

REGULAR ARTICLE

Gap Analysis of Good Manufacturing Practice Compliance in Fruit Crunch Production: A Case Study of CV Sahabat Pangan*Fifi Dian Anugraheni^{*1}, Dianita Kumalasari², Arinda Novita Dewi³***Address:**¹Universitas Pembangunan Nasional "Veteran" Jawa Timur, Faculty of Engineering and Science, Departement of Food Technology, Jl. Raya Gunung Anyar, 60294 Surabaya, East Java, Indonesia, Telp (031) 8782179²Universitas Pembangunan Nasional "Veteran" Jawa Timur, Faculty of Engineering and Science, Departement of Food Technology, Jl. Raya Gunung Anyar, 60294 Surabaya, East Java, Indonesia³CV Sahabat Pangan, Jl. Klayatan Gg. 2/18, Bandungrejosari, Sukun, 65148 Malang, East Java, Indonesia*Corresponding author: 23033010009@student.upnjatim.ac.id**ABSTRACT**

Good Manufacturing Practices (GMP) serve as a fundamental prerequisite for ensuring food safety and quality by controlling potential hazards throughout the production process. This study aimed to evaluate the level of GMP compliance at CV Sahabat Pangan based on the Regulation of the Minister of Industry of the Republic of Indonesia No. 75/M-IND/PER/7/2010 using Gap Analysis, identify existing nonconformities, and propose corrective actions. A descriptive study with a cross-sectional approach was conducted. Data were collected through direct observation, interviews, and document review using a GMP checklist developed in accordance with the Good Processed Food Manufacturing Practices (CPPOB) guidelines. A scoring system was used to assess the implementation level of each GMP aspect, followed by Gap Analysis to compare actual practices with regulatory requirements. The results showed that the overall GMP implementation level at CV Sahabat Pangan reached 96.93%, indicating a high level of compliance with GMP requirements. Of the 189 parameters evaluated, most met the established standards, although several nonconformities were still identified. Major nonconformities were primarily related to employee hygiene, storage practices, equipment condition, pest control, and waste management, while minor nonconformities were found in building conditions, sanitation facilities, and chemical labeling. Overall, GMP has been implemented effectively at the company. However, improvements in the identified areas are necessary to strengthen the effectiveness of the food safety system and support continuous improvement.

Keywords: Good Manufacturing Practices (GMP), Gap Analysis, Corrective Action, Food Industry**INTRODUCTION**

The food industry is responsible for producing products that are safe, of high quality, and suitable for consumption. Food safety refers to the conditions and measures necessary to prevent food from being contaminated by biological, chemical, or physical hazards that may endanger human health, as regulated by Indonesian Food Law No. 18 of 2012. The importance of food safety is reflected in data from the World Health Organization (WHO), which indicate that more than 200 diseases can be transmitted through contaminated food (foodborne diseases) (Guntur & Rosyani, 2020). As the food industry continues to expand and consumer demand for processed food products increases, the risk of food contamination has also become more significant. Contamination may arise from various sources, including inadequate hygiene and sanitation practices, poor production environments, improper use of food additives, and contamination during processing and handling. These conditions can reduce product quality and pose potential health risks to consumers (Aini *et al.*, 2023). Therefore, effective control systems are needed to ensure product safety and quality throughout the production process. One of the fundamental prerequisites for ensuring food safety is the implementation of Good Manufacturing Practices (GMP). GMP provides a set of guidelines designed to control biological, chemical, and physical hazards during food production, thereby ensuring that food products are safe, of consistent quality, and suitable for consumption (Fajrah & Ridho, 2026).

