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Article

Technical Assistance in Determining the Heat Adequacy Number (F0) in the Sterilization Process of Packaged Rendang for Rendang Business Actors IKABOGA in Padang City

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Abstract

This community service activity aims to assist rendang business actors who are members of IKABOGA in Padang City in determining the heat adequacy number (F0) in the sterilization process of packaged rendang. Determining the correct F0 number is very important to ensure food safety, extend product shelf life, and maintain rendang quality. Assistance methods include theoretical training, F0 calculation simulations, sterilization practices, and preparation of Standard Operating Procedures (SOPs). The results of the activity showed an increase in business actors' understanding of the F0 concept, as well as the implementation of a more measurable and safe sterilization process. Laboratory tests showed that rendang products sterilized with the appropriate F0 value were proven to be free from pathogenic microorganisms, while the quality of taste, texture, and aroma were maintained. This activity is expected to help business actors improve product quality and competitiveness, and comply with applicable food safety standards.

INTRODUCTION

The sterilization process is an important part of the production of packaged rendang, especially for Micro, Small, and Medium Enterprises (MSMEs) who want to ensure that their products are safe for consumption and have a long shelf life (Sayekti et al 2024). One of the key concepts in food sterilization is determining the heat adequacy number or F0 (Azhari et al., 2023). The F0 number measures the total heat exposure received by the product during sterilization to ensure the elimination of pathogenic microorganisms, such as Clostridium botulinum, which can grow in anaerobic conditions in food packaging.

Determining the correct F0 is very important because it is directly related to product safety and sensory quality such as taste, texture, and color. If the sterilization process uses an inadequate F0, the rendang product may still contain harmful microorganisms that can cause product damage or pose a health risk to consumers. Conversely, if the F0 value is too high, the organoleptic quality of the rendang can decrease because the product becomes overcooked or dry (Dewi et al., 2019; Praharasti et al., 2020;Jimenez et al., 2023)

For MSMEs producing packaged rendang, understanding and calculating this heat adequacy

number (F0) is very important so that they can maintain product quality while meeting food safety standards set by regulations. Although determining F0 is often considered a complicated technical process (Skoglund, 2022), a basic understanding of this concept can help MSMEs optimize their sterilization process. This allows them to produce packaged rendang that is not only safe and durable, but also maintains the original taste that is the advantage of their product. With the right information on how to calculate and determine the F0 heat adequacy number, MSMEs producing packaged rendang can avoid mistakes in the sterilization process, maintain consumer trust, and increase product competitiveness in local and international markets.

METHODOLOGY

This methodology is designed to provide practical guidance in assisting rendang business actors who are members of IKABOGA in Padang City in determining the heat adequacy number (F0) in the sterilization process of packaged rendang. The aim is to help business actors understand the importance of the F0 number in ensuring food safety, extending the shelf life of products, and maintaining the quality of packaged rendang.

Methodology Stages

Preparation Stage

1. Identification of Business Actors: Identifying IKABOGA rendang business actors who are participating in the assistance. Collecting data such as production scale, type of sterilization equipment used, and production capacity of each business.
2. Initial Data Collection: Conducting a field survey to understand the sterilization process currently implemented by business actors, both traditionally and using modern technology. Identifying the temperature and time used in the sterilization process of packaged rendang products.
3. Preparation of Equipment and Resources: Preparing test equipment such as thermometers, pressure gauges, and calibration instruments needed to measure temperature and pressure in the sterilization process. Forming a mentoring team consisting of food experts, food technology, and sterilization equipment operators.

Technical Mentoring Stage

1. Basic Sterilization and F0 Concept Training: Providing training to business actors on the basic concepts of sterilization, the importance of sufficient heat (F0), and the microbiological risks faced if F0 is not achieved. Explanation of the relationship between temperature, sterilization time, and elimination of pathogenic microorganisms.
2. Calculation of F0 Value: Demonstrating the calculation of F0 on packaged rendang samples using sterilization equipment. Teaching how to measure the appropriate temperature and pressure and calculating F0 based on a combination of time and temperature. Simulating several sterilization scenarios with variations in temperature and time to obtain the optimal F0 for rendang products.
3. Sterilization Practice Mentoring: Assisting business actors in sterilizing packaged rendang products using the equipment they have. Testing the temperature at several points in the packaging to ensure even heat distribution during the sterilization process. Teaching monitoring and recording techniques for the sterilization process as part of the documentation and evaluation of the implementation of food safety standards.

Evaluation and Monitoring Stage

1. Laboratory Testing: Testing sterilized rendang samples to ensure that there is no growth of pathogenic microorganisms, and that product quality is maintained after sterilization. Testing also includes sensory tests (taste, texture, aroma) to ensure that there is no decrease in quality due to the sterilization process.
2. F0 Value Evaluation: Evaluating the results of various sterilization parameters applied, comparing the F0 numbers produced from each sterilization practice with the recommended standards for packaged rendang products. Providing specific recommendations regarding the optimal temperature and time to achieve the right heat adequacy (F0) for each business actor.
3. Periodic Monitoring: Conducting periodic monitoring of the implementation of the sterilization

process by business actors. Providing further guidance if necessary, for example if there is a change in the scale of production or equipment used.

Preparation of Guidelines and SOPs (Standard Operating Procedures)

1. Preparation of SOP for Sterilization Process: Assisting business actors in preparing SOPs for the sterilization process of packaged rendang that are adjusted to the conditions of the equipment and production capacity of each. This SOP includes steps for setting the temperature, sterilization time, measuring the core temperature of the product, and recording the F0 value for each production batch.
2. Preparation of F0 Guidebook: Compiling a short guidebook on determining and applying the heat adequacy number (F0) that is easy for rendang business actors to understand, as well as tips for maintaining product quality during the sterilization process.

