DEVELOPMENT AND IMPLEMENTATION OF GOOD

JAMU GENDONG PRODUCTION PRACTICE TO IMPROVE
ITS MICROBIOLOGICAL QUALITY AND SAFETY

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2013
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ABSTRAK


Jamu gendong adalah minuman tradisional Indonesia yang dapat dianggap sebagai minuman fungsional karena kandungan flavonoid dan minyak atsirinya. Meskipun diperlukan dapat membantu menjaga kesehatan, Jamu gendong rendah dalam kualitas dan keamanannya. Penelitian ini bertujuan untuk menilai kualitas mikrobiologis jamu gendong dari dua produsen jamu gendong di Bogor dengan menggunakan parameter cemaran mikrobiologis pada: peralatan, pekerja, proses pengolahan dan produk yang akan digunakan dalam pengembangan dan penerapan pedoman Praktek Produksi Jamu Gendong yang Baik (PJGB) untuk skala industri rumah tangga. Penelitian ini terdiri dari evaluasi langkah-langkah produksi melalui pengamatan, pengembangan pedoman PPJGB dengan mempertimbangkan Cara Produksi Pangan yang Baik untuk industri rumah tangga yang dikeluarkan oleh Badan Pengawasan Obat dan Makanan Indonesia, menerapkan pedoman PPJGB dan evaluasi kualitas mikrobiologis (Angka Lempeng Total, analisis Salmonella sp. dan Staphylococcus sp.) produk (sari beras kencur dan temulawak), peralatan (botol) dan lingkungan (sanitasi udara) sebelum dan sesudah implementasi.

Hasil yang diperoleh dari penelitian ini menunjukkan bahwa jumlah mikroorganisme dalam sari beras kencur dan temulawak melebihi standar maksimum yang disarankan dan produknya tidak memenuhi persyaratan standar untuk praktek produksi yang baik. Hampir semua standar praktek produksi yang baik dilanggar. Faktor-faktor yang mempengaruhi jumlah mikroba termasuk: praktek produksi (sortasi dan pencucian rimpang yang buruk) dan praktek higienis yang buruk selama pengolahan, tidak ada standar prosedur pengolahan dan formulasi untuk kedua sari temulawak dan beras kencur, dan juga didukung oleh karakteristik produk yang memiliki pH tinggi, ketersediaan nutrisi, aktivitas air dan suhu (pengolahan dan penyimpanan), tetapi juga dihambat oleh kandungan antimikroba. Setelah implementasi GJGPP, produk menunjukkan penurunan jumlah mikroba sesuai dengan standar maksimum yang disarankan dan negatif Salmonella sp. dan Staphylococcus sp. Hasil pada sanitasi udara sebelum dan sesudah implementasi menunjukkan sedikit penurunan, sehingga praktek kebersihan lingkungan tidak sama kritisnya dengan higien perorangan. Penerapan praktek produksi dan sanitasi yang baik dalam produksi jamu gendong telah meningkatkan kualitas dan keamanan mikrobiologis jamu gendong.

Kata kunci: jamu gendong, keamanan mikrobiologis, Cara Produksi Jamu Gendong yang Baik
ABSTRACT

RANTI RIZKA RAMADHINI F24080109. Development and Implementation of Good Jamu Gendong Production Practice to Improve Its Microbiological Quality and Safety. Supervised by RATIH DEWANTI-HARIYADI and ANTUNG SIMA FIRLIEYANTI.

Jamu gendong is a traditional Indonesian herbal beverage that can be considered as functional beverages because of their flavonoid content and essential oils from its herbs and spices. Although they are believed to help maintain good health, they are often considered low in quality and safety. This study aims to assess the microbiological quality of jamu gendong from two jamu gendong producers in Bogor using parameters such as microbiological quality of utensils, workers, processing and product to be used in developing a Good Jamu Gendong Production Practice (GJGPP) guideline for a home industry scale and implement it to those jamu gendong producers. This study consist of evaluation of production steps through observation, development of GJGPP guidelines by taking into considerations of Good Food Production Practice for home industry issued by The Indonesian National Agency for Drug and Food Control, implement the GJGPP guideline and evaluation of microbiological quality (Total Plate Count, Salmonella sp. and Staphylococcus sp. analysis) of the investigated products (beras kencur and temulawak extract), utensils (bottles) and environment (air sanitation) before and after implementation.

The results obtained from this study showed that the number of microorganism in beras kencur and temulawak extract exceeded the maximum recommended standards and that its production did not meet the standard requirements for good production practices. Almost all standard of good production practices was violated. Factors influencing the high microbial content include : poor production practices (poor rhizome sortation and washing) , lack of hygienic practices during processing, no standardized processing procedures and no written standardized formula for both temulawak and beras kencur extract. and are also supported by the characteristic of the product that has a high pH, availability of nutrients, water activity and temperature (processing and storage), but also was inhibited by antimicrobial content. After implementation of the GJGPP, investigated samples show a decrease in microbial load. Product microbial load succeed to decrease near enough the maximum recommended standards and are negative in Salmonella sp. and Staphylococcus sp. Results on air sanitation before and after implementation showed a slight decrease, therefore environmental hygiene practices was not as critical as personnel hygiene. Application of good production practices in jamu gendong production has improved jamu gendong microbiological quality and safety.

Keywords: jamu gendong, microbiological safety, Good Jamu Gendong Production Practices
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FOREWORD

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1 INTRODUCTION

1.1 Background

Jamu gendong is an Indonesian traditional herbal beverage that are generally produced by home industries. This product are vendored from house to house in bottles that are placed in a basket strapped to the seller’s back. In everyday life, jamu gendong is used to maintain good health and are also believed of curing certain diseases (Pratiwi 2005).

Because of its flavonoid and essential oil content from its herbs and spices, this product can be categorized as functional beverage. The Indonesian National Agency of Drug and Food Control (2005) defines functional food as a food product that contains one or more functional components, based on scientific studies have specific physiological functions, health benefits and are proved to be safe. Jamu gendong product vendored today in general are: tamarind extract, beras kencur extract, turmeric extract, temulawak extract and ginger extract. Fardiaz (1997) stated that jamu gendong can be developed into functional beverage industry.

Despite the fact that jamu gendong is a functional beverage, problems faced this industry are its poor microbiological quality and safety. The poor microbiological quality and safety are related to the quality of its raw materials, poor production practices (process control) and sanitation practices in the processing that has not been properly supervised and controlled (Zulaikhah 2005).

The possible risks resulted from this poor adequacy are physical and microbiological risks. There are evidences in literatures that affirm high microbiological risks in jamu gendong products and have even found pathogens such as Salmonella sp., Staphylococcus sp. and Escherichia coli which are environmental and human contamination indicator pathogens. The high microbial risks or presence of pathogens is closely related to the behavior of producers in the processing that pays less attention to or even notices hygienic factors such as personnel and environmental hygiene (Sayuti et al 2005). Recent reports of jamu gendong outbreaks have occured in Magelang, Central Java on 2011 (Daryono 2011) and also in Jember East Java on 2007 (Kapanlagi.com 2007). Victims experienced symptoms of poisoning after allegedly consumed jamu gendong that was vendored. However, not all jamu gendong products are of high microbiological risk due to methods of preperations. There are certain jamu gendong products that cannot undergo heating, such as beras kencur and temulawak extract because of their high starch content while other jamu gendong products can. Due to the nature of their methods of preperations which involve extensive handling, they are prone to microbiological contamination. Thus, hygienic practices becomes a major factor in jamu gendong microbiological quality and safety.
Assessment to maintain microbiological quality and safety of *jamu gendong* should be established for the development and implementation of good production practices on a small home industrial scale that is practical and easy to follow based on the capability of *jamu gendong* producers. In addition, the guideline for a Good *Jamu Gendong* Production Practice has not yet been established.

### 1.2 Statement of The Problem

The problem being faced by *jamu gendong* has been described above. To improve *jamu gendong* microbiological quality and safety, a guideline for a good *jamu gendong* production practice need to be developed and implemented. In order to conduct a research that focuses on the specific problem that has been described above, some questions were formulated as follows:

1. What are the critical control points (CCP) in the processing of *jamu gendong* production?
2. What are the practices and major factors that affect *jamu gendong* microbiological quality and safety?
3. What solution could be formulated to improve *jamu gendong* microbiological quality and safety?

