

Food safety standards: GMP and SSOP in rendang production by MSMEs in Padang

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Abstract. Food MSMEs play a crucial role in the food industry, contributing to economic growth and food security. In Padang City, food safety concerns, including food poisoning cases, underscore the need for proper food safety practices among business owners. To mitigate these risks, implementing Good Manufacturing Practices (GMP) and Sanitation Standard Operating Procedures (SSOP) is essential for ensuring product safety and quality. This research focuses on rendang MSMEs, as the lengthy cooking process increases the risk of contamination. The study assesses GMP and SSOP compliance in five rendang businesses, finding that the average compliance rate for GMP is 82%, while SSOP compliance stands at 62%. The causes of non-compliance, including inadequate sanitation facilities, employee training, and equipment, are analyzed using a fishbone diagram. Based on these findings, recommendations are made to enhance employee health, sanitation facilities, and infrastructure. Such improvements are crucial to ensuring safer food production and reducing foodborne risks, ultimately enhancing product quality and consumer confidence.

1 Introduction

Indonesia has significant potential to drive economic growth, including in business activities. Business involves production, purchasing, selling, or exchanging goods and services, engaging many individuals and companies [1]. It encompasses all activities conducted by individuals or business entities aiming for profit [2]. Beyond profit, business activities can reduce high unemployment rates by expanding job opportunities for the general public. However, establishing a business should not solely focus on profit, job prospects, and customer satisfaction. It is also crucial to pay attention to the safety of the products being produced. Recent studies emphasize that foodborne disease remains a significant challenge, especially in developing countries, where over 2 million deaths are reported annually due to unsafe food handling and consumption practices [3].

The National Food Agency encourages the strengthening of the MSME business sector in its efforts to diversify the food industry. It states that local food MSMEs play a crucial role in driving the growth of the local food industry, thereby impacting economic growth and food safety [4]. One of the efforts in developing the food business and industry is through advocacy, outreach, and the implementation of food quality and safety standards for food business operators. Additionally, innovative food packaging design, as reviewed by [5], can enhance food safety by preventing contamination during distribution and storage, making it a valuable component in the implementation of GMP and SSOP. The city of

Padang faces ongoing challenges and issues related to food safety, including those affecting fresh, processed, and ready-to-eat food. There have been instances of trade violations, including the shipment of damaged or expired food products. The Head of the Padang City Food Agency stated that food safety is a central issue in the community. Recent food poisoning cases underscore the need for increased public awareness and a demand for healthy and safe food. The quality and safety of food must be prioritized to prevent recurring outbreaks of food poisoning. In developing countries, for every reported case, there are likely 99 unreported cases, indicating many similar incidents may go unnoticed.

There have been several cases in Padang that have been revealed, one of which was reported by the findings of the Padang City Food and Drug Monitoring Agency (BPOM), which found that pathogenic bacteria in grilled meatballs caused food poisoning among students at SD 29 Gunung Sarik in Padang. These bacteria emerged due to inadequate cleaning practices in food processing and the use of contaminated utensils. This issue relates to one of the indicators of GMP and SSOP, specifically the facilities used during food processing. Additionally, a food poisoning incident involving chicken porridge occurred in Padang in 2023. Beyond poisoning cases, production defects also contribute to low food safety standards.

As stated by [6], livestock products are now a crucial component in the food supply chain. Their rich nutritional content and significant benefits make products like beef, milk, eggs, and other variations popular among

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consumers. In Indonesia, beef is commonly processed into dishes such as satay, meatballs, and sausages. However, a common issue faced is the tendency of beef to spoil or deteriorate due to physical, biological, and chemical contamination. Processing beef, such as turning it into rendang, is one strategy to extend its shelf life.

Rendang, a traditional Minangkabau dish, requires a lengthy cooking time of about 4 to 6 hours. This extended cooking process increases the potential for contamination during production. Therefore, the Food and Drug Agency (BPPOM) recommend obtaining distribution permits for businesses in high and medium-risk food categories through GMP training. The goal of GMP training is to ensure business operators can create GMP and SSOP design documents for food production facilities. As of 2022, several rendang MSMEs have been granted permits for GMP implementation. Table 1 below shows the food industry facilities for rendang that received GMP implementation permits in 2022.

