8. Summary

Optimization of disinfection procedures in food supply facilities of the German Armed Forces in view to the *B. cereus* prevalence of surfaces and food

Routine epidemiologic investigations of frequently occurring gastrointestinal diseases among German army personnel provides valuable data on the prevalence of *B. cereus*-associated diseases. *B. cereus* is the aprimary cause of foodborne diseases in the Bundeswehr and its importance continues to grow.

Routine microbiological investigations on surfaces performed in the years 1999 and 2000 in 183 food supply facilities of the former military districts III and IV have been evaluated with a view to the *B. cereus* prevalence on surfaces of kitchen and cooking equipment. Further investigations were to provide a comparison between the sporocoidal effect of Wofasteril® E400 / alcapur® and Tego 2000® which is used as a standard disinfectant in Bundeswehr kitchens.

The qualitative suspension test according to the DVG method, in which different disinfectant concentrations act upon a spore suspension with and without protein load, was evaluated on the basis of growth of surviving bacteria in a nutrient broth. Thus it was determined to which extent all spores used (1.0×10^7 KbE) are destroyed under certain concentration / time conditions.

In the quantitative suspension test the sporocoidal effect was demonstrated by the reduction of bacteria due to the effect of the disinfectant. Various concentrations of the disinfectants acted upon spores of *B. cereus* in a reaction vessel, too.

Spore carriers of stainless steel and polyethylene (PE) vaccinated with spore suspension, which are materials that normally have to be disinfected in kitchens, were also subjected to a quantitative disinfectant test with various concentrations of the preparations to be tested.

In a field trial a total of 700 surface samples of daily used items in seven food supply facilities were tested for the presence of *B. cereus* prior to and after disinfection.

Routine investigations in Bundeswehr food supply facilities in the years 1999 and 2000 show that the contamination of surfaces with *B. cereus* is at a high value of 14 % (n=4412). In these facilities amphotensides are used for disinfection.

In the suspension tests performed Tego 2000® did not have any sporocoidal effect on a *B. cereus* test strain. The alternatively tested disinfection method on peracetic acid basis (Wofasteril® E400 / alcapur®) had a sporocoidal effect even under conditions of high protein load. Further reaching practical tests with spore carriers of stainless steel and PE showed that Wofasteril® E400 / alcapur®, in a concentration of 0.25 % and after a time of exposure of 30 min at 20°, could reduce the number of the *B. cereus* spores used by about log 5 KbE levels. When using Tego 2000® in the concentration of 1 % recommended for the contaminated area, no reduction of the number of spore carriers could be determined in the

spore carrier test; thus the results of the suspension tests could be confirmed in a practial test.

In the field trial a significant difference in the sporocoidal effect of Tego 2000® and Wofasteril® E400 / alcapur® could be demonstrated. The use of Wofasteril® E400 / alcapur® under practical conditions resulted in a significantly greater reduction of the *B. cereus* prevalence than that of Tego 2000® which was tested for comparison. The value determined for relative efficiency clearly shows that the sporocoidal effect of Wofasteril® E400 / alcapur®, under consideration of the actual starting prevalence of *B. cereus* on surfaces of daily used items, has to be rated 6.25 times greater than that of Tego 2000®.

The *B. cereus* prevalence determined on surfaces of the food supply facilities in connection with the described frequency of *B. cereus* based diseases in the communal food service of the Bundeswehr indicates that the risk of food contamination via contaminated surfaces is highly significant. It suggests itself to reduce this high prevalence by the selection of a suitable disinfectant. The conduct of disinfectant tests and the evaluation of their results is made more difficult due to the lack of standards for the testing of chemical disinfectants for their sporocoidal effect. Analogously to existing standards for the efficiency test of disinfectants for non-sporeforming bacteria, methods were modified and a reduction factor of at least lg 3 KbE in the quantitative suspension test as well as in the spore carrier test was required as a proof of sporocidal efficiency. Since, due to different influencing factors, the results of laboratory tests can not necessarily be transferred to practical field conditions, the disinfectants were subjected to a field trial to test the sporocidal effect in the planned area of application. Despite the lack of a sporocidal effect of the disinfectant normally used in Bundeswehr kitchens, recommendations for application need to include other selection criteria like harmlessness for humans and the environment as well as ascpects of occupational safety.

The exclusive use of Wofasteril® E400 / alcapur® in food supply facilities is therefore not generally recommended. The good sporocidal effect of peracetic acid should rather be used specifically, especially in case of officially ordered decontaminations in connection with a *B. cereus* based epidemic, particularly since the use of Wofasteril® is permissible for that purpose according to the "List of Disinfectants and Disinfection Methods Tested and Approved by the Federal Health Office" of the RKI and the disinfectant is included in the DVG list. Moreover, the specific use of Wofasteril® E400 / alcapur® is reasonable if an increased *B. cereus* prevalence was determined in a food supply facility during microbiological own checks. If the one-time use of Wofasteril® E400 / alcapur® only leads to termporary success, the exclusive use of Tego 2000® and Wofasteril® E400 / alcapur® should be recommended. During Bundeswehr missions abroad the exclusive use of Wofasteril® E400 / alcapur® is also advisable.