### 1.3 Research Objectives

This study aims to assess the production process and the microbiological quality of *jamu gendong* from two *jamu gendong* producers in Bogor with the observed parameters that include utensils sanitation, personnel hygiene, processing and products which are specifically aimed on formulating a Good *Jamu Gendong* Production Practice guideline for home industrial scale and implement. Research objectives are as follows:

1. Evaluate the production process at the site.
2. Develop good production practice guidelines.
3. Implement good production practice guidelines and identify the CCP in the implemented production of *jamu gendong*.
4. Evaluate the microbiological quality before and after implementation.

### 1.4 Outcome

The outcome of this research is to provide a good production practice guideline to improve and ensure *jamu gendong* quality and safety for producers to practice.

### 1.5 Time and Venue

The study was conducted in May 2012 to October 2012, held in the Laboratory of Microbiology South East Asia for Food and Agricultural Science Technology (SEAFAST) Center, Bogor Agricultural. Observation and implementation was conducted in Batuhulung Margajaya, West Bogor.
2 LITERATURE REVIEW

2.1 Jamu Gendong

Jamu gendong is one of Indonesia's heritage. Jamu gendong is sold in bottles that are placed in a basket strapped to the seller back and are vendored from house to house (Apriyanthy 2000). Jamu gendong does not only provide herbal drinks, but also a social exchange between the seller and the customers. Jamu or traditional medicine is a mixture/concoction from ingredients such as plants, animals, minerals, extract, galenic, or mixtures of these ingredients, which have been used for treatment for generation based on experience (Indonesian National Agency of Drug and Food Control 2005)

Jamu gendong product sold in general today are tamarind (Tamarindus indica Linn) extract also known as sari asam, beras kencur (rice and Kaemferia galanga L) extract, turmeric (Curcuma domestica) extract also known as sari kunyit, temulawak (Curcuma xanthorrhiza Roxb) extract and ginger (Zingeber officinale Rose) extract also known as sari jahe. Other jamu gendong product that may be sold are cabe puyang extract, sirih extract, sambiloto extract and papaya leaf extract.

Jamu gendong is served based on customer's needs and request. Jamu gendong serving method is pour-it-on-the-spot method where customers may request a combination of one jamu gendong product with the other, for example customers generally request kunyit asam which is a combination of turmeric and tamarind extract or in some cases, customers may request a combination of all jamu gendong product in one glass. With this particular method, jamu gendong vendors always carry a small bucket for placing and washing glasses for servings.

Jamu gendong, especially in Java, as a means to improve state of health and well being. The use of jamu gendong since ancient times are for preventive, promotive, curative and rehabilitative usage (Pratiwi 2005). Turmeric and temulawak essential oil have been reported to increase the production of bile, protects liver cells from toxins and has antifungal and antibacterial activities, while ginger has anti-inflammatory properties (Trubus 2012). Tamarind extracts has properties that are reported of relieving nausea, body slimming and bactericidal effect (Nagy and Shaw 1980). Beras kencur has a property that warms the body and improves blood circulation / fatigue reliever, while kencur itself has efficacy as cough, flatulence and nausea suppressant (Sina 2012).

According to Suhamiati and Handayani (1998), jamu gendong prescriptions are not written down but handed down between generations through experiences. There are two jamu gendong product that is the main concern of this research namely, temulawak and beras kencur extract.

2.1.1 Temulawak Extract

Temulawak extract is made of temulawak which has the scientific name Curcuma Roxb xanthorrhiza, a medicinal plant belonging to Zingiberaceae family. Chemical components of temulawak rhizome as a source of food or raw material can be divided into several fractions, the starch fraction 48.18% - 59.64%, the
fraction of curcuminoids 1.60% - 2.20% and essential oils 6.00% - 10.00% fractions. In addition to the above three fractions, there are other ingredients in temulawak rhizome, the fat 5.38%, crude fiber 2.58% - 4.83%, and protein 29.00% - 30.00%. Curcuminoids has an antibacterial, hepatoprotector, anti-cancer, anti-tumor, antioxidant and hypocholesteromic activity that can lower total cholesterol and increase HDL (High Density Lipoprotein) cholesterol (Susanti 2009).

Temulawak essential oils contains sesquiterpene, a-curcumene, 1-cycloisoprenmyrsene, zingiberene, xanthorrhizol, lasabolen derivatives, epolisid-bisakuron, bisakuron A, B bisakuron, bisakuron C, ketoneseukuiterpen, turmeron, a-turmeron, a-atlanton, Germakon, monoterpenes, sineol, d-borneol, daphellandren, and d-camphene. Temulawak contains many chemicals that are beneficial to human organs such as the gallbladder, liver and pancreas. Its effect towards the gallblader is to prevent the formation of gall stones and cholestasis. In the liver, promotes the stimulation of liver cells to produce bile, prevents hepatitis and other liver diseases, help lower levels of GOTS (Glutamic Oxaloacetic transaminase Serum) and GPTS (Glutamic Pyruvic Transaminase Serum) and as an anti-hepatotoxic. Also, it can stimulate the function of the pancreas, increases appetite, capable of stimulating the hormone system function and physiology of the metabolism. Efficacious ingredients are organic compounds that contain mainly carbon (Susanti 2009). Temulawak essential oil have been reported to have antibacterial activities. Temulawak extract is able to inhibit two species of gram positive bacteria (Staphylococcus aureus and bacillus subtillis) and two species of gram negative bacteria (E. coli and salmonella sp) (Trubus 2012).

Other ingredients added in temulawak extract are sugar, salt and in some cases, several jamu gendong producers may add honey and turmeric. Although its composition is not the same for every jamu gendong producers because of financial matters, according to Sina (2013), the composition of temulawak extract are 50 kg of temulawak, 10 kg of sugar, 0.25 kg of cinnamon, 5 pieces of lime, 0.25 kg of clove, 50 pandan leaves and salt in proportion to taste.

2.1.2 Beras Kencur Extract

Beras kencur extract is made of a combination of kencur and rice. Kencur which has the scientific name Kaemferia galanga L is not a native Indonesian herb and is thought to originate from India. Chemical components of rhizome kencur are starch, minerals, flavonoids, alkaloids, proteins and essential oils (Rostiana 2011). Kencur is used as expectorants, diuretic, carminative, stimulant, appetite enhancer, dysentery prevention, tonic, cold and asthma medicament, antibacterial and antifungal infections from its flavonoids and essential oils (Rostiana, 2011). Regianto (2009) also stated that kencur contains saponins, and essential oils (2.79 - 3.04%) and polyphenols. Phenolic compounds contained in plant materials which has been reported to have antimicrobial activity against several pathogenic bacteria such as Staphylococcus aureus, Salmonella, Escherichia coli, and etc. Besides preservative function, the use of phenolic compounds as antimicrobial agent in foods provides health benefits (Cueva et al. 2010).
Rice are composed by starch, protein, and other elements such as fat, crude fiber, minerals, vitamins, and water. The main carbohydrate in rice are 85-90% starch and only a fraction from 2.0 to 2.5% of pentosan, cellulose, hemicellulose, and 0.6 to 1.4% of sugar. Protein as the second largest constituent of starch. Highest lipid content of rice grains contained in the embryo and the aleurone layer gathered in lipid granules (Argasasmita 2008).

Other ingredients added in beras kencur extract are sugar, salt and in some cases, several jamu gendong producers may add cinnamon, kedawung seed, ginger, tamarind, turmeric, lime and nutmeg. Although its composition is not the same for every jamu gendong producers because of financial matters, according to Sina (2012), the composition of beras kencur extract that are generally vendoed are rice that are roasted for 5-10 minutes, 15 kg of kencur, 7.5 kg of ginger, 2.5 kg of cinnamon, 50 gr of palm sugar, 10 kg of salt, 0.5 gr of cloves, 2 kg curcumin and 50 lt of water.

2.1.3 Jamu Gendong Processing

Jamu gendong processing can generally be divided into two methods depending on the product, one which applies thermal and the other does not (Pratiwi 2005 and Zulaikah 2005). There are certain jamu gendong products that do not undergo heating, such as beras kencur and temulawak extract because of their high starch content while other jamu gendong products does. Starch content in temulawak rhizome varied between 48% to 54% (Susanti 2009), rice starch content ranged from 76-82% (Argasasmita 2008) while kencur rhizomes contain starch content ranging from 51.09 – 79.71% (Rostiana 2011).

