

## P-45: Power Ultrasound Effect on Poultry Meat Microbial Flora

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Power ultrasound was reported as a potential tool to reduce microorganisms in food such as milk (Cameron, 2007), fruit juice (Patil *et al.*, 2009) and poultry (Haughton *et al.*, 2010). However, there are no specific studies about the effect of power ultrasound on the microorganisms present during deterioration of fresh chicken meat. The goal of this study was to determine the effect of power ultrasound on bacteria of chicken. The power of three ultrasound systems was measured by calorimetry method. The goal was monitoring the ultrasonic devices power to determine the levels to use in the microbiological test. 40 portions (150 g per portion) of chicken breasts were used, 10 breasts per treatment. Each chicken breast was packed in polyethylene bags and stored during 48 hours (4 °C) to allow bacteria to adapt to the packaging and storage conditions. After 48 hours of storage, bags were opened and the breast was immersed in 200 ml of MRD (Maximum Recovery Diluent) sterile solution in a 400 ml flask, and 1 ml of MRD solution was taken. Subsequently, the ultrasound treatment was applied for 5 minutes. In the 850 kHz bath, the 200 ml of MRD were placed directly into the device after disinfected it. Immediately after, a new sample (1 ml of MRD solution) was taken, the chicken breast was packed in the bags and was stored at 4 °C, after 7 days the bags were opened and the breast was immersed in 200 ml of MRD sterile solution and a final sample of 1 ml was taken. The control breasts were immersed in MRD sterile solution for 5 minutes and samples were taken before and after this time and after 7 days storage at 4 °C. A series of dilutions from 1:10 to 1:100 in MRD were prepared with the collected sample solution of the chicken breasts before and after treatment. On the other hand, with the samples taken after 7 days of storage dilutions were prepared as follows from 1:10 to 1:1000000 in MRD. 100 µl of each dilution were inoculated into the following culture media: mesophilic and psychrophilic bacteria in agar PCA (Plate Count Agar) and lactic acid bacteria in MRS agar (Man, Rogosa, Sharpe). The mesophilic bacteria was incubated at 25 °C for 3 days, the psychrophilic bacteria at 4 °C for 5 ± 1 days and the lactic acid bacteria was incubated at 35 °C for 5 ± 1 days. Finally the microbial counts were performed for each petri dish. The temperature difference was determined after the data was plotted. The curve slope value was considered like dT/dt. The value dT/dt was replaced in the ultrasonic power equation mentioned above, where the heat capacity of water (C<sub>p</sub>) was considered 4.181J kg<sup>-1</sup> °C<sup>-1</sup> and the solvent mass (M) like 200 kg. Table 1 shows the ultrasound power of the 850 kHz bath. The device has four intensity levels, but just the three highest were measured. This device has variable intensity and is selected through amplitude percentage. In this case measured at 30%, 40% and 50% amplitude. After calculating the power intensity of the devices was one similar level was selected in each in order to compare the effect in the microbiological tests. In the 850 kHz bath was selected the III level (24.1 W) and the 30% amplitude (27.6 W) in the 20 kHz bath. However, the 40 kHz bath showed not a similar power (10.3 W) at no other level in the devices tested, however also was used in the microbiological tests. The psychrophilic bacteria show a biggest decrease after 5 minutes of sonication with the 20 kHz probe; however this positive effect is not noticed in the final count, after 7 days under refrigeration. The above can see in the Figure 1a and 1b, the first displays the plot in 5 minutes of ultrasonic treatment and the other one shows the CFU in the 7 days of storage. Both plots were adjusted to clearly see the effect of each device. During the storage of the chicken breast samples, the psychrophilic bacteria amount was similar in all the treatments (Figure 1b). Nevertheless the Figure 1a displays that besides the 20 kHz probe, the 850 kHz bath also produce a decrease in the microbial content of the chicken samples. The experiment conducted by Sams and Feria (1991) can help to explain the similarity between the treatments during storage, since it suggests that a cause of microbial growth in cooling is that ultrasound can help release nutrients from processed food and that these can be exploited by certain types of bacteria. Samples treated with the 20 and 850 kHz showed higher microbial content and it decreased during the 5 min of sonication, unlike those treated with 40 kHz which indicated that there was an increase in the content of bacteria as in the control samples. Samples control shows a big increase in the lactic acid bacteria after first 5 minutes sonication. The lactic acid bacteria did not show any decrease during sonication; however the untreated samples showed a higher growth with time than the treated one. The ultrasonic effect is evident with the 20 kHz and 850 kHz devices since the highest growth were samples treated in the 40 kHz bath, even more than the control samples. When a bacterial decrease during the ultrasonic treatment was not observed, the samples subjected to 20 kHz probe had lower growth until the end of the experiment. Ultrasonic treatment has proven be effective in controlling lactic acid bacteria (Dolatowski and Stasiak, 2002), however