Table 1. List of rendang MSMEs granted GMP implementation permit in 2022 by BPOM

Business Name	Explanation
Rendang Bundo Limbago	
Rendang Uni Lili	BPOM has given food recommendations in Padang.
Wakatu Rendang	
Sentra Rendang Padang	
Rendang Ega	

Despite this progress, challenges remain. Only a small percentage of MSMEs in Padang meet GMP and SSOP standards. For instance, out of 54 rendang businesses, many still do not comply with GMP requirements, as indicated by the 2022 annual report from the Food and Drug Monitoring Agency. Updated statistical data, such as the exact number of non-compliant MSMEs and recurring food safety issues, would underscore the urgency of addressing these gaps. Such data would not only highlight the scale of the problem but also emphasize the importance of strengthening food safety measures in the region. Some rendang MSMEs in Padang have already been granted permission to implement GMP standards. Based on Table 1, only a few rendang businesses, such as Rendang Bundo Limbago and Wakatu Rendang, have received recommendations for food safety.

Therefore, an analysis of GMP and SSOP in rendang MSMEs in Padang City is necessary to ensure proper implementation of these standards. This study aims to analyze the extent to which rendang MSMEs in Padang City comply with GMP and SSOP standards. By evaluating current practices and identifying gaps, this research seeks to contribute to the enhancement of food safety measures, ultimately benefiting both producers and consumers in the local food industry.

2 Literature review

2.1 Food safety

Food encompasses everything derived from biological sources, such as agricultural, plantation, forestry,

fisheries, livestock, aquatic, and water products, whether processed or unprocessed. Food safety refers to the hazards associated with food when consumed [7]. According to the WHO, food safety ensures that food or food raw materials do not adversely affect the health of consumers if processed or consumed as intended. Food safety, as defined by Law Number 86 of 2019 on Food Safety, refers to the conditions and efforts necessary to prevent food from potential biological, chemical, and other contaminants that can disrupt, harm, or endanger human health [8].

2.2 Good manufacturing practices (GMP)

Good Manufacturing Practices (GMP) were introduced in Indonesia in 1978 through Minister of Health Decree No. 23/Menkes/SKJI/1978, aiming to prevent microbial, chemical, and physical contamination in food production. GMP includes practices such as facility maintenance, employee hygiene, pest control, raw material handling, process control, product recall, and training. It ensures compliance with Food Law No. 7 of 1996, which mandates quality standards and production process integrity for food safety [9]. Regulated under the Indonesian Ministry of Industry Regulation No. 75/M-IND/PER/7/2010, GMP emphasizes environmental control, sanitation, equipment maintenance, and water safety to maintain food production standards.

2.3 Sanitation standard operating procedure (SSOP)

The Sanitation Standard Operating Procedure (SSOP) aims to prevent contamination in processed products, ensuring safety and quality through eight key aspects: water safety, cleanliness of food contact surfaces, cross-contamination prevention, maintenance of handwashing and sanitation facilities, protection from contaminants, proper labeling and storage of chemicals, employee health monitoring, and pest control. SSOP enhances product quality, promotes safe hygiene practices, and supports more straightforward implementation of Hazard Analysis and Critical Control Points (HACCP). These principles are crucial for maintaining sanitary conditions in food processing environments as outlined by the FDA and the National Seafood HACCP Alliance.

2.4 Good processed food production practices (CPPOB)

The concept of Good Processed Food Production Practices (CPPOB) in Indonesia was first introduced in 1978 by the Ministry of Health through Decree No. 23/Menkes/SKJI/1978 on Good Food Manufacturing Practices (CPMB). The implementation of CPPOB helps management establish a strong quality assurance system. Following the enactment of the Food Act No. 7 of 1996, applying quality standards for food products and production processes became mandatory for food producers.

CPPOB refers to proper practices, processes, and procedures applied during food production to prevent microbial, chemical, or physical contamination. It includes maintaining facilities and equipment, pest control, raw material handling, process control, labeling, product recall, and personnel training. Hazards not covered in the HACCP plan are generally addressed through CPPOB. While CPPOB focuses on hygiene and operational practices within production areas, Critical Control Points (CCP) emphasize food safety aspects.

