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Short Commentary

Development of Neutralizing Buffered Peptone Water for *Salmonella* Verification Testing in Commercial Poultry Processing Facilities

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ABSTRACT

Contaminated poultry continues to be a major source of human foodborne illness, and an estimated 2 million cases of foodborne illnesses can be traced to poultry each year in the United States. When the United States Department of Agriculture (USDA) Food Safety and Inspection Service (FSIS) became aware of concerns that sanitizers used by commercial poultry processors might produce inaccurate results in *Salmonella* verification testing of commercially processed poultry, FSIS requested that the USDA Agricultural Research Service (ARS) conduct research on the effect of sanitizer carryover on the recovery of *Salmonella* from test samples. After it was determined that sanitizer carry-over into test samples could reduce recovery of *Salmonella*, a neutralizing Buffered Peptone Water (nBPW) was formulated. The nBPW is now used in *Salmonella* verification testing in commercial poultry processing facilities in the U.S. and has been shown to enhance recovery of *Salmonella* from whole broiler carcasses in verification testing.

Keywords: Poultry; *Salmonella*; Neutralizing buffered peptone water

SANITIZER CARRY-OVER

Wholesome poultry meat contaminated by foodborne pathogens is a major source of human foodborne illnesses. *Salmonella* is one of the main pathogens associated with contaminated poultry, and this pathogen has been estimated to cause over 1 million cases of foodborne illness and over 5 thousand deaths in the U.S. each year [1]. In order to reduce bacterial contamination of processed poultry, processors typically apply chemical sanitizers to poultry meat during various processing operations. The most commonly used sanitizers include acid mixtures; acidified sodium chlorite (ASC); cetylpyridinium chloride (CPC); 1,3-dibromo-5,5-dimethylhydantion (DBDMH); and peroxyacetic acid (PAA).

The United States Department of Agriculture (USDA) Food Safety Inspection Service (FSIS) is responsible for monitoring commercially produced poultry meat for the level of contamination by harmful bacteria, such as *Salmonella* [2]. FSIS became concerned that residual concentrations of chemical sanitizers used by commercial processors might remain on processed meat after food safety experts became aware of new research that was conducted in this area [3]. The research indicated that there was the potential that residual concentrations of sanitizers on processed poultry could be carried-over into verification test samples. The carry-over of sanitizers into the test samples might then produce "false negative" results because *Salmonella* present on the chicken meat could be killed by sanitizers in the samples and then not be detected by verification testing.

NEUTRALIZING BUFFERED PEPTONE WATER

In order to determine if sanitizer carry-over could affect the recovery of *Salmonella* during verification testing, in 2015 FSIS requested that the USDA-Agricultural Research Service (ARS) initiate research to address this potential problem. The results of the research demonstrated that sanitizer carry-over could result in inaccurate verification testing by reducing the number of *Salmonella* recovered from contaminated poultry, thereby potentially resulting in false negative results [4,5]. FSIS then requested that the ARS scientists conduct additional research to determine if a new rinse could be formulated to inactivate residual concentrations of sanitizers that might be carried over

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into test samples. In collaboration with FSIS, the ARS scientists developed neutralizing Buffered Peptone Water (nBPW) which was able to reduce the ability of commonly used sanitizers to kill *Salmonella* in verification samples, and thereby reduce the potential of false negative test results [6]. In a Federal Register notice dated February 11, 2016, FSIS stated that once proven effective, the new buffer would replace standard BPW in verification testing. In early 2016, ARS scientists provided FSIS with nBPW research results and FSIS made the decision to change procedures used in *Salmonella* verification testing in commercial poultry processing facilities. FSIS issued Notice 41-16 on June 8, 2016 to inform inspection program personnel in these facilities that the Agency had adopted nBPW for monitoring pathogens on whole chicken and turkey carcasses and on chicken parts. Additionally, the notice informed inspectors that on July 1, 2016, nBPW would replace regular BPW in poultry verification sampling. Initially, the Eastern FSIS Laboratory handled production of nBPW. Currently, the nBPW is commercially manufactured and available to commercial poultry processors.

IMPLEMENTATION

The U.S. is the largest producer of broiler chickens in the world [7]. In 2017, the U.S. produced about 9 billion broiler chickens, and about 16% of this broiler meat was exported to Mexico, Canada, Hong Kong, and other regions. There are 35 federally inspected companies in the U.S. involved in the production and processing of broiler chickens, and these companies operate about 180 processing facilities [7]. The nBPW is used to conduct approximately 27,000 poultry *Salmonella* verifications tests per year in these facilities.

Research conducted by the FSIS indicates that there has been a threefold increase in the number of test samples that tested positive for *Salmonella* contamination since the use of nBPW was implemented [8]. This finding has required some of these facilities to reexamine the pathogen control strategies and the use of antimicrobials during processing to control *Salmonella* contamination. The introduction of nBPW into *Salmonella* testing revealed that some commercial processor had probably started or increased the use of antimicrobials in processing to meet the *Salmonella* standards set by FSIS in 2011 [8]. Although use of antimicrobials had previously enabled these facilities to pass *Salmonella* inspection tests, the introduction of nBPW indicated that the carcasses were probably still contaminated by *Salmonella*, but the pathogen was not detected because of sanitizer-carryover. Therefore, nBPW allowed FSIS to more accurately detect the *Salmonella* contamination of broiler carcasses and to continue to examine the best methods for decreasing contamination of poultry by this pathogen.

Research studies have been conducted at academic and regulatory laboratories to continue to evaluate the effectiveness of the nBPW to enhance the recovery of *Salmonella* and other human foodborne pathogens from processed poultry. These studies have indicated nBPW is more effective for increasing recovery of *Salmonella* from whole broiler carcasses than from chicken parts [8,9] and that nBPW might reduce recovery of Campylobacter [8,10,11]. However, FSIS adjusted its laboratory procedures to mitigate this potential impact on Campylobacter recovery.

CONCLUSION

The use of nBPW will improve verification testing and increase the confidence of FSIS in the results of the Agency's *Salmonella* testing data, thus enhancing the ability of the Agency to protect consumers. Utilization of nBPW in commercial processing facilities means that the consumers of chicken and turkey processed in the U.S. can have more confidence in the results of *Salmonella* verification testing.

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