Good Manufacturing Practices (GMP) are fundamental requirements that must be implemented by food industries to ensure the production of safe, high-quality, and suitable food products. GMP also serves as a prerequisite program for the implementation of more advanced food safety systems, such as Hazard Analysis and Critical Control Points (HACCP). As a prerequisite program, GMP encompasses a range of basic requirements that must be fulfilled throughout the production chain, from raw material reception to the distribution of finished products, in order to prevent contamination and ensure food safety. In Indonesia, GMP implementation is regulated under the Regulation of the Minister of Industry of the Republic of Indonesia No. 75/M-IND/PER/7/2010 concerning Good Processed Food Manufacturing Practices (CPPOB). The regulation

covers various aspects of food production, including production site and environment, buildings and facilities, production equipment, water supply, hygiene and sanitation facilities, process control, storage, employee health and hygiene, supervision, product recall, employee training, as well as record keeping and documentation (Rudiyanto, 2016).

Although GMP has been widely established as a fundamental guideline for food processing industries, its implementation still faces various challenges in practice. Nonconformities may arise due to several factors, including limitations in human resources, inadequate infrastructure, and weaknesses in internal quality control systems (Syahid *et al.*, 2025). These conditions can hinder the consistent implementation of GMP requirements and result in gaps between actual practices and established standards. Therefore, regular evaluation is necessary to assess the extent of GMP implementation within a company. One approach that can be used for this purpose is Gap Analysis, which identifies discrepancies between current practices and the requirements specified by applicable standards. Through this method, areas that do not fully comply with GMP requirements can be systematically identified, providing a basis for developing appropriate corrective actions and improvement strategies (R. P. A. Dewi *et al.*, 2025).

CV Sahabat Pangan is a food processing company that produces a variety of fruit- and vegetable-based snack products, including banana crunch, apple crunch, jackfruit crunch, mango crunch, salak chips, sweet potato crunch, oyster mushroom chips, and broccoli chips. The diversity of products and the multiple stages involved in the production process require consistent implementation of GMP to maintain product quality and safety. As a food processing industry, compliance with GMP is essential to ensure that products are manufactured under controlled conditions and meet food safety requirements. Therefore, periodic evaluation of GMP implementation is necessary to assess the extent to which current practices comply with established standards. This study aimed to evaluate the implementation of GMP at CV Sahabat Pangan based on the Regulation of the Minister of Industry of the Republic of Indonesia No. 75/M-IND/PER/7/2010 using Gap Analysis. Specifically, the study assessed the level of compliance and noncompliance with GMP requirements and developed corrective action recommendations for aspects that did not fully meet the prescribed standards.

MATERIAL AND METHODS

Study Site and Research Design

This study employed a descriptive design with a cross-sectional approach and was conducted at CV Sahabat Pangan, located in Malang, East Java, Indonesia, over a three-month period from March to May 2026. The cross-sectional approach was used to observe and assess the compliance of actual production practices with GMP requirements at a specific point in time.

Data Collection

Data were collected through direct observation, interviews, and document review, adapted from methods used in previous studies (R. N. Dewi *et al.*, 2024). Observations were carried out in the production area to assess the actual implementation of Good Manufacturing Practices (GMP). Interviews were conducted with the company owner, production staff, and quality control (QC) personnel to obtain supporting information regarding GMP implementation. Document review involved the examination of production records, Sanitation Standard Operating Procedures (SSOP), and other relevant documents. Data were collected using a GMP checklist developed based on the Regulation of the Minister of Industry of the Republic of Indonesia No. 75/M-IND/PER/7/2010.

GMP Assessment and Gap Analysis

The collected data were analyzed using a Gap Analysis approach by comparing the actual implementation of Good Manufacturing Practices (GMP) at CV Sahabat Pangan with the requirements specified in the Regulation of the Minister of Industry of the Republic of Indonesia No. 75/M-IND/PER/7/2010 concerning Good Processed Food Manufacturing Practices (CPPOB). The analysis was conducted to identify compliance and noncompliance across individual GMP parameters and to evaluate the implementation level of each GMP aspect assessed during the study.