The objectives of Good Processed Food Production Practices (CPPOB) include controlling the production environment, which covers the location, design, and construction of buildings and interiors, equipment, and water supply. It also emphasizes employee hygiene, including handwashing, proper clothing, footwear, and headwear, as well as managing injuries, illnesses, access flow, and chemical use.

Furthermore, CPPOB regulates the delivery, reception, handling, and storage of materials through inspection procedures for vehicles, loading and unloading, product checks, and allergen and waste control. Pest control procedures ensure proper monitoring of both the interior and exterior of the facility. Sanitation and pre-operational cleaning assessments are carried out to maintain hygiene standards, while equipment maintenance focuses on preventive actions and calibration. Product recall and traceability systems are established to ensure proper coding and labelling of finished products. Lastly, water safety is maintained through regular monitoring and treatment of water, ice, and steam to ensure their suitability for food processing.

Good Processed Food Production Practices (CPPOB) ensure food safety by maintaining hygiene and controlling contamination throughout production. Facility locations must be free from pollution sources, supported by clean water, and have proper waste management. Buildings and equipment should be designed from durable, non-toxic, and easy-to-clean materials, with clear separation between clean and dirty areas. Sanitation facilities, adequate lighting, ventilation, and proper waste disposal are essential to maintain a hygienic environment.

All production activities must follow strict hygiene procedures, including raw material inspection, controlled processing, and safe packaging. Employees must maintain personal hygiene, wear protective clothing, and receive proper training. Raw materials and packaging must meet safety standards, while storage, maintenance, and pest control systems must prevent contamination. Accurate labelling, documentation, and traceability ensure consumer protection and product reliability.

Finally, effective implementation of CPPOB requires commitment from management and staff through continuous training, monitoring, and evaluation. Proper transportation, regular inspections, and product recall systems maintain safety from production to distribution. By applying CPPOB consistently, food manufacturers can guarantee safe, high-quality products that comply with national food safety standards.

3 Research methodology

The preliminary study began with a visit to the Office of Labor and Industry of Padang City to identify the research subject within the Industry Sector. The data obtained included the list of SMEs participating in GMP training and the distribution data of rendang SMEs in Padang City. Problem identification is the process of recognizing issues that the researcher observes. The research problem is first identified through a preliminary study [10]. The Padang City Government is striving to enhance food safety in Padang City. Food safety is being investigated through SMEs engaged in the food sector. Improving food safety can be achieved by analyzing compliance with GMP and SSOP to ensure they align with the guidelines [11].

This research employs the Gap Analysis method, a common approach used to compare actual field conditions with the regulation's businesses are required to follow according to applicable rules. Gap analysis is often used to compare the actual conditions in the field with the regulations that a business should follow according to applicable rules [12]. The initial step involves creating a gap analysis checklist. The implementation of GMP is examined based on Regulation of the Minister of Industry of the Republic of Indonesia Number 75/M-IND/PER/7/2010 concerning Guidelines for GMP, and the implementation of SSOP is based on the guidelines of the Food and Drug Administration (FDA) USA.

The data collection in this research is divided into two categories: primary data and secondary data. Primary data are obtained from firsthand sources, such as interviews or questionnaire responses [13]. In this research, primary data is collected through surveys of rendang SMEs in Padang City, focusing on aspects of GMP and SSOP. Secondary data supports the needs of primary data and comes from various sources, including journals, theses, previous studies related to GMP and SSOP, and ministerial regulations.

