumed one half glass of Kombucha tea three times daily for the past two months, hoping this would alleviate the symptoms of his osteoarthritis. Subsequent examination and tests failed to identify the cause for his dizziness, and Kombucha was suspected as a possible cause. The outcome of this case was not reported. Causality in this instance is speculative.

A report from Iran described 20 patients (12 female, 8 male, aged 8–62 years) who contracted cutaneous anthrax infections through the topical application of Kombucha tea as an analgesic [13]. Cultures from the skin lesions confirmed the presence of *Bacillus anthracis*. All patients made a full recovery after treatment with penicillin. Analyses of the Kombucha material which had been stored in extremely unhygienic conditions failed to confirm the presence of *Bacillus anthracis* due to multiple bacterial contamination and overgrowth. In further tests, it was demonstrated that the Kombucha material provided a good medium for the growth of this bacterium.

Discussion

The main result of this systematic review, it seems, is the total lack of efficacy data. None of the many health claims made for Kombucha is supported by evidence from controlled clinical trials. *Vis-à-vis* the popularity of this remedy, this is a surprising finding. It should stimulate proponents of Kombucha to test these claims in controlled clinical trials. *In vitro* studies have suggested that Kombucha has antibiotic activity, and animal studies have implied that it reduces pain and promotes sleep in animals (possibly due to its alcohol content) [5]. The clinical relevance of such findings is, however, unclear.

Several reports associate Kombucha tea consumption with serious adverse effects. These are isolated reports which cannot form the basis for any generalisations. The evidence is based on case reports and case series none of which were reported in sufficient detail to allow firm conclusions about a cause-effect relationship. There are, for instance, no details on the product quality which is known to be highly variable [1]. The method of preparation of Kombucha does carry the risk of contamination: the Kombucha material is incubated at room temperature in a sugar-containing liquid (e.g. tea) for 7–12 days. It is not surprising that, under such conditions, human pathogens may grow. It would seem to follow that, depending on the method of preparation and standards of hygiene, some Kombucha teas may be entirely innocent whilst others carry the risk of contamination and infection. Contaminated batches may act like a ‘biological chain letter’ [10]. Greenwalt et al.

noted that ‘sterile containers and utensils must be used during preparation’, [5] but it is questionable whether sterility is always observed under real life conditions. In addition, the high acidity of the drink (pH usually around 2.5) could constitute a risk when large amounts are being consumed [5].

The relative paucity of documented adverse events might indicate that problems occur rarely; it could, on the other hand, also be due to a high level of under-reporting of adverse events. Consumers are considerably less likely to report adverse effects from unconventional therapies than from conventional OTC medications [14]. Even though the case reports and case series mentioned above are in themselves not compelling, they have to be taken seriously and should be followed up with more rigorous investigations.

Unconventional remedies such as Kombucha are increasingly popular, not least because they are supported by frequent and favourable media coverage [15]. For many of these treatments there is little clinical evidence supporting efficacy. Kombucha is an extreme example in several ways: there is no convincingly positive clinical evidence at all; the claims for it are as far reaching as they are implausible; the potential for harm seems considerable. In such extreme cases, healthcare professionals should discourage consumers from using (and paying for) remedies that only seem to benefit those who sell them.

In conclusion, none of the numerous health claims for Kombucha is supported by clinical evidence. The consumption of Kombucha tea has been associated with serious adverse events. Its therapeutic use can therefore not be recommended.

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