NATIONAL ADVISORY COMMITTEE ON MICROBIOLOGICAL CRITERIA FOR FOODS

RESPONSE TO THE QUESTIONS POSED BY FSIS REGARDING CONSUMER GUIDELINES FOR THE SAFE COOKING OF POULTRY PRODUCTS

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Executive Summary

The National Advisory Committee on Microbiological Criteria for Foods (NACMCF, or the Committee) was asked to provide advice on developing guidelines for consumers for the safe cooking of poultry products. The questions were generated in response to foodborne illnesses from *Salmonella* related to the consumption of processed chicken products that appeared to be ready-to-eat (RTE) but contained poultry that was not ready-to-eat (NRTE).

The purpose of this document is to address the questions posed to the Committee by the United States Department of Agriculture (USDA) Food Safety and Inspection Service (FSIS). In so doing, the Committee will provide guidelines to consumers for the preparation of poultry products to ensure that they are microbiologically safe. The document also will furnish information to food processors[1] on product labeling that clearly states if the product is RTE or NRTE and provide validated cooking instructions that minimize consumer confusion.

To address this request, the Committee reviewed the advantages and limitations of the various types of processes used in cooking. The Committee also examined current labeling practices for NRTE and RTE products and the effect of those practices on the preparation of a microbiologically safe product. An update on the cases of salmonellosis in Minnesota and Michigan that focused on labeling and retail product appearance was presented.

The Committee determined that guidance for consumers is needed for cooking poultry products to provide an adequate lethality for pathogenic bacteria commonly associated with poultry and for interpreting the labeling and cooking instructions provided on the packaging. The delivery of an adequate lethality to the product is affected by the product composition and geometry, temperature before cooking, and crust formation. The guidance also must address proper use of thermometers by the consumer and how to determine if the thermometer is working properly. The guidance should also describe calibration of thermometers used by consumers and provide them with an understanding of the method for calibrating and the reason for calibrating.

The recommendations of the Committee are based on the seven questions posed by FSIS. A general summary of the recommendations, some of which are directed to the consumer and others to the food processor, follows:

Consumer

- A single minimum internal product endpoint temperature of 165°F for cooking without a time limitation should be recommended to the consumer to ensure

[1] Within this report, food processor refers to any regulated entity such as a Federally or State inspected establishment.

microbiological safety of cooked poultry. This temperature will destroy *Salmonella*, the most heat resistant pathogen of public health concern in raw poultry.

- Guidance to the consumer should indicate that higher final temperatures may be needed for consumer acceptability and palatability (e.g., 170°F for whole muscle breast meat, 180°F for whole muscle thigh meat in order to remove the pink appearance and rubbery texture).
- The product condition or state before cooking should be considered in the guidelines and in the preparation/cooking instructions to the consumer.
- Guidelines for the consumer should convey that a longer cooking time is needed if the product is frozen at the beginning of the cooking process. The consumer should also be informed that microwaving raw product from the frozen state is not advisable unless the package provides substantial further instructions for ascertaining that the product has achieved the recommended endpoint temperature.
- Guidance to the consumer should address how to properly measure product temperature and how to determine if the thermometer is out of calibration. The guidance could also include instructions on how to calibrate the thermometer and describe the purpose and importance of calibration.

Food Processor

- The product label should indicate if the product is RTE or NRTE. A warning to fully cook a product may be necessary on the label if the product is partially cooked or otherwise appears to be RTE. The principal display panel should be the primary focus for certain safety information (e.g., that the product contains uncooked poultry and must be cooked thoroughly for microbiological safety).
- When validating cooking instructions and developing guidelines or labeling, the process must take into account: 1) how the consumer is likely to interpret the cooking instructions and 2) what the consumer may actually do in preparing and cooking the product. The cooking process must be designed to eliminate *Salmonella*, which is the most heat resistant pathogen of public health concern for raw poultry. (Although *Listeria monocytogenes* is more heat resistant, it is considered a hazard from post-process contamination rather than undercooking.)
- The limitations of each type of process should be considered when developing and validating cooking guidelines or instructions. The limitations include difficulty of temperature measurement, uneven heating, equipment differences, a partially cooked surface that may appear as if the product is fully cooked, and the potential for having a cooked surface with an undercooked product interior.
- When a product containing uncooked poultry appears to be cooked, it is necessary to explicitly state that the product contains uncooked poultry and must be thoroughly cooked.