The method used in this research is descriptive, involving observation and interviews. This study conducts surveys of SMEs producing rendang. Data collection begins with audits and direct observations of rendang SMEs in Padang City. The data is processed through the steps in the analysis of GMP and SSOP. The initial step involves identifying GMP based on the Regulation of the Minister of Industry of the Republic of Indonesia Number 75/M-IND/PER/7/2010 concerning Guidelines for GMP. Following this, SSOP is identified based on the guidelines of the FDA USA, which must be met to prevent product contamination. The percentage calculation is performed by determining the percentage of compliance and non-compliance as follows [14].

$$\text{Total compliance percentage} = \frac{A}{C} \times 100\% \quad (1)$$

$$\text{Total non-compliance percentage} = \frac{B}{C} \times 100\% \quad (2)$$

A = Total Compliant Criteria

B = Total Non-compliant Criteria

C = Total Criteria in scope

The analyzed data will be processed into information that is easy to understand and useful for finding solutions

to the problems faced by SMEs in the rendang sector. The data analyzed includes the results of the GMP identification and the SSOP identification analysis. The data analysis involves calculating the percentage of compliance and non-compliance using formulas (1) and (2). These calculations will provide a clear overview of the extent of compliance and non-compliance with GMP and SSOP standards. The result will be processed into information that is easy to understand and useful for identifying solutions to the issues faced by MSMEs in the rendang sector.

The purpose of this data analysis is not only to quantify the level of compliance but also to identify the underlying causes of non-compliance within each GMP and SSOP aspect. By interpreting the results, researchers can pinpoint which operational areas such as sanitation, employee hygiene, or documentation require the most improvement. This analytical approach allows for the development of targeted recommendations that are practical and achievable for MSMEs. Moreover, the analysis supports the continuous improvement process by providing a measurable framework that can be used for future evaluations and audits. Ultimately, these findings aim to enhance food safety performance and ensure that rendang producers in Padang meet national and international food quality standards.

4 Results and discussion

Data collection consisted of primary and secondary data. Primary data were obtained through direct interviews with five confirmed rendang business owners. Secondary data were gathered from regulations regarding GMP and

SSOP. Data collection took place from February 19, 2024, to March 2, 2024, through direct observations of rendang businesses in Padang, focusing on GMP and SSOP aspects.

4.1 GMP assessment

The GMP assessment contained 18 aspects of five rendang businesses, namely Rendang A, Rendang B, Rendang C, Rendang D, and Rendang E. Based on Table 2, the percentages of compliance and non-compliance for each rendang business are presented. The highest percentage of compliance with GMP aspects lies in Rendang E, with a value of 88%. This indicates that the GMP aspects implemented by Rendang E are almost in line with GMP standards. The highest percentage of non-compliance is found in Rendang A and Rendang B, with a value of 24%. The rendang business still requires recommendations for improving measurement results to ensure compliance with GMP standards.

Table 2. Overall GMP assessment aspects

No	Business Name	Percentage of Compliance	Percentage of Non-Compliance
1	Rendang A	76%	24%
2	Rendang B	76%	24%
3	Rendang C	87%	13%
4	Rendang D	84%	16%
5	Rendang E	88%	12%
Average		82%	18%

Table 3. Non-compliance assessment GMP aspects of MSMEs

MSMEs	A	B	C	D	E	Average of Non-Compliance
Aspects						
Location	0%	0%	14%	0%	0%	3%
Building	40%	32%	8%	20%	16%	23%
Sanitation Facilities	35%	35%	20%	20%	15%	25%
Machinery/Equipment	11%	11%	11%	11%	0%	9%
Raw material	0%	0%	0%	0%	0%	0%
Process Monitoring	29%	29%	7%	21%	14%	20%
The final product	0%	0%	0%	0%	0%	0%
Laboratory	100%	100%	50%	100%	100%	90%
Employee	29%	29%	14%	29%	0%	20%
Packer	0%	0%	0%	0%	0%	0%
Product Labels and Descriptions	0%	0%	0%	0%	0%	0%
Storage	0%	0%	0%	0%	0%	0%
Maintenance and Sanitation Program	14%	14%	29%	0%	14%	14%
Transportation	0%	100%	0%	0%	0%	20%
Documentation and Recording	100%	100%	100%	100%	100%	100%
Training	0%	0%	0%	0%	0%	0%
Product Recall	0%	0%	0%	0%	0%	0%
Implementation of Guidelines	33%	67%	67%	33%	67%	53%

Based on Table 3, the percentage of non-compliance in each rendang business regarding each aspect of GMP is presented. The highest average percentage of non-compliance is found in documentation and recording, at 100%. This indicates that five rendang businesses have not yet documented and maintained records regarding rendang production and employee information. The percentage of non-compliance is 0% for raw materials, final products, packaging, labels, product descriptions, storage, training, and product recalls. This shows that the five rendang businesses have maximally fulfilled this aspect