The level of GMP implementation was assessed using a scoring system adapted R. N. Dewi *et al.* (2024). The scoring criteria are presented in **Table 1**. The percentage of GMP implementation for each aspect was calculated by comparing the obtained score with the maximum possible score using the following equation:

Table 1. Scoring criteria used for GMP implementation assessment

Score	Criteria
1	The requirement was not implemented
2	The company recognized the importance of the requirement but had not implemented it, or the required conditions had not been fulfilled.
3	The activity had been carried out, but implementation was limited to documentation or record-keeping.
4	The activity had been implemented, but not consistently applied.
5	The activity had been fully implemented, consistently applied, and complied with all applicable requirements.

$$\% \text{ GMP Implementation} = \frac{\text{Score of each parameter}}{\text{Maximum score}} \times 100\%$$

The calculated implementation percentages were interpreted according to the established criteria. Implementation levels between 75% and 100% indicated compliance with GMP requirements, values between 50% and 74% indicated that improvements were required, and values between 1% and 49% indicated the need for substantial improvements in GMP implementation (R. N. Dewi *et al.*, 2024). In addition, the percentages of compliant and noncompliant GMP parameters were calculated using the following equation Sari *et al.* (2024):

$$\% \text{ Compliance} = \frac{\text{Number of compliant parameters}}{\text{Total parameters assessed}} \times 100\%$$

$$\% \text{ Noncompliance} = \frac{\text{Number of noncompliant parameters}}{\text{Total parameters assessed}} \times 100\%$$

Parameters that did not comply with GMP requirements were further classified according to the severity of noncompliance based on the Regulation of the Head of the Indonesian National Agency of Drug and Food Control (BPOM) No. HK.03.1.23.04.12.2207 of 2012. Noncompliance related to requirements categorized as “mandatory” was classified as critical, requirements categorized as “should” were classified as serious, and requirements categorized as “may” were classified as minor (Sari *et al.*, 2024). The identified noncompliances were subsequently used as the basis for developing corrective action recommendations to improve GMP implementation at CV Sahabat Pangan.

RESULTS AND DISCUSSION

The implementation of Good Manufacturing Practices (GMP) at CV Sahabat Pangan was evaluated across 18 GMP aspects comprising a total of 189 assessment parameters. Based on the evaluation conducted using the Regulation of the Minister of Industry of the Republic of Indonesia No. 75/M-IND/PER/7/2010 as the reference standard, the company achieved an average GMP implementation score of 96.93%. According to the interpretation criteria proposed by R. N. Dewi *et al.* (2024), this value falls within the 75–100% range, indicating that CV Sahabat Pangan generally complies with the requirements of Good Processed Food Manufacturing Practices. The implementation scores for each GMP aspect are presented in **Table 2**.

Table 2. GMP Implementation Scores by Aspect at CV Sahabat Pangan

No	GMP Aspects	Number of Parameters	Total Score of Each Parameter	Maximum Score Amount	% implementation
1	Location	7*	33	35	94,29
2	Building	35*	172	175	98,29
3	Facility Sanitation	24*	110	120	91,67
4	Machinery and Equipment	13*	64	65	98,46
5	Material	9*	45	45	100,00
6	Process Monitoring	25*	124	130	95,38
7	Final Product	3*	15	15	100,00
8	Laboratory	3*	15	15	100,00
9	Employee	8*	38	40	95,00
10	Packaging	8*	40	40	100,00
11	Label and Descriptions Product	2*	10	10	100,00
12	Storage	9*	42	45	93,33
13	Maintenance and Sanitation Program	24*	114	120	95,00
14	Transportation	3*	15	15	100,00

No	GMP Aspects	Number of Parameters	Total Score of Each Parameter	Maximum Score Amount	% implementation
15	Documentation and Record Keeping	1*	5	5	100,00
16	Training	6*	30	30	100,00
17	Withdrawal Product	6*	30	30	100,00
18	Implementation Guidelines	3*	15	15	100,00
	Total	189	917	950	1761,42
Avarage Implementation Score					97,86

Note: The assessment parameters were based on the Regulation of the Minister of Industry of the Republic of Indonesia No. 75/M-IND/PER/7/2010 concerning Good Processed Food Manufacturing Practices (CPPOB).