Cameron (2007) found that some species of lactic acid bacteria exhibit some resistance to ultrasound treatment and this resistance can also be a major cause of non-decrease effect in the samples subject at 40 kHz treatment. This is similar to the observed effect with psychrophilic bacteria, samples with the highest mesophilic load before treatment (20 kHz probe and 850 kHz bath) showed the best ultrasound effect. It has been shown that in fresh chicken mesophilic total counts decrease when subjected to power ultrasound (Haughton et al., 2010). However during storage, the effect is not obvious or permanent. Pholman et al. (1997) found that in some cases the ultrasound intensity is not sufficient; treatment alone had no significant effect on microbial growth for long periods of storage. However, they found that the content of microorganisms decreases significantly immediately after treatment. According to the results found by these authors, the initial content under control with ultrasound treatment can be explained based on the immediate effect power ultrasound. Psychrophilic and mesophilic bacteria are affected just during the sonication time, however the power ultrasound effect is not permanent and it is necessary to investigate when the antimicrobial effect ends. Lactic acid bacteria were not affected by ultrasound during the sonication time, but the ultrasound effect is permanent during refrigeration. Treatment of 20 kHz may be considered the best method to control microbial growth in fresh chicken meat. Contrarily, treatment of 40 kHz shows no effect on bacteria present on chicken breast.

Table 1

Calorimetric measurements of ultrasonic power entering in the 850 kHz bath system

Intensity Level	II		III		IV	
dT/dt	0.005	0.0049	0.0277	0.0299	0.0495	0.066
Power (W)	4.2	4.1	23.2	25.0	41.4	55.2
Average Power (W)	4.1		24.1		48.3	

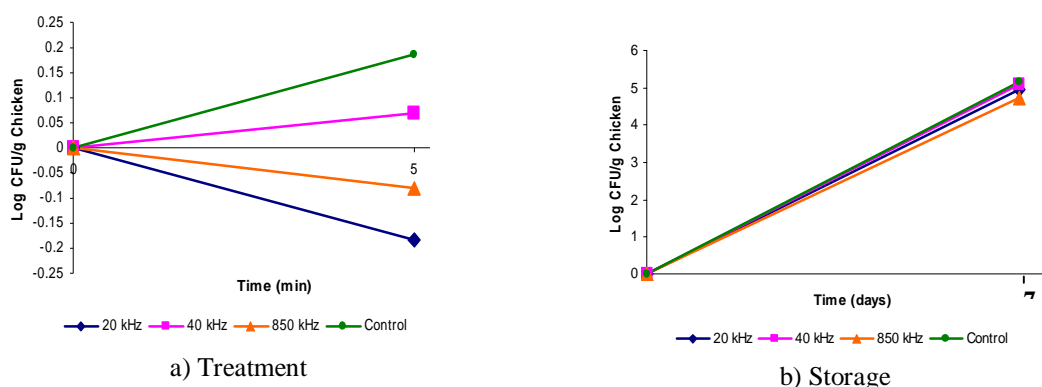


Figure 1. Adjusted plots of psychrophilic bacteria in chicken breast, a) grown during sonication, b) grown during refrigeration

## References

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