Based on the GMP assessment, several aspects require improvement, including location, building, sanitation facilities, equipment, and process supervision. The production site should build flood prevention structures such as levees and drainage systems to reduce flooding risks. Buildings must be renovated to eliminate dead corners and equipped with air curtains and mesh doors to prevent contamination. Sanitation facilities should include handwashing stations with hot water, closed trash bins, and proper hand dryers to ensure hygiene. Providing changing rooms and shoe-cleaning facilities is also essential to prevent cross-contamination between outside and work areas.

Production equipment needs humidity and air control systems to prevent microorganism growth and maintain stable production conditions. The production process should be monitored for temperature and time to ensure product safety. Workers must use protective equipment such as uniforms, helmets, and rubber shoes, while lighting fixtures should be covered to prevent accidents. Raw materials must undergo organoleptic, chemical, and microbiological testing to detect potential hazards. Businesses without laboratories are encouraged to collaborate with universities or certified external labs for product testing.

Additionally, employee health documentation and proper sanitation programs should be implemented to maintain food safety compliance. Chemicals must be stored in labelled containers to avoid misuse. Transportation tools like trolleys should be provided to ensure safe product handling and minimize contamination. Documentation of GMP implementation should be mandatory, supported by staff training on hygiene standards and operational procedures. This ensures that all employees understand and apply GMP principles, improving production quality and food safety consistency.

4.2 SSOP assessment

The SSOP assessment comprised eight aspects of five rendang businesses: Rendang A, Rendang B, Rendang C, Rendang D, and Rendang E.

Based on Table 4, the percentage of compliance and non-compliance for each rendang business is presented. The highest percentage of compliance with SSOP aspects is found in Rendang E, with a value of 74%. This indicates that the SSOP aspects implemented by Rendang E are almost in line with SSOP standards. The highest

percentage of non-compliance is found in Rendang A and Rendang B, with a value of 48%. The rendang business still requires recommendations for improving measurement results to ensure compliance with SSOP standards.

Table 4. Overall SSOP assessment aspects

No	Business Name	Percentage of Compliance	Percentage of Non-Compliance
1	Rendang A	52%	48%
2	Rendang B	52%	48%
3	Rendang C	70%	30%
4	Rendang D	63%	37%
5	Rendang E	74%	26%
Average		62%	38%

Based on Table 5, the percentage of non-compliance in each rendang business regarding each aspect of SSOP is presented. The highest average percentage of non-compliance is found in employee health control, at 100%. This indicates that the five rendang businesses still lack control over employee health. The percentage of non-compliance is 0% for food protection. This shows that the five rendang businesses have maximally fulfilled this aspect.

Table 5. Non-compliance assessment SSOP aspects

Aspects	MSMEs					Average of Non-Compliance
	A	B	C	D	E	
Water Safety	50%	50%	50%	50%	50%	50%
Surface Cleanliness	33%	33%	33%	33%	33%	33%
Prevention of Cross Contamination	20%	20%	0%	20%	0%	12%
Sanitation Facilities	67%	100%	33%	67%	33%	60%
Food Protection	0%	0%	0%	0%	0%	0%
Labeling	67%	33%	67%	0%	0%	33%
Employee Control	100%	100%	100%	100%	100%	100%
Pest Prevention	75%	75%	0%	50%	25%	45%

Based on the SSOP assessment, several aspects need improvement, including water safety, surface cleanliness, cross-contamination prevention, sanitation facilities, labelling, employee health control, and pest prevention. Water used in production should be tested at least twice a year during the dry and rainy seasons to monitor quality changes, while microbiological testing should be conducted monthly by the QC team. Regular testing ensures that the water meets hygiene standards and prevents contamination risks. Equipment in production areas should also undergo monthly microbiological testing to maintain sanitation and ensure the safety of processed food.