As shown in **Table 1**, nine GMP aspects achieved full implementation scores (100%), namely final products, laboratory, packaging, product labeling, transportation, documentation and record keeping, product recall, and guideline implementation. Full compliance in these aspects reflects the company's commitment to maintaining consistent production practices that support food quality and safety. Although the overall level of GMP implementation at CV Sahabat Pangan met the established standards, several parameters were still found to be noncompliant. Of the 189 parameters evaluated, 165 (87.30%) were classified as compliant, 21 (11.11%) were identified as noncompliant, and 3 (1.59%) were categorized as not applicable (NA). Sanitation facilities showed the lowest implementation level (83.33%), followed by storage practices (93.33%). These findings indicate that several aspects still require improvement to achieve more effective GMP implementation. Therefore, a gap analysis was conducted to identify the causes of noncompliance and to develop appropriate corrective actions.

Based on the classification criteria specified in the Regulation of the Head of the Indonesian National Agency of Drug and Food Control (BPOM) No. HK.03.1.23.04.12.2207 of 2012, a total of 21 parameters were found to be noncompliant with the basic GMP requirements at CV Sahabat Pangan. These noncompliances consisted of 8 major and 12 minor findings, while no critical noncompliances were observed. The results of the gap analysis for GMP compliance are presented in **Table 3**.

Table 3. GMP Gap Analysis Results Based on Requirement Compliance

Category	Number of Parameters	Percentage (%)
Compliant Parameters	165	87,30
Noncompliant Parameters		
Major	8	
Minor	13	
Total Noncompliant Parameters	21	11,11

The eight major noncompliances identified in this study indicate that several important GMP requirements have not been fully met. These findings require priority attention because they may affect the consistency of product quality and safety. Employee hygiene was identified as one of the main concerns, as some workers continued to participate in production activities while experiencing cough and cold symptoms, and handwashing practices before entering the production area were not consistently applied. Food handlers are recognized as potential sources of biological contamination through direct contact involving hands, work clothing, and hair. According to Juhaina (2020), food handlers suffering from infectious diseases may contaminate food through droplets or direct contact. Bacteria such as *Staphylococcus aureus* can be transmitted through the nose and throat, while *Salmonella*, *Streptococcus*, and *Clostridium perfringens* may be transmitted through the skin. Furthermore, proper handwashing with soap for at least 10 seconds has been reported to remove more than 90% of transmissible microorganisms, thereby reducing the risk of food contamination.

The location aspect showed a major noncompliance related to the accumulation of unused materials around the production area. Such materials create dark and sheltered conditions that may serve as hiding and nesting sites for rodents. This risk is further increased by the factory's proximity to active plantation areas, which naturally provide habitats for rodents and insects. According to Prabandari *et al.* (2022), the presence of rodent nesting sites around food processing facilities can act as a temporary refuge for pests and increase the likelihood of pest intrusion into production areas through building openings or structural gaps when pest populations rise in the surrounding environment.

The equipment aspect showed a major noncompliance related to the use of containers with physical damage, such as cracks and chipped surfaces. Damaged equipment may retain food residues and provide favorable providing favorable conditions for microbial growth and biofilm formation. In addition to biological contamination, damaged containers may also increase the risk of physical contamination, as fragments generated from repeated use and mechanical stress can be transferred into the product. Such conditions may compromise both product quality and food safety (N & Pujianto, 2020).

The storage aspect exhibited several major noncompliances, including raw materials being stored directly against walls and the absence of segregation and labeling based on inspection status. According to Ma'roef *et al.* (2021), raw materials should be stored on pallets with adequate clearance from walls to maintain air circulation, facilitate handling, and allow effective cleaning and inspection of the storage area. In addition, quality control procedures require raw materials to be classified according to their inspection status (e.g., accepted or rejected). Newly received, inspected, and uninspected materials should therefore be stored separately and clearly labeled to prevent the unintended use of materials during production. Another noncompliance was observed in the banana storage area, where flies were present around stored bananas. Mila *et al.* (2023) report that fly larvae feed on fruit flesh, leading to premature spoilage before the ripening process is completed and ultimately reducing the quality of the raw materials.