Due to the nature of their methods of preparation which involve extensive handling, they are prone to contamination from soil, water, air (environment) and human activities. Jamu gendong processing flow chart with and without boiling are shown on Figure 1 and 2.
First, raw materials go through sortation and washing. After being washed, raw materials go through mashing in a wooden traditional pestle. This process
what differs the boiling jamu gendong product from the non boiling product. In the boiling process, after raw materials are mashed, they go through boiling in a pot by adding water, sugar and salt, and let the heating take control of the extraction. After boiling, extract go through filtering, filling into bottles through hot filling method then finally sealing. In contrast, in the non boiling proses, after mashing, water is added in the wooden pestle and was extracted barehanded to the filter. The pulp from the extraction was put in the wooden pestle to be mashed again. This process was repeated until the color of the pulp extract paled. After the mashing process is done the filtered extract was added hot water, sugar and salt and later was filled in bottles and sealed.

2.1.4 Microbological Quality of Jamu Gendong

Microbial contamination on jamu gendong can be derived from raw materials, handling during processing and servings on vendor practices. Microbiological contamination derived from raw materials which are spices may arise from sources such as indigenous micro flora of plants, microorganisms present in production area, air, post-harvest contamination from dust/soil, use of contaminated water and from human contact (Ahene 2011). In addition to the contamination of raw food supplies that occurs during growing, shipping and processing, there is the problem of food contamination caused by people who are carriers of pathogens such as Salmonella, Escherichia coli and Staphylococcus aureus (Ahene 2011). Even though few food borne outbreaks have been trace to the consumption of contaminated spices, numerous isolations of pathogens, from variety of spices have been reported (Ahene 2011).

Rice, which is one of the main ingredient in beras kencur extract and the main cereal grains used for foods may contribute a microbiological contamination. The sources of microbial contamination of cereal grains are many, but all are traceable to the environment in which grains are grown, handled, and processed. Microorganisms that contaminate cereal grains may come from air, dust, soil, water, insects, rodents, birds, animals, humans, storage and shipping containers, and handling and processing equipment (Bullerman 2011). Microbes that can be transmitted to grain crops are Bacillus cereus, Clostridium botulinum, Clostridium perfringens, Escherichia coli, Salmonella, and Staphylococcus aureus. Coliforms and enterococci also occur as indicators of unsanitary handling and processing conditions and possible fecal contamination (Bullerman 2011). Bainotti (2000) explained that microbiological load of rice grain ranged from $1 \times 10^2$ to $6.8 \times 10^6$ CFU/gr.

Microbes that can be transmitted through water that has been contaminated by human feces are coliforms and Salmonella (Suriawiria 2003). While microbiological contamination derived from sugar are yeast and bacillus sp. (Basyaruddin 2009). Concerning pathogenic bacteria, the risk must be non-existent (Balogh 1992). Antier (1996) explained that ICUMSA (International Commission for Uniform Methods of Sugar Analysis) reports that testing for pathogenic bacteria in refined sugar stopped in 1970 because none were ever found.
Medicinal herbs frequently contain microorganisms indigenous to the soil and plants where they are grown (Farkas 2000), and insufficient sanitation in primitive harvest and postharvest conditions allows their survival (Candlish 2001). Coliforms are found mainly in soil, vegetation and the faeces of warm-blooded animals (Candlish 2001). High coliform counts are an indication of poor hygiene and a lack of sanitation measures. Contamination results from several sources, including improper cleaning procedures and open air drying of plant materials which results in contamination with soils and dust (Sharma 2001).

Airborne microorganisms originate from different sources such as soil, animals and humans (Fang et al. 2007). Bacteria and fungi can also adhere to particles of dust and be transported through air. Based on Ogugbue’s (2011) study on the assessment of microbial air contamination, several species belonging to eight bacterial genera and seven fungal genera were isolated which include the following: *Bacillus* sp., *Salmonella* sp., *Pseudomonas aeruginosa*, *Escherichia coli*, *Micrococcus* sp., *Acinetobacter* sp., *Achromobacter* sp. and *Staphylococcus* sp., while the fungal isolates obtained include species belonging to the following genera: *Aspergillus niger*, *Geotrichum candidum*, *Penicillium notatum*, *Rhodotorula* sp., *Fusarium* sp., *Mucor* sp. and *Cephalosporium* sp.. Apriyanthy (2000) explained that the microbiological quality of tamarind and turmeric extract can be considered as safe, this is evident the low microbial load (<3×10^1 CFU/ml) and absence of *salmonella* sp. On the other hand, beras kencur and temulawak extract samples had a high microbial load (2.4×10^7 CFU/ml and 2.5×10^6 CFU/ml) and some contained *Salmonella*, *Staphylococcus* and *E. coli*. Wiguna et al. (2001) also explained that temulawak extract samples had a high microbial load of 9.7×10^7 CFU/ml, and beras kencur extract of 1.4×10^8 CFU/ml. The differences between these products are their processing methods. tamarind and turmeric extract undergo heating in the processing, while beras kencur and temulawak extract does not. The high microbial load is also pillared by pH where beras kencur have a range of pH of 3.91 – 6.67 and temulawak has 5.16 – 5.56, while tamarind extract and turmeric extract has a low pH, ranging between 3.10 – 3.77. The results from those previous researches showed an inadequacy in microbiological quality and safety. Furthermore, the application of thermal process is one way to improve quality and safety. Wahyuni (2000) explained that heating can reduce a number of microbial load in beras kencur extract. Based on the results of the study above, it can be explained that processing can affect the quality and safety of jamu gendong.

The microbial limit to be considered as safe for consumption according to the ministry of health (1994) based on the standard microbiological contamination of sari jamu (herbal extract) should not exceed 1x10 CFU/ml and absence of pathogenic bacteria negative/ml. This standard is only applicable for big scale industries that are ready to compete with similar products from other countries both in the domestic and international market, considering that jamu gendong is a traditional home industry, 1x10 CFU/ml is imposible to achieve. The best practical standard for the jamu gendong industry is the microbial limit to be considered as safe for consumption according to The Indonesian National Agency of Drug and Food Control (2009) based on the standard microbiological contamination of fruit and vegetable extract is 1x10^4 CFU/ml, absence of *Salmonella* sp. negative/25 ml and *Staphylococcus aureus* negative/ml. Identical
to the Indonesian National Agency of Drug and Food Control, the Indonesian Nasional Standard (2009) has also set the same standard.

The presence of coliforms points to poor sanitary practices by food personnel and could be an indication of possible fecal contamination. Recent data suggests that jamu gendong have incidence of *Salmonella* sp. and *Staphylococcus* sp. which contaminate jamu gendong through raw materials directly or indirectly by human or animal waste, water contaminated by waste or transmitted by human while processing (by hand while handling raw materials or over the utensils used). Thus, according to Zulaikhah (2005) matters concerning jamu gendong quality especially for beras kencur and temulawak extract are its raw materials, processing water, cleanliness of utensils and tools, processing and worker’s personnel hygiene.

2.1.4.1 *Staphylococcus* sp.

*Staphylococcus* has been confirmed to be the causative agent of many cases of severe food poisoning, therefore, its presence in foods is of major concern. *Staphylococcus* is very susceptible to heat treatment and most sanitizing agents (Gotz 2006). Hence, when it or its enterotoxins are found in processed foods, poor sanitation is usually indicated (Kaume 2012). Staphylococci have been isolated sporadically from a wide variety of environmental sources such as soil, beach sand, seawater, fresh water, plant surfaces and products, feeds, meat and poultry, dairy products, on the surfaces of cookingware, utensils, furniture, clothing, blankets, carpets, linens, paper currency, can be found occasionally living on different domestic animals or birds, dust and air in various inhabited areas (Gotz 2006).

The presence of *Staphylococcus* in food and herbal products is associated with unsanitary human handling (Kaume 2012) because *Staphylococcus* can be isolated from human skin and mucous membranes (Gotz 2006). *Staphylococci* are naturally present in the nose, throat, skin, and hair of healthy humans, animals, and feather of birds. *Staphylococcus* can also be present in human infections, such as cuts in skin, abscesses, and facial erupted acne. Food contamination generally occurs from these sources (Tatini 1973, Smith et al. 1983).