RESULTS AND DISCUSSION

Results of Mentoring Activities

Participation of Business Actors From the mentoring activities carried out, as many as 4 rendang business actors who are members of IKABOGA in Padang City actively participated. They are rendang producers with varying production scales, ranging from small to medium businesses. Most participants use traditional sterilization methods, while some have adopted modern equipment such as autoclaves. Figure 1 is documentation of the implementation of activities that show the participation of business actors**.**

Figure 1. Preparation of technical activities for determining the heat adequacy number (F0) in the sterilization process of packaged rendang at rendang business actors

Improving Understanding of the F0 Concept After the basic training session, there was a significant increase in understanding of the concept of heat adequacy number (F0) among business actors. Previously, most producers did not have in-depth knowledge of F0 and only relied on experience and traditional measurements to determine the heating duration. Through training, business actors began to understand that F0 is a key indicator in the sterilization process to ensure product safety without damaging the quality of rendang.

Sterilization Practice Testing During the practical stage, a series of tests were carried out on the sterilization process of packaged rendang products using equipment available at their respective businesses. The test results showed that several business actors had not achieved the ideal F0 value. Several small businesses used sterilization times that were too short or temperatures that were less than optimal, so that the resulting F0 value was below the recommended standard (F0 = 3). Through simulation and evaluation of temperature and time, it was found that increasing the sterilization temperature to around 121°C with a duration of around 30 minutes provided a more appropriate F0 value for safe packaged rendang products. Figure 2 shows the implementation of sterilization practices at the rendang business actors.

Figure 2. Implementation of F0 number measurement practice

Laboratory Test Results. Laboratory test results on sterilized rendang samples showed that business actors who used F0 according to the recommendations succeeded in achieving effective sterilization results. The samples were proven to be free from the growth of pathogenic microorganisms such as Clostridium botulinum. On the other hand, for rendang products that were previously processed without considering the F0 value, microorganisms were found that indicated the risk of contamination or product damage within a certain period of time.

SOP for Sterilization of Packaged Rendang. From this assistance, 12 out of 15 business actors have succeeded in compiling SOPs (Standard Operating Procedures) for the sterilization process of their packaged rendang. This SOP is adjusted to the equipment available in each business, especially to ensure that the temperature and sterilization time used are able to produce F0 that meets food safety standards. For business actors who have not fully implemented the SOP, further assistance is planned to assist the gradual adaptation process.

Product Quality After implementing the appropriate F0, the quality of the packaged rendang product remains maintained. There is no significant difference in the taste, aroma, or texture of rendang processed with the right heat adequacy number compared to the previous product. This shows that with proper understanding and implementation, business actors can achieve food safety without sacrificing product quality.

DISCUSSION

The Importance of Heat Adequacy Number (F0). The results of this assistance underline the importance of determining the heat adequacy number (F0) in the sterilization process for food products such as packaged rendang. Optimal F0 serves to ensure that the product is free from pathogenic microorganisms (Mainardi and Bidoia, 2024), so it is safe to consume and has a longer shelf life. In many cases, business actors initially do not understand the relationship between temperature, time, and product safety, which can pose a risk to consumer health and the sustainability of their businesses. Through the introduction of the F0 concept and simulation of its practice, rendang producers can be more confident in producing sterile rendang without sacrificing quality (Frediansyah et al., 2017; Sugiarto et al., 2024).

Differences in Business Scale and Equipment. One of the challenges faced during the assistance was the difference in production scale and type of equipment used by business actors. Some small businesses still use simple heating techniques that have difficulty reaching high temperatures consistently. This results in difficulty in achieving the ideal F0 value. As a solution, it is recommended that business actors consider investing in more modern sterilization equipment, such as autoclaves, which can help achieve the temperature and pressure required for optimal sterilization. Further assistance will also focus on how to improve sterilization efficiency with existing equipment (Fallah Shayan et al., 2022)

Rendang Product Quality. One of the concerns of business actors is that the application of the right F0 will affect the taste and quality of rendang. However, the results of sensory tests show that the application of the appropriate heat adequacy number does not reduce product quality. With a more measurable sterilization process, packaged rendang maintains the organoleptic characteristics desired by consumers. This is important to provide assurance to business actors that they can produce safe and quality rendang, while also meeting food safety regulations.

SOP and Periodic Monitoring. Developing an SOP for the sterilization process is a crucial step in ensuring uniformity and consistency in the production process of packaged rendang (Frediansyah et al., 2017, Syukri et al., 2023). The preparation of an SOP based on the right temperature, time, and pressure provides practical guidance for business actors in carrying out sterilization according to standards. With periodic monitoring, business actors can ensure that each production batch meets safety standards, so that the risk of contamination can be minimized as much as possible. Figure 3 shows the implementation of a discussion group forum to monitor the mentoring activities that have been carried out.

Figure 3. FGD to monitor the results of mentoring activities

CONCLUSION

The results of the assistance in determining the heat adequacy number (F0) in the sterilization process of packaged rendang for IKABOGA rendang business actors in Padang City show an increase in understanding and technical ability in carrying out proper sterilization. The application of the appropriate F0 number can increase the safety and shelf life of the product without reducing quality. With good SOPs and monitoring, business actors can maintain the quality and safety of packaged rendang, while meeting the standards set to expand the market in the future.

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