I. Original Work Charge and Background

Background

In 2005, illnesses among consumers in the Michigan and Minnesota area (Appendix I) were associated with the consumption of various microwavable poultry entrees that were NRTE but appeared to be RTE and improperly cooked by the consumer. NRTE poultry products, including products that may be partially cooked or have a breaded or batter coating that was heated in order to impart a cooked color and set the batter, such as those involved in the illnesses, may be contaminated with pathogens. *Salmonella* Typhimurium and *Salmonella* Heidelberg were identified in the course of epidemiological investigations. In addition, in 2002, foodborne illnesses were associated with frozen chicken nuggets and strips contaminated with *Salmonella* Heidelberg (6). As in the Michigan and Minnesota cases, the products associated with the 2002 outbreak were par-fried to lend a cooked appearance although the meat was not fully-cooked. The authors also identified the cooked appearance and inadequate labeling as contributing to consumer confusion. These illnesses from both 2002 and 2005 prompted FSIS to consider what actions the Agency should take to decrease the chance of illness associated with the preparation for NRTE poultry products. Additional cases of salmonellosis in Minnesota attributable to stuffed chicken products have since been reported (10).

Product and package appearance and consumer interpretation of the labeling, cooking instructions and safety-based information provided on the label may contribute to confusion by the consumer and subsequent inadequate preparation of the product. With regard to product appearance, products encased in a batter that have been subjected to heat in order to impart a cooked color and to set the batter may appear fully cooked to the consumer when observed either through the packaging or upon opening. As a consequence, the consumer may only re-heat the product for aesthetic or palatability purposes rather than subjecting it to a cook sufficient to kill pathogenic bacteria. NRTE products may be packaged in containers, such as plastic trays, that are commonly associated with RTE, microwaveable products. As a result, the consumer may only microwave the product for a time suitable for an RTE product. Similarly, the presence of both cooking and microwave instructions on the same package could cause the consumer to become confused as to the thoroughness of the cooking required. For example, microwave instructions on an NRTE product may be interpreted by the consumer that the product just needs to be re-heated and not fully cooked for microbiological safety. Also, safety-based labeling messages guiding consumers may not adequately convey critical food safety preparation information. Finally, cooking instructions for NRTE poultry products may not have been validated for microbiological safety to fully address the intended use or the method of cooking by the consumer. The cooking instructions must ensure that the minimum endpoint temperature is reached or fully address the intended use or method of cooking by the consumer.

As with other methods of cooking, preparation of a food product in a microwave oven is influenced by the composition (e.g., moisture, density, ionic content), shape or geometry and size of the product. In addition, the process is also dependent on the microwave frequency and the oven design. A problem facing commercial operations – difficulty in applying heat uniformly – also affects home microwave ovens (3).

Currently a variety of temperatures are recommended to the consumer for cooking poultry. Consumers need clear guidance to know what time/temperature needs to be attained during cooking to ensure microbiologically safe poultry products. The primary microbiological pathogen of concern is *Salmonella*, but others, including *Campylobacter*, may need to be considered.

Charge to the Committee

The charge to the Committee is to determine the minimal requirements for achieving microbiologically safe cooked poultry and associated methods for objective measurement. The Committee should assess all pathogens of concern and poultry cooking methods that may be used by consumers. The information developed by the Committee will be used by the FSIS to develop consumer messages on the cooking parameters necessary to ensure the safety of poultry.

II. Introduction

FSIS published the final rule "Performance Standards for the Production of Certain Meat and Poultry Products" in 1999 (12). The lethality compliance guidelines associated with the final rule listed two temperatures for cooking poultry – 160°F (71.1°C) for uncured poultry and 155°F (68.3°C) for cured poultry. In 2000, at the request of FSIS, the Agricultural Research Service conducted a sophisticated study (5) that provided a range of processing times and temperatures specifically for chicken and turkey containing differing levels of fat. Time-temperature tables based on this study were published in a Federal Register Notice on March 2, 2005. This information was primarily directed at food processors.