*Staphylococci* are facultative anaerobes, but grow rapidly under aerobic conditions. Most strains ferment mannitol and produce coagulase. They are mesophiles with a growth temperature range of 7 to 48°C, with fairly optimal growth between 20 and 37°C. They can grow at relatively low water activity (0.86), low pH (4.8 to 9.3) with the optimum pH of 7.0 to 7.5, and high salt (NaCl) and sugar concentrations up to 15%. Because of their ability to grow under several conditions, *S. aureus* can grow in many foods (Ray 2004). *Staphylococcus* is a gram-positive cocci, occur generally in bunches, and are non-motile, non-capsular and non-sporulating.
2.1.4.2 *Salmonella* sp.

This enteric pathogen has consistently been one of the main causative agents of bacterial food-borne illness worldwide. These facultative anaerobic gram negative bacteria are rod-shaped and usually motile and non-motile without the ability to form spores (Clayton 2002). Typical cultures will produce acid and gas catabolized from D-glucose, while growing optimally at 37°C. The bacteria are oxidase negative, catalase positive, grow on citrate as the sole carbon source, most strains produce hydrogen sulfide and decarboxylate lysine and ornithine (Clayton 2002).

Livestock are common carriers of *Salmonella* sp. and can easily transmit the pathogen to non-carrier animals and human through fecal shedding. Also, many can survive for several months in the soil (Clayton 2002). Environmental sources include animal and human waste and kitchen surfaces (Clayton 2002). Also, the ability of these bacteria to adapt to a varying range of environmental conditions Documented survival of *Salmonella* has been observed among temperatures 5, 2°C - 45°C, water activities 0,945 – 0,999 and pH values 4,5 – 9,5 (Clayton 2002). These ranges of extrinsic conditions would satisfy optimum growth requirements for *Salmonella* sp.

Most enteric bacteria emit distinct odor when they become densely populated in foods. However *Salmonella* does not release a distinct odor during growth. Without the hint of a stagnant odor a consumer would be entirely unsuspecting of a food product contaminated with *Salmonella*.

The efficacy of water rinses to remove fecal contamination has been compared at various temperatures (Clayton 2002). Water rinses at temperatures ranging from 70°C to 80°C are documented to be more effective than cooler water temperatures and organic acids. The application of hot water aids in the removal of dirt and fecal matter while extended exposure of bacterial cells to hot water denatures integral membrane proteins (Clayton 2002).

2.1.4.3 Microbial Growth Factor

The population of microorganisms in every food is influenced by several factors, intrinsic and extrinsic factors. Intrinsic or food related parameters are those parameters of plants and animal tissues which are inherent part of the tissue. e.g., pH, water activity, oxidation-reduction potential (Eh), nutrient content, antimicrobial constituents and biological structures. Extrinsic or environmental parameters are properties of storage environments which affect both foods as well as microorganisms and include temperature of storage, relative humidity of storage environment, and concentration of gases in environment (Dilbaghi 2007).

Factors in beras kencur and temulawak extract that support microbial growth are its availability of nutrients, water activity, temperature (processing and storage) and pH. Jamu gendong is rich in nutrients. Previous literatures explained that beras kencur and temulawak extract is
rich in starch. Efficacious ingredients are organic compounds that contain mainly carbon that can readily utilized by microorganisms (Susanti 2009). Microbes breaks down carbohydrates, particularly the disaccharide sucrose (table sugar), to provide itself with nutrition as a carbon source which the cell uses as energy sources (Dilbaghi 2007). In addition, it also contains fat, minerals, vitamins and protein. Other ingredients added in the extract are sugar and salt. Vitamins are growth factors for some microorganisms. Microbes also require organic molecules such as glucose, amino acids, and vitamins, which supply carbon and energy or are vital growth factors (Dilbaghi 2007). Some microbes also grow on complex media that contain nutrients such as proteins. Microbes breakdown the readily degradable matter, such as sugars, starches, lipids, fats, proteins, organic acids and salt (NaCl) (Cheung 2008). These factors are provided by the major ingredients used in the preparation of jamu gendong production which offers a rich nutrient media for microbial growth.

Although there has not been a literature on jamu gendong water activity, according to Dilbaghi (2007) water activity of fruit juice is in the range of 0.91 – 0.95. Water content affects the shelf life of food. Zulaikhah (2005) explained that jamu gendong, especially beras kencur and temulawak extract only last for 24 hours unrefrigerated due to the nature of its processing that cannot undergo heating.

Based on Apriyanthy’s (2000) research, beras kencur and temulawak extract has a pH ranged from 5.05 to 6.67. Bacteria generally has an optimum pH and water activity where their growth can be supported to the maximum, which are pH in the range of 6.0 - 8.0 and water activity > 0.9 (Dilbaghi 2007).

Factors in beras kencur and temulawak extract that inhibits microbial growth are its antimicrobial contents from its herbs and spices. Previous literatures explained that curcuminoids and essential oils in temulawak has an antibacterial activity while kencur has flavonoids, saponins, polyphenols, and essential oils which has antibacterial and antifungal activity.

2.1.4.4 Food Borne Infections/ Intoxications

Most foods serve as good growth medium for many different microorganisms, and nutritious foods are essential to human health, however, food-borne diseases pose a significant problem worldwide. Considering the variety of foods and methods used for processing, it is apparent that practically all kinds of microorganisms are potential contaminants. Given a chance to grow, the microorganisms will cause changes in appearance, flavor and odor. Foodborne disease is any illness resulting from the consumption of food contaminated with one or more disease producing agents. These include bacteria, parasites, viruses, fungi and their products as well as toxic substances not of microbial origin. Microbe or toxin enters the body through the gastrointestinal tract often causes the first symptoms such as: nausea, vomiting, abdominal cramps
and diarrhea are common symptoms in many food borne diseases (Dilbaghi 2007).

2.1.4.4.1 Intoxication

Illness occurs as a consequence of ingestion of a pre formed bacterial or a mold toxin due to its growth in a food. Once the microorganism have grown and produced toxin in a food, there is no need of viable cells during the consumption of the food for illness to occur in a fast onset. e.g. Staphylococcal food poisoning. Staph toxins are enteric toxins and cause gastroenteritis. About 30 g or ml of food containing toxins produced by $10^6$ to $10^7$ cells per gram (ml) for a normal healthy individual is sufficient to cause the symptoms. The primary symptoms are salivation, nausea and vomiting, abdominal cramps and diarrhea. Secondary symptoms are sweating, chills, headache and dehydration (Dilbaghi 2007).

2.1.4.4.2 Infection

Illness occurs as a result of consumption of food and water contaminated with enteropathogenic bacteria. It is necessary for the cells of enteropathogenic bacteria to remain alive in the food or water during consumption. The viable cells even if present in small numbers have the potential to establish and multiply in the digestive tract to cause the illness in a slow onset. e.g. Salmonellosis. Generally $10^5$ to $10^6$ cells need to be consumed for food borne salmonellosis but it can be as few as 15-20 cell in some cases. The disease starts with the penetration and passage of Salmonella organisms from gut lumen into epithelium of small intestine where inflammation occurs; there is evidence that an enterotoxin may be produced, perhaps within the enterocyte. Salmonellosis generally produce symptoms which includes nausea, vomiting, abdominal cramps, diarrhea, chills, fever, headache and prostration (Dilbaghi 2007).

The main factors responsible for the food borne illness include:

a. Improper holding temperature during processing.
b. Inadequate cooling during storage.
c. Contaminated equipments and utensils.
d. Food from unsafe source.
e. Poor personal hygiene.
f. Adding contaminated ingredients to cooked foods.

General control measures for prevention of food borne diseases are:

a. By employing proper sanitary measures.
b. By the use of chemical agents in preventing the growth of microorganisms.
c. Removing left over food promptly from work surfaces and utensils in food preparation area.
d. By cooking or applying proper and desired processing treatment to the
food before consumption.
e. By avoiding chances of re-contamination of food, hence storing it in proper package.
f. Maintaining good personal hygiene, like food handlers should not have any open cuts and wounds.

