Level of Implementation of GMP and SSOP in SMEs Wet Noodle Production Process with Gap Analysis Tools

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Abstract: The main characteristics of wet noodle products that determine the quality and limits of food safety are the relatively short shelf life of wet noodle products, 10-12 hours at room temperature due to their high-water content, and the absence of harmful substances such as formalin and boric acid. To ensure that the product is of high quality and safe for consumers, the production process must have proper control to manage the shelf life and minimize any potential risks. This study aims to analyze the level of application of the basic feasibility of GMP and SSOP for wet noodle production. This research is a quantitative descriptive study using survey methods in collecting data through observation and interviews with questionnaires through case studies in wet noodle producers SMEs and analyzed by gap analysis tools. The percentage calculation using gap analysis tools for each GMP and SSOP aspect shows that the level of compliance is 69% for the GMP aspect and 75% for the SSOP aspect. Compliance with GMP aspects is included in category 2 (50% - 74%), so it can be concluded that the program GMP on SMEs still needs improvement to comply with GMP regulations. The results show that the SSOP aspect of GMP compliance with a score of 75% falling into category 1 (75% - 100%), indicated that the SSOP program on SMEs is already in compliance with SSOP requirement.

Keywords: Small and Medium Enterprises (SMEs), wet noodles, Good Manufacturing Practices (GMP), Sanitation Standard Operating Procedure (SSOP)

1. Introduction

According to applicable procedures and regulations, the main raw material for wet noodle products is wheat flour, with or without other food additives. The process of making wet noodles starts with mixing the main ingredients and additional ingredients, then stirring, making layers, and then cutting according to the size of the noodles you want. Under these conditions, noodle products may or may not go through the cooking process (boiling or steaming)[1)]. In simple terms, wet noodles are processed from flour-based ingredients mixed with other additives[2)]. Wet noodles are a popular food product and are often consumed by most consumers both as breakfast and as a snack[3)], and can replace rice as a staple food for Indonesian people[4)].

One of the strategies to succeed in the wet noodle industry is to improve product quality. Besides that, it can also be done by maintaining and increasing shelf life, adding marketing connections, using information technology, and providing added value to products. Standard is one of the criteria that a product meets quality parameters. Good wet noodle products are processed following applicable regulations to produce quality products and following regulatory provisions. Therefore, the production processes play an important role, and proper handling is needed to maintain the quality until the product reaches the hands of consumers for consumption. Product quality improvement is carried out by controlling the processing through the application of a food safety management system in the form of a basic feasibility program based on the concept of an integrated quality management program. This program consists of the application of Good Manufacturing Practice (GMP) and Sanitation Standard Operating Procedures (SSOP). GMP and SSOP must be carried out in all types of food and beverage production businesses, both modern and traditional. An effective quality management system in food processing can ensure product quality and safety. The application of GMP consists of 19 aspects that should be applied in the production process[5)]. At the same time, the application of SSOP discusses the general maintenance of buildings or business facilities, materials used for cleaning or sanitation, pest control, surface sanitation, storage, and handling of equipment[6)].

Determination of the quality and safety limits of wet noodle products can be seen from the main characteristics, namely in terms of short shelf life[7)] having a relatively

high water content[8] and without preservatives such as boric acid and formalin[1]. This condition makes wet noodle products mostly stored and circulated as frozen food products, so wet noodles have a moderate health risk[9]. This shelf life and level of risk require processing control in the production process so that it is quality and safe when consumed by consumers. One of the obstacles faced by wet noodle producers, among others, is the lack of attention to sanitation and hygiene, especially in the home industry or small and medium enterprises (SMEs). This can lead to poor quality and short shelf life of the product[10]. Good and consistent implementation of GMP and SSOP is expected to maintain product quality and competitiveness.

This study aims to analyze the level of implementation of the basic feasibility of GMP and SSOP for wet noodle production. The implementation of GMP is mandatory for all food processing industries, including SMEs, that will sell their products in the Indonesian market. The GMP implementation model is universal, generic, and a one size fits all type of organization. With the existing limitations, implementing GMP is a challenge for SMEs. For SMEs to effectively and efficiently implement GMP, their traditional model needs to be simplified and made more cost-effective[11]. Through analysis of levels and gaps in GMP implementation, it is hoped that it will contribute to continuous improvement for SMEs and related agencies as government representatives in developing SMEs.

