

Acetic acid, found in vinegar, shown to be effective against bacteria found in burn wounds

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Highly diluted acetic acid, an active ingredient of household vinegar, has been shown to be an effective alternative agent to prevent infection and kill bacteria found in burn wounds.

Researchers from the University of Birmingham and the National Institute for Health Research (NIHR) Surgical Reconstruction and Microbiology Research Centre (SRMRC) investigated the antibacterial activity of [acetic acid](#) against key burn wound colonising organisms growing both planktonically and as biofilms.

Burns are a common traumatic injury and prone to becoming infected due to loss of a normal skin barrier. Local infection of the burn wound and subsequent sepsis (blood poisoning) are key concerns for patients, with sepsis the leading cause of death among patients with burn wounds.

Infections of burn wounds are difficult to treat with traditional antibiotics as they do not effectively reach the wound, and the infecting organisms are often highly antibiotic resistant.

The study, published in *PLOS ONE*, demonstrated that low concentrations of acetic acid can be used to treat biofilms, and therefore could be used as alternatives to topical (surface applied) antimicrobials and traditional antimicrobial dressings for preventing bacterial colonisation of burns.

The current use of acetic acid in clinical settings has been limited due to concerns of patient tolerability. The finding that it is effective at far lower concentrations than previously thought therefore offers hope for the development of novel treatments.

Miss Fenella Halstead, NIHR SRMRC Clinical Scientist at the Queen Elizabeth Hospital, explained, "As resistance to antibiotics grows, we need to find ways to replace them with alternative topical agents that can kill bacteria and help our burns patients. The evidence in this study offers great promise to be a cheap and effective measure to do just that."

29 isolates of common wound-infecting pathogens including *Pseudomonas aeruginosa*, *Acinetobacter baumannii*, *Staphylococcus aureus*, *Enterococcus faecalis*, *Escherichia coli*, *Klebsiella pneumoniae*, and *Enterobacter* spp. were grown in the laboratory.

The ability of highly diluted acetic acid to inhibit growth of pathogens, prevent the formation of biofilms, and then eradicate pre-formed biofilms was tested on each isolate. Low concentrations of acetic acid (0.16-0.3%) were shown to be able to inhibit growth of all strains, prevent them from forming biofilms (bacteria attached to a surface) and also to eradicate mature biofilms for all isolates after three hours of exposure.

Previous clinical use of acetic acid as an antimicrobial treatment has used much higher concentrations of 2.5%.

Miss Halstead continued, "A key way in which bacteria cause infection is in a biofilm; where instead of living as single cells they form a community in the form of a slimy layer that we see on a wound, on a valve or on a catheter, for instance."

"As much as eighty percent of infections in the body are due to these

biofilms which, typically, are even more resistant to antibiotics because they essentially have safety in numbers and their metabolic rate is a lot slower. For that reason, seeing that acetic acid was effective against all types of these pathogens was really great."

The team are now designing clinical trials with acetic acid in which they will test plain dressings soaked with acetic acid, against the more commonly used silver-based dressings. A further study will test the effectiveness of two specific concentrations of acetic acid on patients at the Healing Foundation Centre for Burns Research based at the Queen Elizabeth Hospital.

Dr Mark Webber, from the University of Birmingham, added, "Acetic acid, or more commonly, vinegar, has been used sporadically in medicine for the past 6000 years - being successfully implemented to treat plague, ear, chest, and urinary tract infections. So in that sense it's a well-known antimicrobial which has seen sporadic clinical application. Our work now gives a firm evidence base to guide the development of treatments which promise to be cheap and effective"

"These new trials will hopefully provide clarity on how this can be implemented for burns patients across the world. What we can say however, is more work still needs to be done to determine the best way in which to use acetic acid or similar chemicals to treat and prevent bacterial infection. We also need to study the way in which bacteria may adapt or evolve over time to exposure to these acids to again understand how they are effective and ensure any clinical usage is designed to minimise emergence of resistance as we have seen with antibiotics."

The team stress that people should not self-apply vinegar in the case of a burn however; but should go to hospital as normal. The acetic acid treatment would only be required in serious burns where infection can become a problem.

More information: "The Antibacterial Activity of Acetic Acid against Biofilm-Producing Pathogens of Relevance to Burns Patients." *PLoS ONE* 10(9): e0136190. [DOI: 10.1371/journal.pone.0136190](https://doi.org/10.1371/journal.pone.0136190)

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