2.2 Food Quality-Safety Management Systems

The intent of food laws is to protect the public because consumers cannot detect contamination in food simply by sight, smell, taste or touch. Several food quality-safety management systems are as follows:

2.2.1 Hazard Analysis Critical Control Point

HACCP provides the management of a food industry a systematic approach to evaluate product and processes for physical, microbiological, chemical and allergenic hazards that might occur and pose a food safety hazard as well as direction to install corrective measures to prevent them from accruing (Clute 2009). In order to manage microbial contamination and growth from the farm up to the consumer, HACCP approach is widely used. This approach emphasizes monitoring the quality of food ingredients at critical process handling steps. A safe product will result if the individual steps are carefully controlled. There are seven principles incorporated into the HACCP system (Clute 2009):

2. Determine the critical control points (CCPs) that will eliminate or minimise the risk.
3. Establish critical limits.
4. Establish a monitoring system to demonstrate that the CCP is under control.
5. Establish a procedure for corrective action when the CCP is seen to be moving out of control.
6. Introduce verification procedures to confirm the effectiveness of the HACCP plan.
7. Establish documentation and records to demonstrate that the HACCP system is working effectively.

A thorough understanding of the whole process is required in order to identify the most appropriate means of monitoring CCPs. The Critical Control Points (CCP) in a food process means points in the process at which a physical, chemical, microbiological or allergen hazard can be controlled, removed or prevented from entering the process as a means of ensuring the safety of the food (Clute 2009). Once hazard analysis has shown a CCP defined as a location, step or procedure at which some degree of control can be exercised over a microbiological or other hazards, the hazard can either be prevented, eliminated or reduced to acceptable levels. Loss of control at a CCP would result in an unacceptable risk to the product and/or consumer. A raw material could be a CCP if it is likely to contain a microbiological or other hazard, and if subsequent processing, including correct
consumer use, will not guarantee its control. Specific processing steps such as cooking, chilling, freezing or some feature of formulation may be a CCP, as could aspects of plant layout, cleaning and disinfection procedures or employee hygiene. It is clear that different hazards will be controlled by different CCPs (heat treatment, chilling and so on) (Davidek 2013).

2.2.2 Sanitation Standard Operating Procedures
Sanitation Standard Operating Procedures (SSOP) are the specific, written procedures necessary to ensure sanitary conditions in the food plant. They include written steps for cleaning and sanitizing to prevent product adulteration. The SSOP procedures are specific, but may be similar in the same or a similar industry (Vasconcellos 2005).

SSOP describe the procedures that must be followed in order to make sure that cleaning and sanitation activities are performed correctly. This involves the development of detailed descriptions of the cleaning procedures and sanitation operations that must be performed prior to initiating the food manufacturing process to prevent contamination or adulteration of the product. SSOPs also describe the frequency with which each sanitation procedure is to be conducted, and identify the employee(s) responsible for the implementation and maintenance of each procedure. The SSOP written, should be a comprehensive document and must include the following areas according to Vasconcellos (2005):

1. Hygiene and personnel practices
   Regardless of the type of processing or food handling operation, the first consideration in food sanitation is people. People set, follow, and break the rules of sanitation.

2. Sanitation principles and food handling practices
   Personnel training should nurture an understanding of processes and technologies involved in manufacturing and handling food products.

3. Manufacturing controls of operations
   Production personnel must be trained in the critical elements of the operations for which they are responsible.

4. Communicable diseases/injuries
   Persons known to be suffering from, or known to be carriers of, a disease likely to be transmitted through food must be restricted from any food-handling area.

5. Handwashing
   Facilities with hot water for handwashing must be provided and must be conveniently located in food handling areas.

6. Personal cleanliness and conduct
   Personal cleanliness must be maintained while involved in food handling operations.

7. Traffic control/controlled access
   Personnel and visitor access to specific food-product handling areas must be restricted.

8. Outside surroundings
   Outside surroundings to a manufacturing plant should be evaluated for sources of contamination such as vermin, bird harborage areas, drainage problems, odor problems, debris, refuse, smoke, dust, and other contaminants.
9. Buildings and facilities
   Food processing and handling areas should be cleanable, and so designed and constructed.

10. Building construction
    Floors, walls, and ceilings must be constructed of suitable, approved materials that are durable, smooth, and easy to clean.

11. Overhead structures and lighting
    Should be situated and constructed so as to prevent contamination of food products; lighting must be protected with properly sealed, safety-type overhead fixtures.

12. Heating, ventilation, air conditioning
    Must be designed and installed to prevent buildup of heat, steam, condensation, or dust, and to remove contaminated air. Positive air pressure is required in microbiologically sensitive areas.

13. Drainage and sewage systems
    Appropriate traps and vents are to be used throughout.

14. Waste facilities
    Facilities should be designed so as to prevent contamination and for the sanitary storage of waste and inedible materials prior to their removal from the plant or its surroundings.

15. General protection from contamination
    The facilities and nonproduct contact surfaces and equipment must be evaluated to assess potential for food product contamination.

16. Flow-through pathways
    A well-designed food processing or handling facility should be constructed to minimize traffic and to prevent cross-contamination from raw product to finished product.

17. Washrooms, lunchrooms, changing rooms
    Self-closing doors must be provided for these rooms. The areas must be separate from and not directly entered from food processing and handling areas.

18. Water quality program
    Potable water, steam, and ice supply is imperative for sanitary food processing and handling facilities.

19. Raw material receiving
    All operations involved with receiving and storage of ingredients, packaging, and other incoming materials must be monitored to prevent potential contamination of the food product manufactured. Incoming materials must be received into an area that is separated from the processing areas.

20. Temperature and humidity control
    The primary rule of sanitation is to pay strict attention to food temperatures. The temperature and humidity of storage rooms for raw materials, ingredients, packaging materials, and food should be maintained and monitored.

21. Returned foods
    Foods returned from retail outlets must be clearly identified and stored in a designated area for appropriate disposition.

22. Nonfood chemicals
Detergents, sanitizers, and other chemicals must be properly labeled, stored, and used in a manner that prevents contamination of food, packaging materials, and food contact surfaces.

23. **General cleanliness and housekeeping**

All food processing, food handling, and other rooms must be maintained in a clean, sanitary manner.

24. **Equipment construction and maintenance**

Equipment for food processing and food handling operations must be designed and constructed in a manner that makes them cleanable and maintained in such a manner as to prevent contamination.

### 2.2.2.1 Pre-operational SSOPs

These are established procedures that describe the daily routine sanitary procedures that occur before processing begins. The procedures must include the cleaning of product contact surfaces of facilities, equipment, and utensils to prevent direct product contamination or adulteration. These might include according to Vasconcellos (2005):

1. Safety of water
2. Condition and cleanliness of food contact surfaces
3. Use of acceptable chemicals and cleaning techniques/concentrations
4. Prevention of cross-contamination
5. Proper labeling of toxic compounds
6. Employees’ health conditions
7. Exclusion of pests
8. Descriptions of equipment disassembly and reassembly after cleaning
9. The application of sanitizers to product contact surfaces after cleaning

Established procedures for operational SSOPs vary with the operations, the plant design, and the location of the equipment, but pre-operational sanitation will result in clean facilities, equipment, and utensils prior to starting the operation (Vasconcellos 2005).

### 2.2.2.2 Operational SSOPs

These are established procedures that describe the daily, routine sanitary procedures that will be conducted during operations to prevent direct product contamination or adulteration. Established procedures for operational sanitation must result in a sanitary environment for preparing, storing, or handling food products. Established procedures during operations might include, where applicable: 1) Equipment and utensil cleaning/sanitizing/disinfecting during production, as appropriate, at breaks, between shifts, and at mid-shift cleanup. 2) Procedures for employee hygiene, such as cleanliness of outer garments and gloves, hair restraints, handwashing, health, etc. 3) Product handling in raw and in cooked product areas. Both pre-operational (before daily processing begins) and operational (during processing) sanitation needs are included in SSOPs to prevent direct product contamination or adulteration (Keener 2009).
2.2.3 GMP (Good Manufacturing Practices)

Good Manufacturing Practices should be strictly adhered to by food processing industries to maintain healthy conditions during production operations. GMP requirements cover all aspects of food manufacturing from employee requirements through facility and equipment design and cleaning (Cramer 2006). They also provide good guidelines, understanding and raises awareness of the standards needed to be observed in food processing by manufacturers and their employees (Hayati and Khairul, 2009). Good health and personal cleanliness of food handlers as well as knowledge of food handling techniques are needed for good hygiene practice to be implemented. GMPs’ pre-requisite programmes comprise the basic, universal steps and procedures that control operating conditions within establishments and ensure favourable conditions for the production of safe food. These differ from HACCP systems which focus on the critical points in a manufacturing process that affects food safety. GMPs are the control factors that relate to the entire operation and are not process-specific. GMPs include programmes such as facilities/grounds, equipment/utensils, pest control, receiving and storage, process control, product recall and personnel training (Vasconcellos 2005):

1. **Plant Facilities**
   A detailed review is conducted to determine acceptability of the building and facilities, including the areas of warehousing and storage (storage conditions, code dating, separation of allergen-containing ingredients, proper label declarations, specifications and Certificate of Analysis (CoA) on file). Buildings and facilities construction, plant and grounds maintenance, walls, floors, and ceilings are closely scrutinized. Utilities and support services, including sanitary operations, sanitary facilities, and maintenance are evaluated to determine if measures need to be taken to provide an effective food safety environment.