To prevent cross-contamination, employees must wear designated uniforms separate from outside clothing. Sanitation facilities should be sufficient for the number of employees and include handwashing stations with dryers, covered trash bins, and foot baths to maintain cleanliness before entering work areas. All toxic materials must be stored in sealed, clearly labelled boxes to avoid misuse, and product storage conditions should be recorded to maintain safety and quality. Regular health checks and recordkeeping are required for employees to prevent the spread of infectious diseases and ensure workplace safety.

Air vents should be fitted with insect screens, and air filters must be installed to reduce dust and airborne contaminants. Pest control programs should be established to monitor and manage pest activity around the production site. These measures are essential to ensure a hygienic and safe food processing environment. Proper implementation of SSOP guidelines not only supports product quality but also reinforces compliance with food safety standards, minimizing contamination risks and maintaining consumer trust.

To further deepen the analysis, a comparative review of similar studies on GMP and SSOP compliance in other regions and industries was conducted. For instance, a study on rendang production in West Sumatra (Istana Rendang Jambak) found that GMP compliance ranged from 34.17% to 85%. In comparison, SSOP compliance varied from 0% to 68.75%, indicating significant room for improvement in these food safety practices. Similarly, research across small and medium-sized food enterprises globally, including those in developing regions such as East Java, has shown that compliance with GMP and SSOP often faces challenges due to limited resources, a lack of technical knowledge, and difficulties in implementing complex hygiene standards [15].

5 Conclusion

Based on research findings on GMP and SSOP aspects, the researcher concludes the following: The measurement of GMP and SSOP began with conducting direct surveys at the location. The assessment results of GMP and SSOP were obtained by filling out the GMP and SSOP checklist forms. The forms contain statements indicating whether the aspects of GMP and SSOP are met or not. As a result, Rendang A's application of GMP demonstrated a compliance rate of 76%, whereas SSOP achieved a compliance rate of 52%. Rendang B's application of GMP also showed a compliance rate of 76%, with SSOP at 52%. Rendang C's application of GMP demonstrated a compliance rate of 87%, with SSOP at 70%. Rendang D's application of GMP indicated a compliance rate of 84%, with SSOP at 63%. Rendang E's application of GMP achieved a compliance rate of 88%, with SSOP at 74%. These figures indicate that there are still percentages of non-compliance in each GMP and SSOP indicator, which help provide recommendations based on the measurement results. Overall, among the five rendang businesses, there are GMP aspects that have not met the compliance percentages, including building, sanitation facilities, machinery/equipment, process supervision, laboratory,

employee training, maintenance and sanitation programs, and documentation and recording. Meanwhile, SSOP aspects such as water safety, surface cleanliness, cross-contamination prevention, sanitation facilities, labeling, employee health control, and pest prevention also require improvement.

Recommendations were provided for aspects that did not meet GMP and SSOP standards. For GMP, improvements are recommended in the areas of location, building structure, sanitation facilities, machinery and equipment, process supervision, laboratory, employee hygiene, maintenance and sanitation programs, transportation, documentation and recording, and guideline implementation. For SSOP, improvements are needed in water safety, surface cleanliness, prevention of cross-contamination, sanitation facilities, labeling, employee health control, and pest prevention. The proposed recommendations include adding sanitation and hygiene facilities, installing educational posters on handwashing, improving documentation and recordkeeping, and ensuring the consistent use of personal protective equipment and health monitoring for employees. These actions are expected to increase the overall level of GMP and SSOP compliance.

To address these issues, policymakers should prioritize enhanced training programs and support for MSMEs, with a focus on improving sanitation facilities, employee health standards, and documentation practices. Government support, in the form of subsidies or grants, for upgrading facilities could help address the infrastructure challenges, particularly in buildings and sanitation systems. Additionally, enforcing mandatory food safety training programs for all employees, including workers in smaller MSMEs, can significantly improve compliance with GMP and SSOP standards. Moreover, industry practitioners can collaborate with local food safety experts and international organizations to implement best practices in pest control, cross-contamination prevention, and sanitation procedures. Establishing regular audits and certifications will also incentivize MSMEs to maintain higher standards and ensure continuous improvement. By addressing these gaps, MSMEs can enhance their food safety measures, reduce risks of contamination, and improve the overall quality of their products, ultimately benefiting both consumers and the broader food industry.

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