Information for consumers is provided by the FSIS Meat and Poultry Hotline by phone (1-888-674-6854) and on the Food Safety Education section of the FSIS website (http://www.fsis.usda.gov/Food_Safety_Education/index.asp). In the Frequently Asked Questions on the FSIS website, the temperatures specified for cooking are: 180°F for whole poultry as measured in the thigh and wing pieces; 170°F for breasts; and 165°F for ground poultry. The temperatures recommended to consumers by FSIS exceed those provided to food processors, as poultry pieces cooked to 160°F are generally unpalatable to the consumer because of the pink appearance and rubbery texture. For whole poultry, temperature measurement in a whole carcass wing joint, which is the slowest heating, is difficult. A temperature greater than 160°F in the wing joint is achieved when the thigh reaches 180°F. These temperatures also provide a margin of safety, since cooking is generally less controlled in the home than in processing facilities.

Microwave cooking instructions on product labels usually list just the time for heating and holding and do not indicate a minimum endpoint temperature. Comparatively, labeling instructions for fully cooking a product usually specify an endpoint temperature that can be considered "instantaneous" – no additional time at that temperature is required to produce a microbiologically safe product. Further, the size and geometry of the product may impact cooking temperatures. For a large mass product, the temperature

may continue to increase after the endpoint temperature is reached and may remain at the endpoint temperature for some time after the product is removed from the heat source. In contrast, a smaller mass product probably will not remain at the specified temperature for more than a few seconds once removed from the heat source. This information on differences of heating large and small mass products does not appear to be adequately communicated to the consumer.

III. Response to Questions in the Charge

1. What are the limitations in various cooking methods, particularly microwaving, that may need to be conveyed through labeling and other means to ensure that poultry cooked by consumers is safe?

Table 1 was developed to illustrate the advantages and limitations of various cooking methods to achieve a microbiologically safe product. A single minimum internal product endpoint temperature of 165°F for cooking without a time limitation is recommended to the consumer and can be achieved by any of the cooking methods listed in Table 1. For purposes of this document, the Committee is using definitions of cooking methods as accepted by various consumer cooking guides (e.g., Food Lovers Companion (4)). Issues regarding labeling, particularly with regard to microwaving, are addressed in the responses to later questions.

Canning and home pressure cookers, in addition to combination methods (e.g., convection microwave; grilling and steaming; heat treatment in combination with drying for jerky), were also discussed by the Committee. The Committee determined that these need not be addressed by the Committee for this charge because these methods usually are not conveyed by food processors on the product label as recommended methods of cooking.

Table 1 – Comparison of Methods to Achieve Safe Cooking of Poultry Products

Method	Advantages	Limitations	Comments
Boiling	• Complete product surface contact with the heating medium • Long process (lethality applied for long time)	• Difficulty of taking internal product temperature while cooking	• May include poaching
Broiling	• Good surface lethality	• Crust formation limits heat transfer • Uneven heating	• Product under (below) an intense heat source • For electric ovens the doors should remain ajar in order to prevent the element from cycling off and resulting in undercooking
Deep Fat Frying (complete immersion in oil)	• Complete product surface contact with the heating medium • Heat carryover (temperature continues to increase)	• Oil temperature recovery may be slow when cooking frozen product • Difficulty of taking internal product temperature while cooking • Undercooking interior because exterior looks cooked	• Undercooking a bigger issue with larger size products • When done outdoors, weather may affect cooking time

Method	Advantages	Limitations	Comments
Pan Frying	• High temperature at the heating surface	• Uneven cooking • Undercooking interior because exterior looks cooked	• Lid on or off can influence cooking time and uniformity
Grilling	• Good surface lethality	• Crust formation limits heat transfer • Non-uniform heat; weather may affect cooking time for outdoor grilling • May not be feasible for very large whole carcasses (e.g., greater than 16 lbs.)	• Greater chance of cross-contamination by utensils • Inexperienced cooks may undercook product
Simultaneous two-sided Grilling	• Better heat transfer than one-sided grilling	• Large or thick product may not allow full closure of the equipment • No temperature control	• Placement of product may affect heat penetration • Consumers may not have adequate guidance