2. **Employee Hygiene**
   Procedures and practices are inspected and evaluated. Control and enforcement of personal hygienic practices, control of employee health conditions, proper use of gloves and outer garments are reviewed in detail. Evaluations are made regarding the appropriateness of plant practices relative to food risks associated with the products manufactured.

3. **In-Process Control**
   Plant operating conditions are observed in detail. This includes review of sanitation standard-operating procedures and sanitation control records for adherence to food safety and plant policies and procedures. Quality of the water that comes into contact with the food or food surfaces is determined and conditions and cleanliness of food contact surfaces, equipment and utensils maintenance, and prevention of cross-contamination are reviewed.

4. **Contamination and Adulteration**
   Appropriate programs must exist for the protection of food ingredients, raw materials, food products, packaging materials, and food contact surfaces from adulteration with lubricants, fuel, pesticides, cleaning compounds, sanitizing agents, etc. Proper labeling of cans, boxes, bags, etc. For identification of contents, as well as the proper storage and use of toxic compounds are reviewed.
5. Pest Control

A food plant’s records of pest control are examined as part of an audit. A food company should not attempt to perform its own pest control but rather should rely on a dependable outside firm. Still, it is important for the sanitation manager or someone in QA to be trained in the area of pest control.

2.2.4 Good Food Production Practice for Home Industry

The Indonesian National Agency of Drug and Food Control (2003) defines good food production practice is the guidelines and procedures that ensure the quality and safety of food production so that it is suitable for consumption. In a jamu gendong industry, the implementation of Good Food Production Practice is needed to improve quality and safety. It is necessary to prevent possible biological, chemical, and other objects that may harm human health. Most jamu gendong are made traditionally using simple equipment, thus is related to the process control and sanitation levels in the processing that has not been properly supervised and controlled, resulting in poor microbiological quality and safety.

Good Food Production Practice is one of the prerequisites to produce a high quality and safe food consistently. And also very useful for the survival of the food industry for either small, medium or large scale. Through implementing this guideline, the industry can produce a good quality product, suitable for consumption and safe, thus, building consumer trust and the industry will grow rapidly, and consumer will be protected from health-threatening hazards.

Measures that are generally regulated in good food production practice in guidelines and procedures are:

1. Production Environment

   To establish a home industry, environmental conditions that may be a source of potential contamination and their preventive measures should be considered. Home industry should be in place where:
   1. Free of pollution, shrubs and puddles
   2. Free from pests, especially insects and rodents
   3. Not in the vicinity of both solid waste landfills or liquid waste or used goods accumulation area and other dirty areas.

   Home industry should not be in slum settlements. Environment should always be maintained in a clean condition by means:
   1. Waste should be disposed of and does not accumulate and should always be closed
   2. Roads has to be maintained free of litter so that the sewers function properly

2. Buildings and Facilities

   Home industry buildings and facilities should assure the quality and safety of the product during production uncontaminated by physical, biological, chemical and can easily be cleaned and sanitized. This area covers:
A. Production area:

a. Design and Layout
   Production area should be spacious enough and easy to clean.

b. Floor
   1. Floor should be made of water-resistant, flat, smooth but not slippery, strong, easy to clean and is angled to facilitate water drainage.
   2. Floor should always be clean from dust, mucus and other debris.

c. Wall
   1. Walls should be made of water-resistant, flat, smooth, light-colored, durable, does not easily flake off, strong and easy to clean.
   2. The walls should always be clean from dust, mucus, and other impurities.

d. Ceiling
   1. Construction of the ceiling should be well designed to prevent accumulation of dust, mold growth, peeling, pests, minimize condensation, and made of durable materials and easy to clean.
   2. The ceiling should always be clean from dust, cobwebs and other impurities.

e. Door, Window and Ventilation
   1. Doors and windows should be durable, not easily broken, flat, smooth, brightly colored and easy to clean.
   2. Doors, windows and vents should be fitted with wire gauze and removable for easy maintenance.
   3. The door should be designed to open outwards / sideways so that dust or dirt from the outside is not brought in through the air into the processing area.
   4. The door should be closed properly and always in a closed state.
   5. Vents should be sufficient so that fresh air is always flowing in the production area.
   6. Vents should always be clean, not dusty and not filled with cobwebs.

f. Production Facility
   1. Production area should be bright enough so that employees can do their job thoroughly.
   2. Production area must provide hand washing facility (complete with soap/detergent) that is clean.
   3. Production area must provide first aid kit.

g. Storage
   1. The storage of food ingredients/ raw materials including food additives should be separated from the final product.
   2. Special storage place should be provided for storing non-food Ingredients/materials such as detergents, lubricants and oils.
3. Storage areas must be easy to clean and free of pests such as insects, rodents, birds or microbes

Production Equipment

The layout of the production is set in order to avoid cross-contamination. Production equipment in direct contact with food should be designed, constructed and placed to ensure the quality and safety of product. This area regulates:

1. Production equipment should be durable, does not rust, easy to be assembled so it is easy to clean
2. Surfaces in direct contact with food should be smooth, no gaps, does not peel and does not absorb water.
3. Production equipment should be placed in the order process and easy to clean
4. All equipment should be maintained in order to function properly and always clean.

Water Supply

Water that is used during the production process must meet the requirements of clean or drinking water.

1. Water used in production has to be clean water in sufficient quantities to meet all the needs of the production process.
2. Sources and water pipes for purposes other than food processing should be separated and given different colors.
3. Water in direct contact with food before being processed must meet the requirements of clean or drinking water.

Sanitation Facilities and Practices

Sanitation Facilities and practices are needed to ensure that the building and equipment are always clean and to prevent cross-contamination from employees. This area covers:

A. Cleaning equipments:
   a. Cleaning Equipment such as brushes, mops, detergents and sanitizers must be available and well maintained.
   b. Hot water can be used to clean equipment.

B. Personnel hygiene facilities:
   a. Personnel hygiene facilities such as wash basins and toilet / latrine should be available in sufficient quantities and always clean.
   b. Doors toilet / latrine should always be closed.
C. **Hygiene and sanitation activities**

a. Cleaning can be done physically with a brush or with chemicals such as detergents or a combination of both.
b. If needed, cleaning can be done using chlorine according to the instructions recommended.
c. Cleaning and washing equipment should be done routinely.
d. There should be an employee responsible for cleaning and washing.

6. **Pest Control**

Pests (rodents, insects, etc.) is a carrier of biological contaminants which can reduce the quality and food safety. Pest control activities are performed to reduce the possibility of pests into the production area that will contaminate the product.

The holes and ditches that allow the entry of pests should always be closed.

Pets like dogs, cats, and chickens should not roam the yard especially in the production room.

Foodstuffs should not be scattered as it may invite the entry of pests.

A home industry should check the environment from potential pests.

7. **Employee Health and Hygiene**

Good health and hygiene of employees can assure that the workers in contact directly or indirectly with food is not a potential source of contamination.

A. **Employee health condition**

Employees who work in the production area must meet the following requirements:

- In good health. Employees who are ill or recovering from an illness and is believed to carry the disease are still not allowed to work.
- Employees who show symptoms or illness such as hepatitis, diarrhea, abdominal pain, vomiting, fever, sore throat, skin diseases (itching, scabies, sores, etc.), discharge from the ear, eye illness and colds are not allowed to work.
- Employees should be health inspected periodically.

B. **Employee hygiene**

- Employees should always maintain the cleanliness of the body.
- Employees should wear work clothes / apron complete with head cover, gloves
and work shoes. Clothing and equipment is used only for work.
d. Employees should wash their hands with soap before and after handling raw materials or ingredients / equipment and after out of the toilet.

