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# Stability and inactivation of hepatitis E virus during food processing and in the environment

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**Key words**
Hepatitis E virus, stability, inactivation, pH, salt, drying

**Aim of the study**
The study was performed to investigate the stability of hepatitis E virus (HEV) at different conditions, which occur during food processing or in the food-processing environment. As quantitative determination of HEV infectivity directly in a food matrix is not possible so far, the investigations should mainly focus on HEV stability against pH, salt and other physico-chemical parameters using liquid solutions. Environmental stability should assessed after drying of HEV on different surfaces. The investigations should help to identify conditions during food processing, which bear a high risk of HEV transmission, as well as suggest effective inactivation methods.

**Material and methods**
A cell culture-adapted HEV strain was propagated, concentrated and dissolved in phosphate-buffered saline. After treatment of the solution at the different physico-chemical conditions, the remaining infectivity was titrated using cell culture followed by immunofluorescence staining of infected cells. The counted fluorescent foci were used to calculate inactivation rates. The data were further used for the establishment of inactivation models.

**Results and significance**
The cell culture-based method for HEV infectivity titration could be optimized and showed a high degree of robustness and reproducibility. Using this method, a high stability of HEV at pH2-9 was assessed; inactivation was only evident by treatment at pH1 and pH10. The pH values usually occurring during fermentation of meat products did not show sufficient inactivating effects. Also, high salt concentrations up to 20% sodium chloride, with and without addition of sodium nitrite or sodium nitrate, did not lead to HEV inactivation, and salt conditions used during sausage fermentation did not effectively inactivate HEV. Application of high hydrostatic pressure showed almost complete HEV inactivation; however, only at the extreme condition of 600 MPa for 2 min. Drying had only a slight effect on HEV infectivity. Remaining HEV infectivity could be demonstrated by storing dried HEV at 3°C on plastic and ceramic surfaces for up to 8 weeks. Storage at room temperature led to faster inactivation and HEV stability was dependent on the surface material, decreasing from plastics through ceramics and steel to wood.
The results indicate a very high stability of HEV against different physico-chemical treatments. The pH and salt conditions usually occurring during fermentation of meat products did not show significant inactivating effects. Therefore, remaining infectious virus might be present in those products, e.g. raw sausages, if HEV-contaminated starting material was used. Application of high hydrostatic pressure can be considered as an efficient technology to inactivate HEV if extreme conditions are applied; however the inactivation has to be confirmed directly in the meat products. On surfaces, HEV appears to be highly stable; therefore rigorous cleaning regimes have to be applied to surfaces after contact to meat to reduce the risk of cross-contamination. Use of surface materials showing a higher HEV inactivation rate may further reduce this risk. Generally, the developed HEV inactivation models can be used in future to predict the HEV inactivation at several conditions and to further help with the development of effective inactivation methods.

**Publications**

Wolff, A.; Günther, A.; Albert, T.; Schilling-Loeffler, K.; Gadicherla, A.K.; Johne, R. (2020) Stability of hepatitis E virus at different pH values. International Journal of Food Microbiology, 325, 108625.

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