Method	Advantages	Limitations	Comments
Microwaving*	• Faster come-up time resulting in less time in danger zone • Less potential for cross-contamination for products cooked in the original package	• Uneven heating • Cooking is affected by: 1. Volume of product in the oven 2. Product characteristics (shape and composition) 3. Cooking container characteristics (material, shape, and whether covered) 4. Product placement in the oven 5. Presence or absence of rotating carousel	• Possible influence of other appliances on available power • Differences in equipment makes standardized cooking instructions difficult • Inexperienced cooks such as children may not use appropriate settings
Dry Roasting/Baking	• Longer heat exposure	• Crust formation slows heat penetration • Product shape may lead to uneven cooking	• Baking and roasting are often used synonymously • Influence of non-poultry component (stuffing, breading, batter, casserole) on temperature profile
Wet Roasting/Baking (covered in/above liquid)	• Longer heat exposure • Crust formation, if it occurs, occurs after moist heat delivers adequate surface lethality	• Product shape may lead to uneven cooking	• Includes cook-in-bag and foil wrap • Influence of non-poultry component (stuffing, breading, batter, casserole) on temperature profile

Method	Advantages	Limitations	Comments
Rotisserie	• More even heat exposure than static process • Good surface lethality	• Crust formation limits heat transfer	
Slow Cooker	• Long time at lethal temperature	• Large pieces of poultry and frozen poultry remain in the danger zone of microbial growth for longer time • Slow come-up time at low temperature	
Smoking	• Long time at lethal temperature	• Difficult to determine doneness • Difficult to control temperature • Temperature and moisture drops when charcoal or wood replenished (dependent on design of smoker) • Weather may affect cooking time	• Moisture is needed for adequate surface lethality • Equipment and heat source variability make standardized cooking instructions difficult • Remote digital thermometers can be used

Method	Advantages	Limitations	Comments
Steaming	• Good heat penetration	• Difficulty of taking internal product temperature while cooking • Overcrowding of product may reduce heat transfer • Ensuring adequate liquid	• May include poaching
Stewing and simmering	• Long time at lethal temperature	• Ensuring adequate liquid • May take a long time	

* refers to microwave oven only, not to a microwave convection oven

2. [How][2] do cooking requirements differ by type of poultry (e.g., chicken versus turkey, whole carcasses versus parts, ground products with different levels of fat, raw versus partially cooked)?

The cooking requirements to achieve the desired internal product temperature for poultry will vary according to size, geometry, degree of processing, and composition of the product (e.g., some products like cheese stuffed chicken breasts have more fat than whole muscle chicken). The FSIS time/temperature guidelines (11) to food processors for chicken and turkey are based on varying fat levels. With an increase in the level of fat, there is a concomitant increase in time at certain temperatures to achieve the same lethality. The Committee agreed that the differences among poultry species are not significant enough to recommend to consumers different cooking temperatures, nor is there a reason to justify different temperatures for specific cuts of poultry for microbiological safety. Regardless of the type or size of product, the time and temperature for adequate lethality must be achieved in the slowest heating part of the product.

The recommended cooking requirements to consumers should at least achieve the same level of pathogen reduction required of food processors (i.e., a 7-$\log_{10}$ reduction of *Salmonella*, the level of lethality required in 9 CFR 318.150(a)(1), should be the target level of reduction). A process sufficient to control *Salmonella* will also control *Campylobacter*, another pathogen of concern in poultry (e.g., a 7-$\log_{10}$ process for *Salmonella* would achieve a greater than 50-$\log_{10}$ reduction of *Campylobacter* (Appendix II)). Although *Listeria monocytogenes* is more heat resistant than *Salmonella*, it is considered a hazard from post-process contamination rather than undercooking. Moreover, because a highly pathogenic strain of avian influenza H5N1 virus has arisen as a concern in the international trade of poultry and poultry products (7, 13), the Committee has determined, based on available data (8, 9), that a process that results in a 7-$\log_{10}$ reduction of *Salmonella*, whether applied by the food processor or the consumer, is adequate to destroy the avian influenza virus and other pathogens of likely concern in poultry, should they be present.