C. Employee habits

Employees should not be chewing, eating, drinking, smoking, spit, sneeze or cough into food, should not wear jewelry such as earrings, rings, bracelets, necklaces, watches and pins.

Process Control

To produce good quality and safe products, the production process must be controlled properly. Home industry process control can be done as follows:

a. Determination of raw material specifications
   1. Should determine the type, quantity and specification of raw materials
   2. Do not accept damaged materials
   3. Use food additives that are allowed within the limits of maximum use.

b. Determination of the composition and formulation
   1. Should determine the composition of the materials used and the composition of the formulas
   2. Should take note and use the composition consistently.

c. Determination of standard production methods
   1. Must determine the standard of food production
   2. Should make a flow chart or process sequence clearly.

d. Determination of type, size, and packaging specifications
   1. Must specify the type, size, and specifications of packaging.
   2. Must use appropriate packing materials for food
   3. Should record and use these information to monitor

e. Determination of a complete description of product include product name, date
   of production, expired date.
   1. Should determine the characteristics of products.
   2. Must specify the expired date
   3. Must record the date of production.

9. Food Label

Food labels should be clear and informative to enable customers to select, store, process and consume food. The code required for the production of food product recalls, if necessary. This area covers:
1. Food label and advertisement must comply with Government Regulations.
2. The description on the label consist of:
   - The name of the product
   - List of product composition
- Net weight or net contents
- The name and address of produces
- The date, month and year of expiration
- Production Certification number

3. Production code must be included on every food label.

10. **Storage**

   Good storage can guarantee the quality and safety of raw materials and final products. This area covers:

   **Storage of materials and products**
   1. Storage of materials and food products should be in a clean place.
   2. Raw materials, food additives and final products of each should be kept separate.
   3. Storage of raw materials and food products must comply with the storage temperature
   4. Ingredients that are easy to absorb water should be stored in a dry place, such as salt, sugar, and spice powder
   5. Raw materials, food additives and final product should be marked to distinguish which are eligible from which are not.
   6. first-in-first-out method
   7. product that is first produced should be used / distributed first.

   **Storage of hazardous materials**
   Hazardous materials such as pest chemicals and other hazardous materials must be stored in separate rooms and their use should always be supervised.

   **c. Storage and packaging labels**
   1. Packaging and labeling should be kept in a clean place and away from pollution.
   2. Labels should be stored in a neat and in order.

   **d. Storage equipment**
   Equipment that has been cleaned and sanitized should be kept in a clean place. Equipment surface should be facing down, to protect from dust, dirt or other contamination.

11. **Responsibility**

   A responsible person is required to supervise the whole stages of the production process and its control to guarantee the quality of products. This area covers:

   Person in charge must have knowledge of the principles and practices of hygiene and sanitation, food security and food production processes.
   Monitoring activities should be carried out routinely.
12. **Product Recall**

Product recall is an act to stop distribution because suspected as the cause of illness or food poisoning. The goal is to prevent more victims from consuming the product. This area covers:

1. Product recall is necessary if suspected to cause disease or food poisoning
2. Producer have to stop production until the problems associated is overcome.
3. Producer must report the recall to the Government of the District / town with copies to the Great Hall / Food and Drug agency.
4. Foods that are proved to be harmful must be destroyed.

**Records and Documentation**

Good record keeping and documentation is necessary to facilitate problems tracking associated with the production process.

a. Producer should record and document:
   1. Acceptance of raw materials and food additives
   2. Final product which contains at least the name of the product, production date, production code, and production number.

b. Records and documents must be kept for 2 (two) times the shelf life of food products produced

14. **Employee Training**

Home industry management and employees should have a basic knowledge of principles and practices of hygiene and sanitation, food and food processing in order to produce good quality and Safe product.

1. Producer must have counseling on Good Food Production practice for Home Industry.
2. Producer must implement and teach the knowledge and skills to other employees.

### 2.3 Employee Motivation

Motivation is an important aspect of any organization, and it includes food industry. Motivated workers normally perform better, which result in greater productivity and excellence. Moreover, highly motivated workers strive to produce at the highest possible level and exert greater effort than workers who are less motivated (Schultz et al. 2003). Ways to improve employee motivation in the food industry include good remuneration, effective training and skills development, a proper recognition and reward system, and employee growth prospects (Schultz et al. 2003). Motivation is a process, which accounts for an individual’s intensity, direction and persistence of effort towards attaining a goal (Robbins et al. 2007). Therefore, intensity relates to how hard a person tries, while direction is the channel through, which a job is performed. Persistence is a measure of how long a person can maintain his/her effort (Robbins et al. 2007).

Through employee motivation, an organization can achieve a competitive advantage through higher productivity and improved customer service (Stone,
Providing excellent service can be possible by motivated employees that can create lasting positive experiences for customers (Petcharak 2002). The outcomes of motivated employees, in addition, include low turnover, loyalty and harmony, high performance that contribute significantly to the growth and development of a company (Lai 2009).

Employee motivation regulates the behaviour of employees/workers and enables them to achieve the desired goals of an organization. Therefore, motivation is the psychological process that provides behaviour, purpose and direction. It is also defined as an internal force/drive, which is based on an individual’s conscious and unconscious needs that drive him/her to achieve a goal or to satisfy an unsatisfied need (Robbins 1993). It is a complex issue of human behavior which varies from person to person, as a result, different people are motivated in different ways.

Regarding motivation, some theories cannot be ignored, since they explain why people act the way that they do and why others refrain from doing certain things (Swanepoel et al. 2003). One theory that explains motivation is Maslow’s hierarchy of needs that is illustrated on Figure 3. These needs are biological and physiological, safety, belongingness and love/social fulfillment, esteem and self-actualization needs. Biological and Physiological needs are: air, food, drink, shelter, warmth, sleep, etc. Safety needs are: protection, security, order, law, limits, stability, etc. Belongingness and love needs covers: work group, family, affection, relationships. Esteem needs are: self-esteem, achievement, mastery, independence, status, dominance, prestige, managerial responsibility, etc. While self-actualization needs are: realizing personal potential, creativity, self-fulfillment, seeking personal growth and peak experiences.

![Figure 3 Maslow’s hierarchy of needs](image)

People always have needs, and as soon as one need is satisfied, another need takes its place (Nel et al. 2004). From Figure 3, Maslow stated that individuals move up the steps of a hierarchy and in order to be motivated, one should know, which level of hierarchy that person is currently on and focus as on satisfying those needs first (Robbins et al. 2007). Maslow distinguished between higher and lower order needs, hence, physiological and safety are grouped as lower order needs while social, esteem and self-actualization are
referred to as higher order needs. This hierarchy suggests that people are motivated to fulfill basic needs before moving on to other, more advanced needs.

According to Maslow, when the lower order needs, namely physiological and safety, are substantially satisfied, the next need becomes dominant (Robbins et al. 2007). Therefore, in order to motivate someone, a person should understand what level of the hierarchy that particular person is currently on and focus on satisfying those needs within the particular level. Accordingly, higher order needs can be satisfied internally while lower order needs are satisfied externally. Hence, if basic needs or lower order needs are not met, efforts to satisfy higher order needs will be postponed (Prasad, 2003).

Physiological needs, safety, belongingness and love and esteem reflects deficiency motives that is needs whose motivating powers triggered by the absence of the underlying requirements. Based on deficiency, the more basic the need, the more powerfully it is experienced and difficult it is to suppress or ignored. The most basic needs, like hunger, are universally experienced, whereas the higher needs (esteem and particularly self-actualization) are less commonly experienced. In simple terms, a person who is starving is not likely to worry about prestige, creativity or status. On the other hand, self-actualization reflects growth motives which is based on using one’s capacities to their fullest to achieve excellence and perfection. Not being based on deficiency, it can also never be satisfied. Unlike other needs, the expression of self-actualization is a process, not a goal. It is expressed through moment to moment experiences of living, of facing challenges to one’s abilities and of interacting with the world in all its diverse aspects (Glassman 2009).

Workers are motivated because of the type of work that they produce and of course they do not have a choice because they need the job (La Motta 1995). Workers are sometimes motivated if a goal is set for them or a reward is provided to them. La Motta (1995) defines job performance as the result of motivation and ability. It is the amount of training that is provided to employees/workers that enhances their performance rather than the quality or quantity of education achieved prior to employment (Sheridan et al. 1997). Behavior is determined by what motivates them and their performance is the product of both ability level and motivation (Mullins, 2007).

