Assessment of good manufacturing practice for small scale food industry in Malang region, East Java, Indonesia

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Abstract. Enhancing food safety in developing countries, such as Indonesia, poses more challenges, especially those of the small- and medium-scale. Various food safety systems are available and readily implemented in the food industry. However, to ensure the effectiveness of such systems, pre-requisite programs should be applied prior to the implementation of food safety system. One of the most acknowledged pre-requisite program is Good Manufacturing Practices (GMP). The aim of this study is to assess the GMP compliance of some small-scale food companies in East Java. Three types of traditional food product were selected, include tempe chips, palm sugar, and instant herbal drink. A survey involving three companies for each type of traditional food was conducted. Data was obtained through observation and assessment based on tabulated criteria in GMP criteria. In essential, the result revealed the compliment level of the food companies being surveyed. There was different level of compliment between each type of the food industry, where the palm sugar industry had the lowest level of compliment compared to the other two. This difference is due to the food safety awareness, social and cultural influences, and also knowledge on food safety and hygiene practice.

1. Introduction

Food safety has become more and more essential both in developed and developing countries due to the expanding food trade, affecting health, economic and sustainability aspects [1, 2]. Enhancing food safety in developing countries, such as Indonesia, poses more challenges due to the situation of the food companies, especially those of the small- and medium-scale [3, 4]. These condition emerges due to improper processing of food, lack of awareness and responsibility toward handling and food additive uses, and lack of knowledge upon food preparation and production environment requirements [5].

Good Manufacturing Practices (GMP) is one of the well-known food safety program, developed by Food and Drug Administration-USA, as a guideline for the food, cosmetics and drug producers, handlers, retailers, etc.[6, 7]. GMP includes policy, procedures and methods as guidance for complying quality standards and hygiene. It provides guidelines for producing food that complies specific requirements to aid food producers in the manufacture and distribution of unadulterated and no misbranded foods. These
guidelines are located in the Code of Federal Regulations 21CFR part 110 as Current Good Manufacturing Practice in Manufacturing, Packing or Holding Human Food. It serves as the standard by which the government determines if the food is adulterated [7, 8]. Thus, it is critical that every food manufacturer and distributor understand the regulations and develop systems and programs that prove adherence to the letter of this law [9–11].

Various criteria are included in the standard, including personal hygiene, food production facilities sanitation and design, process control and pest control. These criteria are qualitatively described in the standard and used as the basis for GMP compliment assessment. This study focused on assessing the real condition of small-scale food companies in East Java based on GMP criteria issued by Food and Drug Control Agency (BPOM). This can be very important for setting up the basis understanding for the real condition of small-scale food companies and hence the action plan of the sequential steps to achieve food safety for both the government agencies and the food companies.

2. Materials and Methods
Investigation was carried out on many aspects of plant sanitation based on the standard issued by BPOM and Ministry of Health. Three types of traditional food were selected, include palm sugar (PS), tempe chips (TC), and instant herbal drink (HD). Codes were applied rather than actual company names of each type of food industry to protect the reputation of the company. Alphabetical scores were given to sanitary observation on 3 classes of complimentary condition: G-good, F-fair, I-insufficient. These classifications were developed accordingly to the issued standard criteria. The classification is quantified into numerical scale for each class as 3= good, 2=fair, and 1=insufficient. Data was obtained through observation and evaluation of each company performance were tabulated.

3. Results and Discussion
Assessment of GMP according to the standard criteria [12] can be seen on Table 1. The figures show the quantified class of condition where bigger number shows the higher compliment to the standard.

3.1. Production environment
Production environment varied between industry types, but generally those were not located in swampy areas or near centers of pollution. All the industries visited were located close to or inside residential areas. PS industries were located in rural areas, while TC and HD industries were located in sub-urban or urban areas. Most of the industries surroundings were free from bushes and weeds except for PS1. Waste and disposal container were mostly present at adequate amount; however, some were not fully covered. Normal drainage facilities were found in all industries, except for PS1 where water was logged during visit. Thus, a special precaution should be made due to the possibility of contamination round the location [13].