The Committee recommends that a single minimum internal product temperature of 165°F (74°C) with no required hold time be provided to the consumer to attain an acceptable level of food safety (see question 4). This temperature will reduce viable *Salmonella* by at least 7 logs. In addition, this temperature exceeds the 158°F (70°C) that is recommended to eliminate the avian influenza H5N1 virus (2, 13). The FSIS time-temperature tables for cooking RTE poultry products (11) indicate that a temperature of 165°F (74°C) and a hold time of less than 10 seconds for both chicken and turkey will achieve a 7-$\log_{10}$ reduction of *Salmonella*. The tables also note that the required lethality is achieved instantaneously when the hold time is less than 10 seconds. At 165°F (74°C), there are no significant differences in achieving the required lethality with regard to different fat levels or species (chicken versus turkey). The recommended temperature for cooking poultry, therefore, provides a greater margin of safety against those pathogens,

[2] The word "how" was added to the question in order to develop an answer that would not require only a "yes" or "no" as did the previous phrasing.

such as avian influenza virus and foodborne pathogens such as *Campylobacter*, that are less heat resistant than *Salmonella*.

In addition to the cooking temperature, guidance should be provided on the practical aspects of taking temperatures. This guidance should explain the reason for differences from previous recommendations and illustrate different measurement scenarios. It should also indicate that higher temperatures may be needed for bone-in product to achieve consumer acceptability, as noted below in question 4.

3. What effect, if any, does the condition of poultry just prior to cooking (e.g., chilled versus frozen) have on the cooking treatment?

The degree of freezing (e.g., hard and crust frozen), whether the product is stuffed or breaded, fat level, water activity, pH, marinades (with oil, sugar and salt, acid, seasoning), a bone-in or boneless product, a sectioned-and-formed or a whole muscle, intact product, and whether solution injection is applied, will affect the rate of heating and time required to reach the minimum endpoint temperature. Food processors should consider these factors in developing and validating cooking instructions for NRTE products and heating instructions for RTE products (see response to question 5).

The Committee recommends that the principal display panel identify when NRTE poultry is contained in product that appears to be RTE (see question 7). Food processors should develop practical cooking instructions for the consumer. If the preparation/cooking instructions are overly complex the consumer may not follow or understand the instructions. When food processors include thawing in the cooking instructions, the product label should also provide thawing instructions that ensure microbiological safety, such as “when defrosting in microwave, cook immediately after thawing.”

It is important that guidance to the consumer convey that a longer cooking time is needed for frozen product compared to thawed product. The consumer should also be informed that microwaving raw product from the frozen state is not advisable unless the package provides substantial further instructions for ascertaining that the product has achieved the recommended endpoint temperature. Many NRTE products are frozen and, if to be cooked from the frozen state, require a longer cooking time compared to thawed product. In addition, refrigerated NRTE products may be frozen by the consumer for later use. If the recommended cooking time was based on thawed product, there should be guidance provided on how to ensure that the product is thoroughly and safely thawed. Thus, a minimum starting temperature for a thawed product may be appropriate. Regardless of the initial product temperature, a minimum internal temperature of 165°F must be reached before the product is microbiologically safe.

4. What is the single time/temperature combination for each type of poultry (see question 2 above) for consumers to use to ensure safe cooked poultry?

Because of reasons cited earlier, it would be difficult to develop a comprehensive list of poultry types. Therefore, as noted in number 2 above, for consumers, the recommended

minimum internal temperature of poultry product is 165°F (74°C) with no required hold time. This single temperature for consumers provides an adequate safety margin to ensure that the poultry product is microbiologically safe. However, higher final temperatures may be needed for consumer acceptability and palatability (e.g., 170°F for whole muscle breast meat, 180°F for whole muscle thigh meat in order to remove the pink appearance and rubbery texture). The Committee recommends that FSIS continue to develop and distribute guidance for the consumer to explain temperatures that achieve doneness versus those that achieve microbiological safety and why there is a distinction between the two. The Committee also recommends that any changes in consumer guidance be communicated in the FSIS "Food Safety Educator" located on the FSIS website at http://www.fsis.usda.gov/News_&_Events/Food_Safety_Educator/index.asp. For meat and poultry processors, who operate within the Hazard Analysis and Critical Control Point (HACCP) framework of ensuring safe food, a lower temperature to deliver adequate lethality for a RTE product is acceptable because of the additional control procedures.