The maintenance and sanitation program aspect showed a major noncompliance related to the direct discharge of wastewater generated from production and sanitation activities without prior treatment through a wastewater treatment facility. According to Khomarisah *et al.* (2021), wastewater from food processing industries typically contains high levels of organic matter, including carbohydrates, fats, oils, and suspended solids, which contribute to elevated biological oxygen demand (BOD), chemical oxygen demand (COD), and total suspended solids (TSS). The direct disposal of untreated wastewater may adversely affect the surrounding environment and generate unpleasant odors due to the natural decomposition of organic materials.

Minor noncompliances were identified in several parameters that do not directly affect product quality and safety but still require corrective action. Within the building and facilities aspect, the junctions between floors and walls, as well as between adjoining walls, were constructed with right-angle corners. Such conditions may facilitate the accumulation of dirt and water, making routine cleaning and sanitation activities more difficult (Suparmono *et al.* 2020). In addition, inadequate lighting was observed in the raw material peeling area. Insufficient lighting intensity may reduce visual comfort, increase eye fatigue, and elevate the risk of observation errors and visual stress among production personnel (Baraja *et al.*, 2025).

The sanitation facilities aspect showed several minor noncompliances. Waste bins were not segregated according to waste type (organic, inorganic, and glass waste), and their interiors were not lined with plastic bags. Such conditions may hinder proper waste management and increase the risk of odor generation and contamination from decomposing waste materials (Suryanto & Sipahutar, 2020). In addition, handwashing stations were not equipped with hand-drying facilities, which may facilitate the transfer of microorganisms from wet hands to equipment or food products. The production area also lacked footwear cleaning or sanitizing facilities, increasing the risk of introducing dirt and contaminants from outside into the production environment (Fadhilah *et al.*, 2025).

Within the maintenance and sanitation program aspect, cleaning chemicals stored on shelves were not provided with clear identification labels. This condition may increase the risk of misidentification and improper use of chemicals during sanitation activities. According to Yuniasih (2025), proper labeling and storage of cleaning chemicals protect processed food products from unintended contamination by hazardous substances. Clear identification labels also facilitate monitoring, prevent the misuse of chemicals, and reduce the risk of cross-contamination during production. Therefore, appropriate labeling and storage of cleaning chemicals are essential to support effective sanitation practices and ensure food safety.

Based on the noncompliances identified during the GMP evaluation at CV Sahabat Pangan, a set of corrective action recommendations was developed with reference to GMP requirements and the company's existing conditions. These recommendations are intended to reduce potential contamination risks, improve compliance with GMP standards, and support continuous improvement in product quality and food safety. The proposed corrective actions for each identified noncompliance are presented in **Table 4** and **Table 5**.

Table 4. Corrective Action Recommendations for Minor GMP Noncompliances at CV Sahabat Pangan

GMP Aspect	Noncompliance	Corrective Action
Building	Floor-to-wall and wall-to-wall junctions were constructed with right-angle corners, and lighting in the peeling area was inadequate.	Gradually improve facility conditions by installing coving at floor-to-wall junctions to facilitate cleaning and sanitation activities. Increase lighting intensity in the peeling area by upgrading or adding lighting fixtures to ensure adequate illumination during production operations.
Facility Sanitation	Waste bins were not segregated by waste type (organic,	Provide clearly segregated waste bins for organic, inorganic, and glass waste using labels

GMP Aspect	Noncompliance	Corrective Action
	inorganic, and glass waste) and were not lined with plastic bags. Handwashing stations lacked hand-drying facilities, and no footwear cleaning or sanitizing area was available.	or color-coding, and line each waste bin with disposable plastic bags.
Maintenance and Sanitation Program	Cleaning chemicals stored on shelves were not provided with clear identification labels.	Apply clear identification labels to all cleaning chemical containers to ensure proper identification and handling.