This paper contributes to the discovery of aspects of the ability and inability of SMEs to implement GMP and SSOP, especially for SMEs producing wet noodles. Because the regulations for implementing GMP and SSOP are general in nature for all scales of food processing businesses, it is important to know about the inability of SMEs to implement them and can be used as further recommendations. Furthermore, to determine whether the inability of SMEs to comply with regulations is a result of the regulations being unworkable for the scope of SMEs, further examination is needed to overcome these problems.

2. Literature review

2.1 Good Manufacturing Practices (GMP)

GMP is a reference for every food processing industry to pay attention to every aspect of food safety to produce quality and healthy food for consumers. Food and drinks consumed by the public must comply with health standards, and if they are inappropriate, they are prohibited from being sold[12]. The practice of GMP is an attempt to guarantee the quality of a product so that every food processing industry must control its production to obtain the quality that meets standards[13]. Following the guidelines of GMP involves minimizing the risk of producing a poor-quality product[14].

In general, the regulations of GMP consist of hygienic design and construction of food production, design and construction of production equipment, cleaning and disinfection of equipment, selection high quality of production materials, worker hygiene training, and complete company documentation. Good Manufacturing Practices covers 19 aspects consisting of location, buildings, sanitation facilities, machinery and equipment, materials, process control, final products, laboratories, employees, packaging, product labels and descriptions, storage, maintenance and sanitation programs, transportation, documentation, and recording, training, product recall and implementation of guidelines[6,12]. The reference for applying GMP in Indonesia is regulated and follows the Minister of Industry Regulation No. 75: 2010.

GMP is a guideline as a reference for general manufacturing practices for all food processing industries, both large, medium, and SMEs[5]. The application of GMP provides benefits from improving product quality, safety, and feasibility of consumption [12)6]. Even though it can improve quality, especially for SMEs, implementing GMP is not an easy task due to limitations in knowledge, technology, capital, human resources, and equipment [15)16].

2.2 Sanitation Standard Operating Procedures (SSOP)

Sanitation is generally applied to the food processing industry, which aims to create and maintain hygiene starting from production until the product is marketed in a clean place. The process of sanitation consisting of several stages aims to maintain cleanliness and prevent food contamination. Sanitation works by controlling the causes or factors in production that can pose a hazard seen from receiving raw materials until the product is distributed[17]. To ensure food quality, it is necessary to carry out an effective sanitation program. Deviations in the application of the SSOP, could lead to contamination and are, therefore, a cause for concern. The implementation of the SSOP must be accompanied by control and verification[18]. Aspects assessed from the SSOP are as follows:

a. Water safety
b. Cleanliness of surfaces in contact with food
c. Cross-contamination prevention
d. Employee hygiene
e. Adulteration prevention
f. Proper labelling and storage
g. Employee health control
h. Pest eradication[17].

2.3 Wet noodle product

To produce wet noodles with a chewy texture, uniform color, and a soft, non-mushy taste, a series of steps are followed, including mixing, milling, printing, boiling, and draining[4]. Wet noodles are considered cooked if they go through a boiling or steaming process, and considered raw if they do not[1]. They have a high-water content, so they are classified as the type of noodle that is the fastest to damage and has a short shelf life at room temperature. Food products with high water content are susceptible to

bacterial contamination which poses a risk of food poisoning. Fraud occurs when manufacturers use hazardous chemicals or substances, such as formalin as a preservative. When consumed in high doses or frequently, these chemicals will cause cancer in the human digestive tract[19].

Wet noodles are widely used and stored by traders compared to dry noodles because they are more practical and can be used directly without having to be boiled again[8]. Consumption of wet noodles (meatball noodles, fried noodles, and boiled noodles) in Indonesia reaches 2,488 portions per month per capita of the Indonesian population (not including instant noodles). The total population of Indonesia in 2019 was 268.7 million, so the consumption of boiled and fried noodles per month was 667.03 million portions per month or 22.23 million portions per day. The average per capita expenditure of the Indonesian population for the consumption of boiled and fried noodles is IDR. 19,466 per month, or 5,230 billion per month nationally[20]. This shows that wet noodle products' consumption, market share, and economic value are very high.