5. What parameters should inspected establishments consider in developing validated cooking instructions for use by consumers?

The Committee acknowledges that most consumers do not own and/or use a meat thermometer, particularly when cooking convenience-type products. It is, therefore, important that cooking instructions be validated to ensure that the minimum internal temperature of 165°F will be achieved throughout the cooked product.

When designing validation studies, variability due to the following needs to be considered:

- Consumer cooking device (e.g., different wattage microwave ovens)
- Product (e.g., composition, size, shape, initial temperature, component distribution, and age of product)
- Preparation practice (e.g., cooking vessel, punching holes in the film, number of units to be cooked simultaneously, rotation of product during cooking cycle, appropriate product holding after the microwave process, location of product within the cooking device)
- Location at which internal temperature for poultry is taken in the product container

The appropriate validation study should at least consider conditions likely to result in the lowest temperature with regard to the above bullets. Preliminary studies can be used to determine the amount of variability in the process and the need for additional studies, or the need to change the cooking instructions. If cooking instructions are changed for product quality reasons, the new instructions must be validated to ensure safety.

6. Since consumers typically are not as capable of calibrating the cooking equipment* and temperature measuring devices as inspected establishments, what, if any, special

considerations should be considered in identification of safe cooking guidance for consumers (e.g., adding a safety margin to the minimum time/temperature)?

Since not all consumers are aware of the serious health hazards that can be associated with NRTE meat and poultry products, it is important that FSIS educate consumers that products containing NRTE meat and poultry can pose serious health risks and that all NRTE meat and poultry products must be cooked to a proper internal temperature. FSIS should continue to develop and distribute guidance to consumers on temperature measuring devices (e.g., dial or bimetallic core thermometers, thermometers with thermocouples or thermistors).

FSIS should also continue to proactively promote the purchase, proper use, and calibration of thermometers used to determine safe minimum internal cooking temperatures for NRTE meat and poultry. FSIS should work to reach consumers in innovative and untapped ways through partnerships with schools, physicians, cooking shows, etc. FSIS should seek sufficient funding to do a mass media campaign (e.g., "Is It Done Yet?"; www.fsis.usda.gov/Is_It_Done_Yet/Brochure_Text/index.asp) on a national basis similar to the pilot done in Michigan in August 2004 to educate consumers to use thermometers when cooking meat and poultry products. A mechanism to measure the effectiveness of the campaign should be included.

The FSIS guidance should also describe the need for sanitary handling to prevent cross-contaminating an RTE product and procedures for safe storage and refrigeration of perishable products.

*The Committee interprets equipment as ovens, broilers, smokers, deep fryers or other cooking devices.

7. What safety-based labeling considerations should be considered for conveying safe cooking instructions to consumers?

The labeling on the package or container is critically important in conveying the correct message to the consumer, both for product preparation/cooking and for indicating whether the product is RTE or NRTE. Therefore, the principal display panel should be the primary focus for certain safety information and clearly convey whether the product is RTE or NRTE. Some products, such as those covered with batter and heated to set the batter or those that are char-marked, may appear fully cooked when, in fact, they are not. When a product containing uncooked poultry appears to be cooked, it is necessary to explicitly state that the product contains uncooked poultry and must be thoroughly cooked.

The terminology used and its prominence on the principal display panel must be considered for distinguishing NRTE from RTE product. "Ready-to-Cook" may not clearly inform the consumer that the product must be cooked to a minimum internal product temperature to kill pathogens. Consumers may not distinguish between the terms "Ready-to-Cook" generally associated with an NRTE product and "Ready-to-Heat"

generally associated with an RTE product. Before recommending statements on food safety, consumer research should be conducted to evaluate which statements and their placement on the package will adequately convey to the consumer the appropriate message with respect to cooking poultry for microbial safety.