3.2. Building and facility
The industries visited were all single-story building. There were many false ceiling in all PS, as well as in TC1 and HD3. This open ceiling and cracks enable rodents and reptiles to harbor and also allows mold growth. The walls in all TC and HD industries had smooth surfaces however the opposite was found in PS industries which was constructed from plaited bamboo mats. The floor was made of impervious material except for the PS industries which used no floor but direct hardened soil. The surfaces of all interior should be designed to maximize clean ability and protection toward contamination [13, 14]. Doors and windows in all industries were designed to open outward the production area.
3.3. **Production equipment and utensils**

Production equipment and utensils should be made of stable, non-corrosive and easy to clean material, such as stainless-steel knife, melamine surfaces, and stainless-steel cooking pans. Production lay out were in sequence accordingly to process flow. Process flow is essential to help prevention of cross-contamination in food premises [8–10, 15]. Production equipment were all functioned well, however, maintenance schedule was not established. Cleaning and sanitizing were also inadequately scheduled. Although some utensils in PS industry were very traditional and had shown wear over time, they showed no evidence of leakage, cleavage and other damages that allow contamination to the produced sugar, as it has high osmotic pressure against microbial growth [10].

3.4. **Water supply**

Water supply for the food industries investigated were all obtained from boreholes or municipal water sources. These water resources were supplied sufficient amount and quality for food processing and other purposes in the premises. Thus, awareness of the need to use potable water in their processing were shown in all industries. Clean and contamination-free water is essential in food processing, as water is one of the primary areas of concern in food contamination sources [15].

| Food Industry | PE | BF | PEq | WS | HSF | PsC | PHS | PC | L | S | MR | RD | PTr | TS |
|---------------|----|----|-----|----|-----|-----|-----|----|----|----|----|----|-----|----|
| PS1           | 1  | 1  | 2   | 2  | 1   | 1   | 1   | 1  | 1  | 2  | 2  | 1  | 1   | 18 |
| PS2           | 3  | 1  | 3   | 2  | 1   | 2   | 2   | 1  | 1  | 2  | 3  | 1  | 1   | 23 |
| PS3           | 2  | 1  | 3   | 1  | 1   | 2   | 2   | 1  | 1  | 2  | 1  | 1  | 1   | 19 |
| PS Average    | 2  | 1  | 3   | 2  | 1   | 2   | 2   | 1  | 1  | 2  | 2  | 1  | 1   | 21 |
| TC1           | 2  | 1  | 3   | 2  | 1   | 2   | 2   | 3  | 1  | 3  | 3  | 2  | 3   | 28 |
| TC2           | 2  | 2  | 3   | 2  | 3   | 3   | 3   | 3  | 1  | 3  | 2  | 2  | 1   | 30 |
| TC3           | 2  | 3  | 2   | 2  | 1   | 3   | 3   | 2  | 1  | 3  | 3  | 1  | 2   | 28 |
| TC Average    | 2  | 2  | 3   | 2  | 1   | 3   | 3   | 3  | 1  | 3  | 3  | 2  | 2   | 30 |
| HD1           | 3  | 2  | 3   | 2  | 2   | 2   | 3   | 3  | 2  | 3  | 3  | 2  | 3   | 33 |
| HD2           | 2  | 3  | 3   | 3  | 2   | 3   | 3   | 3  | 2  | 1  | 3  | 2  | 1   | 30 |
| HD3           | 2  | 1  | 2   | 2  | 3   | 3   | 3   | 3  | 3  | 3  | 2  | 1   | 2   | 31 |
| HD Average    | 2  | 2  | 3   | 3  | 2   | 3   | 3   | 3  | 2  | 3  | 3  | 2  | 2   | 33 |

Note:
PE=Production Environment, BF=Building&Facility, PEq=Production Equipment, WS=Water Supply, HSF=Hygiene & Sanitation Facility, PsC=Pest Control, PHS=Process Control, PC=Process Control, L=Labelling, S=Storage, MR=Monitoring & Responsibility, RD=Record & Documentation, PTr=Personal Training, TS=Total Score

3.5. **Hygiene and sanitation facility**

All the industries provided toilet facilities for their staff. Some toilets had their floors and wall tile. No soap was provided in the industries. Hand washing facilities were provided in TC and HD industries but not in PS industries. Hands may become soiled with a wide variety of contaminants during normal food
processing operations [16], which can be a transmitting agents for contamination of food and food contact surfaces [17]. Hygiene and sanitation facilities are essential to ensure that building and equipment always in clean condition to prevent cross contamination, especially those of staff and personnel [7, 11].