3. Research method

This quantitative descriptive study used survey methods to collect data through observation and interviews with questionnaires. The questionnaire was prepared following the GMP and SSOP parameters in the Regulation of the Minister of Industry No. 75: 2010. The research subject is an SME producer of wet noodles in Central Java. This research was conducted by assessing the level of application of the basic feasibility of the GMP and SSOP aspects at the research site using gap analysis. The gap analysis tool was used to identify the gap in conformity between the GMP/SSOP quality management system and the existing quality management system within the company. A gap analysis was carried out using the expert judgment method by researchers and a standardization analyst from the National Standardization Agency of Indonesia (BSN) involving SME owners through direct discussions and interviews. This research was conducted in one of the small and medium enterprises (SMEs) producing wet noodles in Central Java in 2020. SMEs have a production capacity of 2,800 Kg of finished products every month with 21 employees, and the marketing area is throughout Indonesia.

The analysis of the condition of GMP in the company was carried out by comparing the fulfillment of the GMP requirements applied to the GMP standard[5]. The application of GMP is supported by a sanitation procedure or Sanitation Standard Operating Procedure (SSOP) to ensure the safety of the food products produced[21]. Some aspects that must be evaluated in the SSOP are water safe, clean conditions of surfaces that come into contact with food, prevention of cross-contamination, sanitation facilities, protection from adulteration, proper labelling and storage, control of worker health, and prevention of contamination. The flow of the research process is presented in Figure 1.

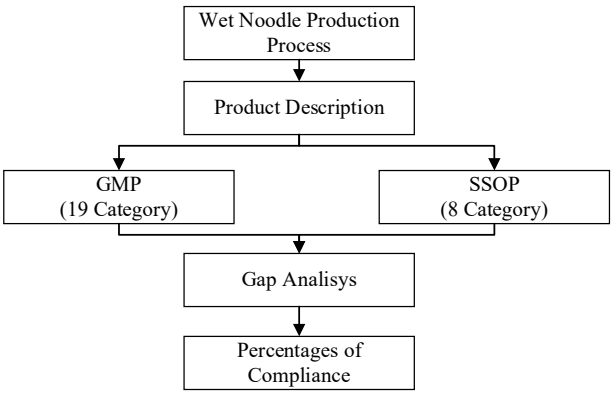

Fig. 1: Research flow chart.

Gap analysis tools can help identify gaps in the GMP/SSOP quality management system and existing quality management systems within the company[22]. Once the gap is known within the company, steps can be taken to improve the quality management system standard within the company. This approach not only complies with GMP and SSOP but can also increase the overall effectiveness of the company's existing quality management system (QMS). Gap analysis assumes that the organization or company already has a QMS function and will improve the QMS function by referencing the GMP and SSOP.

Gap analysis is carried out by comparing to the scoring of business conditions against GMP and SSOP parameters using Table 1. To assess the gap while determining the percentage range of compliance with GMP and SSOP implementation using Table 2. Calculation of the percentage of application and the sum of the weights are as follows:

$$\%\ implementation = \frac{\Sigma\ score\ of\ each\ parameter}{\Sigma\ max\ score}$$

Table 1. Scoring for gap analysis.

Score	Information
0	If an organization or company does not understand what is required or believes it is necessary
1	If an organization or company does not carry out these activities
2	If an organization or company performs activities only occasionally
3	If an organization or company understands this activity is a good thing to do but do not do it
4	If an organization or company performs activities but is not perfect
5	If an organization or company performs activities well

Source: [22,23]

Table 2. Range of percentages of compliance with GMP and SSOP implementation from the sum of weights.

Percentages	Information
75%-100%	The GMP and SSOP programs of organization or companies have met the GMP requirements according to the Regulation of the Minister of Industry Number 75 : 2010.
50%-74%	The GMP and SSOP programs of organizations or companies still have to be improved in order to meet the GMP requirements according to the Regulation of the Minister of Industry Number 75: 2010.
1%-49%	The GMP and SSOP programs of organizations or companies need improvement because they differ greatly from the GMP requirements according to the Regulation of the Minister of Industry Number 75 : 2010.