Because all cooking instructions must result in a microbiologically safe product, preparation/cooking instructions provided on the label must be clear and validated to ensure that the consumer will know that the product must achieve the minimum endpoint temperature of 165°F for food safety. To avoid consumer confusion, the term 'cooking' in the preparation instruction should be used for product containing NRTE poultry components. The term 'heating' should be used only for RTE products that are warmed for palatability but no lethality is required to achieve food safety. If a "preferred method" is identified, the consumer should be informed what is meant by the "preferred method" (e.g., quality versus safety). In addition, a statement is needed about the internal temperature to which the poultry portion should be cooked (e.g., "For food safety [or, To reduce the risk of foodborne illness], cook to a minimum internal temperature of 165°F"). For example, for partially cooked meat patties, FSIS requires such a statement on the principal display panel. If the product can be microwaved, the proper use of a thermometer with measurements taken at multiple points should also be indicated because of the variability among microwave ovens.

The Committee recommends that, at least for products that have a cooked appearance but are NRTE, FSIS should pursue mandating that such products have appropriate and validated cooking instructions on their label.

IV. Recommendations for Data and Research Needs

The Committee recognizes that there are inadequate attribution data in regard to foodborne illness. The Committee recommends that FSIS and the Centers for Disease Control and Prevention (CDC) partner to ensure that the need for foodborne illness attribution data is addressed in current programs such as FoodNet (www.cdc.gov/foodnet/), eFORS (Electronic Foodborne Outbreak Reporting System; www.cdc.gov/foodborneoutbreaks/) and future programs. Specifically, FSIS and CDC should provide foodborne illness attribution data related to commercial products that require cooking to ensure microbiological safety before consumption. The Committee is particularly interested in poultry products that appear to be RTE but actually are NRTE and require cooking (e.g., breaded NRTE poultry). Specifically, when a foodborne illness is attributed to a product, the following data should be collected:

1. Was the product cooked from a frozen state?
2. What cooking method was used to prepare the product, in particular, was the product microwaved?
3. Was the product stuffed?
4. Where was product prepared – at home, food service, etc.?
5. What were the cooking instructions on the label? An attempt should be made to obtain the product label.

6. Did the product label identify in any way that the poultry was NRTE?
7. Did the product label identify in any way that the product should be thoroughly cooked for safety, and if so, how?

In order for FSIS to address the cost and benefit of risk management policies for safe cooking of poultry, FSIS should also partner with the states and food processors to determine food processor practices related to cooking and labeling:

1. What is the proportion of RTE poultry products that appear RTE but require cooking in comparison to NRTE poultry products?

2. How has that proportion of product referenced in question 1 above changed with time?

3. How are commercially prepared poultry products that appear to be RTE but require cooking labeled?

4. What labeling features beyond safe handling instructions indicate that these products referenced in question 3 above require cooking for safety?

5. What proportion of these products referenced in question 3 above is labeled to indicate that they can be microwaved?

6. How are cooking instructions for NRTE poultry products determined? What information is collected by food processors to assess how consumers will interpret and carry out the cooking instructions?

7. What type of studies do the food processors conduct to validate cooking instructions?

8. Are guidelines for studies to validate cooking instructions available or do they need to be developed?

The Committee recommends that FSIS review Agency documents provided to consumers to ensure consistency with minimum recommended single minimum internal product cooking temperature of 165°F. In addition, FSIS should work with the Conference for Food Protection to ensure the Food Code requirements for cooking poultry (165°F for 15 seconds) are consistent with this Committee recommendation to consumers (165°F with no hold time). FSIS should ensure that the information above is collected to the extent possible through the Hotline database and labeling staff.

V. Conclusions

The food processor is responsible for providing validated cooking instructions to the consumer that achieve a microbiologically safe product, and FSIS has the responsibility to verify food processors do so. The food processor must label the product to provide on

the package clear and concise cooking instructions to the consumer and validate these cooking instructions. The public health regulatory agencies (e.g., FSIS and the Food and Drug Administration) must provide the consumer with guidelines on proper cooking and temperature measurement procedures.

