



## Optimization of Boiling Process and Effect of Citric Acid and Sodium Chloride on Enrofloxacin Residues in Chicken Meat Using Response Surface Method

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### Abstract

**BACKGROUND:** Despite the beneficial effects of antibiotics in treating livestock diseases and increasing their weight, their residual effects on food can cause harmful effects on both livestock and humans and endanger human health. The presence of antibiotic residues in food, especially meat, and its transfer to the body of consumers is one of their most important harmful effects. One of the practical ways to reduce drug residues in meat is to use heating methods such as cooking in boiling water.

**OBJECTIVES:** This research aimed to use a suitable cooking method and optimize its conditions in terms of salt content. Organic acids (citric acid) and cooking time to reduce antibiotic residues.

**METHODS:** For this purpose, fifteen 20-day-old Ras broiler chickens were used. To clean their bodies from possible antibiotic residues, the chickens were kept for 10 days and given antibiotic-free food. Then, the antibiotic enrofloxacin was injected into the chest muscle, and 24 hours later, they were killed. Based on the protocol provided by Design Expert software, 18 treatments with different cooking time ranges and percentages of salt and citric acid were designed and implemented, and the drug residue after cooking the samples was determined by HPLC (high-performance liquid chromatography) method.

**RESULTS:** Based on the obtained results, proper cooking methods and optimization of its conditions, such as the amount of salt, organic acids (citric acid), and cooking time, had a significant effect on the reduction of enrofloxacin antibiotic residues. Also, after optimizing the process by the software, the best conditions to achieve the minimum amount of antibiotics could be achieved by the cooking time of 26.59 minutes, 2.95% w/v salt, and 1.49% v/v citric acid.

**CONCLUSIONS:** By cooking properly and adding ingredients such as acids and salt at the optimum level, the amount of antibiotics in chicken meat can be reduced.

**Keywords:** Antibiotics, Chicken, Cooking, Enrofloxacin, Health

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### Figure Legends and Table Captions

**Table 1.** Actual and coded levels of independent variables.

**Table 2.** Experimental and predicted values of responses (Percentage of antibiotic reduction).

**Table 3.** Analysis of variances of regression coefficients of processed models.

**Figure 1.** Standard curve of enrofloxacin.

**Figure 2.** A: Standard sample of enrofloxacin, B: Enrofloxacin of treated sample.

**Figure 3.** Effect of citric acid and sodium chloride on the reduction of antibiotics in chicken tissue.

**Figure 4.** Effect of citric acid and time of heating on the reduction of antibiotics in chicken tissue.

**Figure 5.** Effect of sodium chloride and time of heating on the reduction of antibiotics in chicken tissue.