Tabel 5. Corrective Action Recommendations for Minor GMP Noncompliances at CV Sahabat Pangan

GMP Aspect	Noncompliance	Corrective Action
Location	Unused materials were accumulated around the production area, and the facility was located adjacent to active plantation land.	Remove and properly segregate unused materials from the surrounding area, and install a secure permanent fence to restrict pest access from adjacent plantation land.
Machinery and Equipment	Plastic containers with chipped or cracked surfaces were still used during production, and equipment maintenance was performed only after damage occurred.	Replace damaged containers with food-grade containers in good condition and implement a preventive maintenance program with a regular inspection schedule for production equipment.
Employee	Employees with minor illnesses were allowed to enter and work in the production area	Limit the working hours of employees with minor illnesses, require the use of N95 masks in low-risk production areas, and assign cross-trained personnel as substitutes when necessary.
Storage	Raw materials were stored directly against walls, inspection status labels were not provided, and newly received, inspected, and uninspected materials were stored together. Flies were also observed in the banana storage area.	Reorganize the storage layout by maintaining a clearance of 15–30 cm between raw materials and walls. Implement a clear labeling system to distinguish newly received, inspected, and uninspected materials. Install wire mesh on ventilation openings, place insect glue traps in the banana storage area, and install UV insect-killing lamps at entrances to the peeling area to strengthen pest control.
Maintenance and Sanitation Program	Pest nesting sites were not consistently controlled, and wastewater was discharged directly into external drainage channels without prior treatment.	Implement routine pest control and monitoring programs, and place additional traps at locations with a high risk of pest breeding. Establish a simple on-site wastewater treatment system, including a sedimentation tank, to reduce soap residues and suspended solids before wastewater is discharged into public drainage channels.

The corrective actions proposed in this study were developed based on the type and severity of the identified noncompliances, with the aim of strengthening GMP implementation through the principle of continuous improvement. Recommendations addressing major noncompliances should be prioritized because they pose a greater potential risk to product quality and food safety. These include improvements in employee hygiene practices, replacement of damaged equipment, optimization of raw material storage systems, enhancement of pest control programs, and proper wastewater management. In contrast, corrective actions related to minor noncompliances focus on improving supporting facilities and operational practices, such as upgrading building conditions, enhancing sanitation facilities, and ensuring proper identification of cleaning chemicals. Although these findings are classified as minor, their consistent improvement contributes to a more effective GMP system and helps prevent the recurrence of noncompliance. Therefore, the implementation of the proposed corrective actions, supported by regular monitoring and periodic evaluation, is expected to strengthen food safety assurance and promote sustainable GMP implementation at CV Sahabat Pangan.

CONCLUSION

This study showed that the implementation of Good Manufacturing Practices (GMP) at CV Sahabat Pangan reached 96.93%, indicating that the company generally complied with the requirements of Good Processed Food Manufacturing Practices (CPPOB). However, the gap analysis identified several noncompliances, consisting mainly of major findings related to employee hygiene, equipment condition, raw material storage, pest control, and wastewater management, as well as minor findings associated with building conditions, sanitation facilities, and chemical labeling. These findings indicate that a high level of GMP implementation should be accompanied by consistent compliance with all GMP requirements to further minimize contamination risks and strengthen food safety assurance. Therefore, corrective actions addressing the identified noncompliances are necessary to improve the effectiveness of GMP implementation and support continuous improvement within the company. Future studies are recommended to employ a before-and-after approach to evaluate changes in GMP compliance following the implementation of corrective actions and to assess their effectiveness more objectively.

ACKNOWLEDGMENTS

The authors gratefully acknowledge CV Sahabat Pangan for its cooperation, support, and assistance throughout the conduct of this study. The authors also extend their appreciation to Universitas Pembangunan Nasional "Veteran" Jawa Timur for the academic support provided during the completion of this research.

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