Source: [22,23]

4. Results and discussion

4.1 Identify the condition of the place of business.

Wet noodle products produced by SMEs are cooked wet noodles through a steaming process after the noodles have been molded. The ingredients used in making noodles are wheat flour, water, and salt without preservatives. Product descriptions are presented in Table 3.

Table 3. Product description of wet noodles.

Description	Information
The final product	Wet noodles
Raw material	Wheat flour
Additional material	Salt and water
Processing	Material mixing, sheeting, slitting, cutting, steaming, draining, packaging and storage
Packing type	Sealed plastic
Product characteristics	Biological, chemical, and physical characteristics according to SNI 2987:2015
Shelf life	▪ Room temperature (20^0C – 25^0C) lasts for 3 days ▪ Refrigerator temperature lasts for one month ▪ Freezer temperature (-18^0C) lasts for three months
Distribution	Sold directly at outlets/outlets via the web and online social media
Product use	Fried or boiled
Consumer	Children to parents

As shown in Table 1, wet noodle products have biological, chemical, and physical characteristics following the quality parameters in the Indonesian National Standard (SNI) 2987: 2015. Based on Figure 2, the production process carried out by SMEs broadly follows the developed theory. The process of making wet noodles begins with receiving raw materials. The ingredients are then weighed according to the size in the procedure and mixed to make them homogeneous. The next stage involves making the noodle dough, which is then formed into layers, and cut according to the desired shape of the noodles. The noodles that have been made are then steamed and drained at a predetermined temperature and time. The packaging process is carried out after the temperature of the noodles matches room temperature homogeneously and is stored in the refrigerator.

Product sales are carried out in stores located in the same location as the production location. Sales are also carried out online with the delivery process through a third party. Proper regulation of distribution and storage procedures is crucial for wet noodle products, as they have high moisture content and a short shelf life[24]. Improper storage of the products can lead to damage not being purchased by consumers, and ultimately result in the product becoming food waste[25][26]. This product requires special handling through a cold chain system in the distribution process because consumers are very concerned about product quality and safety due to the nature of the product, which is easily damaged[27].

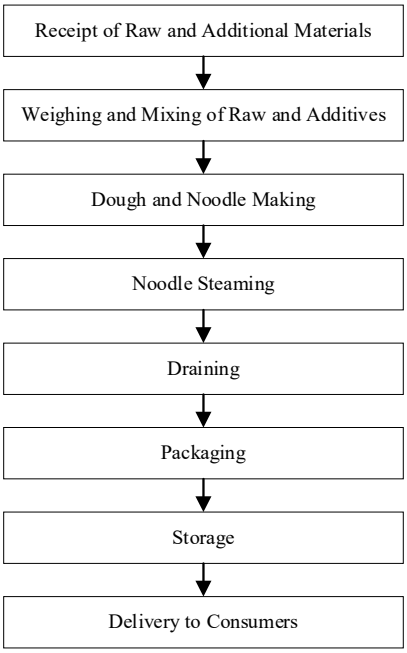

Fig. 2: The flow of the wet noodle production process.

4.2 Compliance with the production process with GMP

Good Manufacturing Practices (GMP), following the Decree of the Minister of Industry of the Republic of

Indonesia number: 75/M-IND-75/M-IND/PER/7/2010 concerning Good Processed Food Production Methods (CPPOB) is a reference for the food processing industry, to build and maintain quality control and safety in the production of processed food. GMP aims to produce quality processed food safe for consumption and in accordance with consumer demands[28]. GMP consists of hygienic design and construction for food product processing, hygienic design and construction for equipment used in processing, cleaning and disinfection of equipment, selection of raw materials and good conditions, training and hygiene of workers, and proper documentation affecting food quality[15]. The application of GMP is useful for improving product quality[29] and maintaining food safety[30]. Aspects of GMP on SMEs producing wet noodles are presented in Table 4.