The principal display panel of the package should be the primary focus for certain safety information and should clearly indicate whether the product is RTE or NRTE. It should not be left to the consumer to determine if the product is RTE, especially if the product is partially cooked or otherwise appears to be RTE. When a product contains uncooked poultry, it is necessary to explicitly state this and that the product must be thoroughly cooked in accordance with the validated cooking instructions.

When validating the cooking instructions, the food processor must take into account how the consumers are likely to interpret cooking instructions and handle the product. The limitations for the various processing procedures (e.g., difficulty in temperature measurement, uneven heating, partially cooked product that appears RTE) should be considered by the food processor when developing and validating cooking instructions.

A single endpoint temperature rather than a time and temperature combination should be recommended to the consumer. The cooking process for poultry should be designed to eliminate *Salmonella*. The Committee recommends that consumers cook poultry to a minimum internal temperature of 165°F for food safety.

Guidelines for the consumer on achieving microbiologically safe poultry products through cooking should be developed. These guidelines should discuss the product condition or state before cooking and provide guidance on thawing procedures for frozen products that ensure microbiological safety. The consumer should be informed that a longer cooking time is needed if the product is frozen before cooking and that microwaving a product from the frozen state is not an acceptable cooking method unless a sufficient number of temperatures are measured throughout the product to ensure the product is properly cooked. The guidelines should also include the proper procedure for measuring product temperature and describe procedure, purpose, and importance of calibrating thermometers.

In addition to cooking, the guidelines should include the need for sanitary handling to prevent cross-contaminating an RTE product. Guidelines for safe storage and refrigeration of perishable products should also be included.

VI. References

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Appendix I

Report on Salmonellosis Linked to Consuming Processed Chicken Products in Minnesota and Michigan

In 2005, Minnesota and Michigan noted several cases of foodborne illness attributable to *Salmonella* Heidelberg. These cases were linked to the consumption of various commercially manufactured processed chicken entrees. The entrees in question were uncooked boneless, breaded chicken breast. The breading was browned and gave the product a cooked appearance. Although the labeling had safe handling instructions on packaging, it was not otherwise designated that the product was not RTE. In addition, the principal display panel indicated that the product was microwaveable. The product had a cooked appearance that was visible through the package.

Because the same product was prepared incorrectly by several households, these illnesses were indicative of problems with product handling and preparation instructions. A survey of consumers of the products involved in the Michigan and Minnesota illnesses and the food processor's response demonstrate this point rather clearly. The majority of consumers thought the product was cooked. They claimed to have followed the cooking instructions on the package but did not recall a safe handling statement on the package. The consumers stated that they did not see anything on the package indicating that the product was NRTE. Although a final internal temperature of 165°F was recommended on the cooking instructions, no one reported checking the product temperature before consumption. Finally, the consumers did not know the wattage of their microwave ovens. Cooking instructions on packaging for microwaved RTE products usually indicate for the consumer to microwave the product on a high or other power setting. This assumes that all microwave ovens deliver the same power at the same setting although these ovens vary in the amount of power used. Consequently, a product may not receive the amount of energy intended or needed.

The food processor of the products involved redesigned the packaging to clearly indicate to the consumer that the product was NRTE and needed to be cooked thoroughly. A symbol with "Cook Thoroughly" was added to the front panel and "microwaveable" was removed. Cooking instructions for a microwave also were removed.

Appendix II

Comparison of a 7 log Reduction of *Salmonella* to the Log Reduction *Campylobacter*

An analysis was conducted to determine the lethality of poultry processes on *Campylobacter* in comparison to *Salmonella*. It is estimated that a 7-log process for *Salmonella* would achieve greater than a 50-log reduction for *Campylobacter*.

Basis for the determination

Assume that the 7-log process for *Salmonella* in poultry is 140°F for 28.2 min or 160°F for 15 sec (based on the Juneja et al. 2001 (5), poultry 6% fat). Based on Blankenship and Craven (1), the D value for *Campylobacter* (composite of 5 strains) in chicken is (by extrapolation) 0.33 min at 140°F and 0.005 min at 160°F. This calculates to the following log reductions.

Log reduction of poultry processes

	Salmonella	*Campylobacter*
140°F, 28.2 min	7	85
160°F, 15 sec	7	50