3.6.  **Pest control**
All the industries visited showed no animals or pets surrounding the plants. Pests (rodents, insects, and other animals) are carrier of biological contaminants that decreases food quality and safety [3, 4, 15, 18]. TC and HD industries showed prevention measures for pest infestation. However, probabilities of pest infestation were found high enough due to the surroundings condition especially in palm sugar industries. False ceilings in the premises contributed probability of pest infestation, as well as the opened door of the production area [19].

3.7.  **Personal hygiene and sanitation**
All personnel in the industries visited were in good health and showed no symptoms of sickness. However, periodical health check was not conducted in all industries. Working apparels were in clean condition except for PS industries and TC1. No faulty habits (chewing, smoking, wearing jewelry, etc.) were found in all premises. Personal health and hygiene plays an important role in assuring food safety and quality, as people and environment can easily contaminate food [9, 10, 15].

3.8.  **Process control**
TC and HD industries had determined their raw material specification, but the PS industries had their raw material as given from nature. Process formulation and flow was established and consistently applied to daily operation. Packaging specification were established in TC and HD industries, but inadequate product information was specified in TC industries. Moreover, no packaging was used in PS industries. According to Lelieveld et al. [14], the operations and processes used in manufacture should, with the premises, equipment, materials, personnel and services provided, be capable of consistently yielding finished products that conform to their specifications and are suitably protected against contamination or deterioration.

3.9.  **Labelling**
No product labels were found in PS industries. Production date and code, expired or best before date as well as net weight were found only in HD labels. Food label should be clear and informative to enable consumer to choose, store, process and consume food [14].

3.10.  **Storage**
Raw material and finished product were stored separately to prevent cross contamination and to increase handling efficiency [18]. All industries visited showed this separation, proving an encouraging awareness of storage essential [20]. Labels and packaging material were stored at separate premise in TC and HD drink industries. This practice is also evidence of GMP compliance [21].

3.11.  **Monitoring and responsibility**
In most industries visited, the owner takes responsibility to monitor production process and directly involved in daily operation except for PS1, PS3, TC2 and HD2 where monitoring was not periodically conducted. In a small scale food industry, the manager who takes responsibility for all production process is the owner [4, 22].
3.12. Record and documentation

Most of the industry investigated had no record and documentation procedure for the entire production process except for TC1, TC2, HD1 and HD3. The four industries recorded material receiving and finish product yield, however, the records were very simple and did not cover other information such as production code and date [23]. Inconsistency of record were shown in TC2 and HD1, as well. Record were not kept or well documented that may cause difficulties in recall [4, 22].

3.13. Personal training

In all industries investigated there were no formal training provided for personnel except for TC1 and HD1. This was reasonable as there were little specific skill needed to run the process. Skills and knowledge were acquired through daily operation practice and dissemination from local Health Agency. Personnel holds significant role in labor-intensive food industry [4, 22]. Sufficient personnel should be available depending on the size and type of business, at all levels with the ability, training, experience and other qualifications [14, 18, 24].

4. Conclusion

There was difference level of compliance between each type of the food industry investigated. All HD industries and TC2 showed high level of compliance, while PS industries had the lowest level of compliance of the standard compared to the other two type of food products.

The findings demonstrated that more focus for improvement should be made especially for: process control, hygiene and sanitation facility, labelling, record and documentation, as well as personnel training. Improving hygiene and sanitation standard will significantly contribute to food safety in the small-scale food industries. Personnel skill and knowledge improvement will also enhance the small-scale industry competitiveness to global market.

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