Table 4. Conformity of SME conditions with GMP aspects and scoring

No	GMP Aspect	SME Condition	Score
1.	Location	The condition of the production site is in a shophouse but far from polluted environments, landfills, and waste. The production process is carried out in a closed and clean room with a special production area separated from other rooms.	5
2.	Building	The design and layout of the production site have been given a name per sub-process. The laying for the production line is well-designed and flowing. However, name tag-related information has yet to be given for each section of the production room. The production floor uses ceramics, and the walls are still covered by wallpaper. The production table is made of wood, and the roof is made of light steel, covered by a ceiling with unprotected lighting.	4
3.	Sanitary facilities	The means of cleaning production materials and washing production equipment are carried out separately. The toilet facilities are outside the production room (next to the room with the production room).	4
4.	Machinery and equipment	The machines and equipment used are mostly made of aluminum (although some are made of plastic, such as trays used for the temporary placing of noodles that have been printed by the machine, water containers such as dispensers, and cleaned immediately when finished using.	4
5.	Material	Using raw materials of wheat flour with SNI and additional ingredients of water and salt also have SNI	5
6.	Process control	Process supervision has not been maximized because the supervision form is only present in some of the production departments.	3
7.	Final product	The final product follows the quality requirements and distribution permit of BPOM	5
8.	Laboratory	It does not have its laboratory, nor does it have quality control tools such as thermometers and water content checking tools	1
9.	Employees	Not all employees wear special production clothes, aprons, gloves, footwear, and masks during production.	2
10.	Packer	The packaging process uses a plastic vacuum packaging machine for as much as one piece. Packaging materials are special plastic food packaging.	4
11.	Product label or description	Already have its product label with a brand name, where the label contains the product name, list of ingredients used, net weight information, name and address of the company that produces it, and expiration date.	5
12.	Storage	The final product is stored in special refrigerators and freezers. Raw materials are stored in warehouses in the production area.	5
13.	Maintenance and sanitation program	Although a checklist has been made for regular maintenance control and sanitation programs, it is not yet complete for all sections	4
14.	Freight	Raw materials and products are transported using cars and motorbikes.	4
15.	Maintenance of containers and transportation	There has yet to be any information regarding this.	2

No	GMP Aspect	SME Condition	Score
	equipment		
16.	Documentation and recording	Need complete documentation and records, even though a monthly sustainable report has been made.	3
17.	Training	Employees have not received GMP and HACCP training	2
18.	Product Withdrawal	There are no product withdrawal procedures and mechanisms.	2
19.	Implementation of the guidelines	There has yet to be any information regarding this.	2
		Total score	66

Based on Table 4, the total compliance score with the GMP aspect is 66, so compared with the maximum score of 95, the percentage of compliance with GMP implementation is 69%. As indicated by the assessment range in Table 2, the GMP program for SMEs still has to be improved to meet the GMP requirements outlined in to the Regulation of the Minister of Industry Number 75 of 2010. Important aspects for improvement include the availability of laboratories, employee awareness to use the correct production clothing, maintenance of production equipment, GMP training for employees, preparation of product recall procedures and mechanisms, and implementation of good and correct guidelines. Production facilities that are not compliant with GMP can lead to cross-contamination of biological, chemical, and physical contaminants, such as foreign matter in food. Using production equipment not following GMP will result in cross-contamination, which can trigger food poisoning[31]. Supervision of the production process will ensure that the production process runs according to predetermined standards and procedures. If supervision is not carried out thoroughly, there is the potential for deviations in the production process, which can negatively impact the quality and safety of food.

Meanwhile, in the employee aspect, compliance with the rules regarding the use of special production clothing, aprons, gloves, footwear, and masks during the production process is a must. Employees are a major risk factor for foodborne illness[32]. Human error is one of the main factors in the successful implementation of GMP[33].

4.3 Conformity of production process with SSOP

Sanitation Standard Operating Procedure (SSOP) is a sanitation control measure that controls the cleanliness of the work environment, personnel hygiene, the feasibility of raw materials, and pest control[34]. The suitability and gap between aspects in the SSOP and the initial conditions of SMEs are presented in Table 5

Table 5. Conformity of SME conditions with SSOP aspects and scoring

No	SSOP Aspect	SME Condition	Score
1.	Water safety	It is necessary to ensure water quality from the Regional Drinking Water Company (PDAM) and install a water filter on the faucet.	4
2.	Condition/cleanliness of surfaces in contact with food	Using a production table made of wood without a base increases the risk of foreign body contamination in food products. The table should be given a pedestal or replaced with stainless steel.	3
3.	Cross-contamination prevention	Products have the potential for cross-contamination from production facilities and employees.	4
4.	Cleanliness of workers	Not all employees use special production clothes, aprons, gloves, footwear, and masks during the production process.	3
5.	Prevention and Protection from Adulteration	Poor placement of chemicals (detergent, mop).	4
6.	Proper labeling and storage	The labeling includes the product's name, a list of the ingredients used, a description of the net weight, the name and address of the company that produces it, and the expiration date. As for storage, it is good, but monitoring of freezer temperature is necessary to maintain product quality.	4
7.	Employee health control	There is no supervision of employee health, such as routine medical checkups for all employees. However, body temperature checks have been carried out for all employees regularly when they arrive at work.	4
8.	Pest eradication	Barriers or protectors in preventing insects from entering the production room are carried out by installing plastic curtains, which effectively minimize this issue.	4
		Total score	27

Based on Table 5, the total score for compliance with the SSOP aspect is 30, so compared with a maximum score of 40, the percentage of compliance with the SSOP implementation is 75%. As indicated by the assessment range in Table 2, the SME SSOP program has met the SSOP requirements according to the Regulation of the Minister of Industry Number 75 of 2010. In general, the implementation of the SSOP in SMEs has largely followed the regulations but still requires improvement and refinement in several aspects. SSOP plays an important role in the food industry in producing products that meet food safety standards[35]. It is closely related to preventing bacterial contamination in food products[36], and plays a role in maintaining the safety of product contact surfaces and preventing contamination[34]. The application of standards provides many benefits, both in terms of tangible economic benefits that can be quantified financially and intangible benefits that cannot be quantified financially[37].

The level implementation of GMP is 69% and SSOP is 75%, even though SSOP is in range 1, the value is very minimum towards the lower limit. This condition means that the level of implementation is also not high, so it still needs improvement implementation. UKM should focus more on aspects of laboratory availability, cleanliness of employees and production sites, product quality and records. The commitment of SME owners to consistently implement GMP and SSOP is a key factor in the success of their implementation[38], which will ensure food safety, quality, and nutrition for consumers as well as create healthy and fair business competitiveness[39]. GMP implementation provides both tangible and intangible economic benefits [40]. A well-supported human resource development system that fosters motivation, participation and positive relationships between employees can maintain and improve compliance with GMP and SSOP implementation[41]. The rapid increase in industrialization causes the environment to be polluted and is a serious problem today, so the application of GMP and SSOP needs to be done to maintain food safety [42].

5. Conclusion

The percentage of wet noodle producer SMEs fulfilling the GMP aspect is 695 and SSOP is 75%. Fulfillment of GMP aspects is included in category II while SSOP is included in category I. In general, implementing GMP and SSOP in SMEs has mostly followed regulations but still requires improvement and refinement in several aspects. Aspects that should be improved are the availability of laboratory facilities (at least the temperature and water content testing equipment for noodles), employee awareness on the proper use of production clothing, regular maintenance of production equipment, GMP training for employees, preparation of product recall procedures and mechanisms and the consistent implementation of guidelines that are accurate and appropriate.

The main obstacle in implementing GMP by wet noodle SMEs is related to laboratory, employee, maintenance of containers and transportation, training, product withdrawal, and implementation of the guideline's aspects. This relates to knowledge, human resources, technology, and capital. It is necessary to identify the constraints on other SMEs in implementing GMP so that a framework for implementing GMP can be developed that takes into account the implementation principle, but still pays attention to the implementation principles and get aspects of benefits and convenience. Further research can be carried out on other SMEs and larger-scale wet noodle production businesses to determine the impact of GMP and SSOP implementation on product quality, sales, and competitiveness.

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