3 METHODOLOGY

3.1 Materials

Jamu gendong temulawak and beras kencur extract taken from two jamu gendong producers located in Batuhulung Margajaya, West Bogor. Buffer phosphate, Plate count agar (PCA), Buffer peptone water (BPW), Hektoen enteric agar (HEA), Bismut sulphite agar (BSA), Xylose lysine desoxycholate agar (XLDA), Triple Sugar Iron Agar (TSIA), Lysine Iron Agar (LIA), Baird-Parker Agar (BPA), Trypticase soy broth (TSB), Rappaport Vasidialis (RV) broth, Tetrothionate Broth (TTB). Alcohol 75%, NaCl, deionized water, iodine, potassium iodine and egg yolk tellurite.
3.2 Equipments

Equipments needed in this study are incubator temperature of 30-37 ºC, autoclave (121 ºC, 20 min), vortex stirrer, pH meter, micropipette, tips, petri dish, beakers, test tubes, test tube racks and Erlenmeyers.

3.3 Methods

Four subdivided steps were carried out with specific approaches that were designed to fulfill the objectives of the study that consist of evaluation of jamu gendong production process, developing guidelines for a Good Jamu Gendong Production Practice (GJGPP), implementation of GJGPP and product and facility microbiological evaluation before and after implementation that covers: environmental air evaluation, jamu gendong bottle evaluation, product evaluation (TPC analysis, Staphylococcus analysis, Salmonella analysis and pH). Research diagram is shown in Figure 4.

Figure 4 Research diagram

3.3.1 Evaluation of Jamu Gendong Production Process

This step was conducted by visiting the location of the production directly and conduct observation and interview on site from two jamu gendong producers located in Batuhulung Margajaya, West Bogor. The tools that was used are check sheet with descriptive evaluation method that consist of evaluating: process control, sanitation, personnel hygiene, processing water, production tools and production area (check sheets are shown in Appendix 2-5). Check sheets was developed by taking...
considerations of Good Food Production Practice for home industry that was issued by The Indonesian National Agency of Drug and Food Control (2003) and are designed based on the capacity and capability of the jamu gendong producers by taking into account their financial status.

3.3.2 Developing Guidelines For a Good Jamu Gendong Production Practice (GJGPP) (Indonesian National Agency of Drug and Food Control, 2003)

Guideline development is based on the observations and laboratory results that was previously conducted. Development was by taking into considerations of Good Food Production Practice for home industry that was issued by The Indonesian National Agency of Drug and Food Control (2003) and the results of evaluation of jamu gendong production process. Other considerations was based on the capacity and capability of the jamu gendong producers that practical and easy to follow by considering their financial status.

3.3.3 Implementation of Good Jamu Gendong Production Practice (GJGPP)

Guidelines were implemented on the producers that has participated since the beginning of the study. This was conducted by visiting the location of the production and perform a socialization and training to the producers regarding the guidelines and carry out a careful supervision throughout processing to ensure the applicability of the guidelines and identify the Critical Control Points in the implemented processing using the CCP decision tree.

3.3.4 Product and Facility Microbiological Evaluation Before and After Implementation (BAM, 2010)

Product from the production was taken to the laboratory for evaluation of microbiological quality (Total Plate Count (product, environmental and bottle), Salmonella sp. and Staphylococcus sp. Analyzes) and pH. Product evaluation is conducted before and after implementation to see the improvements of the product microbiological parameters. Products that was evaluated were beras kencur and temulawak extract. Methods that was used are as follows:

3.3.4.1 Environmental Air Evaluation (Salustiano et al 2003)

The number of airborne microorganisms of jamu gendong processing areas of the production site was evaluated by culture settling plate method. Five point in the area were evaluated. The numbers of aerobic plate count were determined using plate count agar (PCA) by opening petri dishes containing 15-20 ml of culture media and were distributed at the production site and exposed for about 15 to 30 minutes. The Petri dishes were closed and incubated at 48 ± 2 h at 35°C. The
colonies were counted using standard counting rules and the results were expressed as colony/hr/m².

\[
\text{Average colony from 2 plates} \times \frac{60 \text{ minutes}}{30 \text{ minutes}} \times \frac{10000 \text{ cm}^2}{\text{wide plate(cm}^2)}
\]

3.3.4.2 Microbial Contamination of Jamu Gendong Bottle

Fifty mL of buffer phosphate was rinsed into the investigated bottle. Serial dilutions were prepared to achieve readable numbers of colonies according to BAM (2010) in the range of 25-250 colonies. These dilutions generally were \(10^1\) up to \(10^6\).

Ten mL of the investigated sample was aseptically transferred to 90 mL of diluent \((10^{-1})\), then 1 mL from previous dilutions was aseptically dispensed into the next dilutions. One mL of the last three dilutions was aseptically dispensed onto duplicate Petri dishes using a pipette and sterile tips. Fifteen to twenty mL of plate count agar (which was tempered – heated and kept at 45 ± 1°C in the liquid state) was aseptically poured over (pour-plate method) and immediately mixed thoroughly and uniformly by a circular and side-to-side motion of plates on flat level surface. After solidified, the agar plates were inverted and incubate promptly for 48 ± 2 h at 35°C.

\[
\sum \text{colonies/bottle} = \sum \text{colonies on all plates counted} \times \text{rinse volume}
\]

3.3.4.3 Product Total Plate Count (BAM, 2010)

Serial dilutions were prepared according to to achieve readable numbers of colonies according to BAM (2010) in the range of 25-250 colonies. These dilutions generally were \(10^1\) up to \(10^7\).

Total plate count evaluation procedures are as stated in 4.2. The colonies were counted using standard counting rules and the results were expressed as CFU/mL. Counts computed should be in the range of 25-250 colonies.

\[
N = \frac{\sum C}{[(1 \times n1) + (0.1 \times n2) \times (d)]}
\]

where:
- \(N\) = Number of colonies per ml or g of product
- \(\sum C\) = Sum of all colonies on all plates counted
- \(n1\) = Number of plates in first dilution counted
- \(n2\) = Number of plates in second dilution counted
- \(d\) = Dilution from which the first counts were obtained
3.3.4.4 Staphylococcus analysis (BAM, 2010)

One mL portions of determined dilutions of samples was transferred using a sterile pipette to 3 tubes of 9 mL Trypticase Soy broth (TSB) containing 10% NaCl. The tubes were then incubated at 35°C for 48 ± 2 h. Tube showing growth (turbidity) was vortexed and a loopful was streaked on Baird-Parker medium. The plates were incubated for 48 h at 35°C to obtain isolated colonies.

Colony suspected of being *Staphylococcus* is circular, smooth, convex, moist, and gray to jet-black colored, frequently associated with an outer clear zone. The confirmed tube samples were reported as MPN of *Staphylococcus/ml*, according to the three series MPN table shown on Appendix 18.

3.3.4.5 Salmonella analysis (BAM, 2010)

Investigated samples (25 mL samples) were placed into 225 mL of peptone water (BPW) for the pre enrichment and was incubated at 35°C for 24± 2 h. An aliquot of 1 mL was taken from the pre enrichment showing growth (turbidity) to the TT broth. While the RV broth was inoculated with a 0.1 mL aliquot of the pre enrichment and were then incubated at 42°C for 24± 2 h, and the TT broths at 35°C for 24± 2 h. After which, the broths were streaked 3 mm loopful (10 µl) onto Bismuth Sulfite (BS), Hektoen Enteric Agar (HEA), and Xylose Lysine Deoxicholate (XLD) agar plates and are incubated at 35°C for 24 h.

Typical *Salmonella* sp. colonies release H2S and appear completely black or have black centers when plated on BS, HEA, and XLD agar plates. Atypical colonies may appear yellow on XLD and HEA and green, clear or mucoid on BS plates. Indicative colony of *Salmonella* sp. were selected and stabbed into a Triple Sugar Iron agar (TSI) and Lysine Iron Agar (LIA) slant, and incubated at 35°C for 24 ± 2 h.

Salmonella in culture typically produces alkaline (red) slant and acid (yellow) butt, with or without production of H2S (blackening of agar) in TSI. In LIA, Salmonella typically produces alkaline (purple) reaction in butt of tube with or without production of H2S.

3.3.4.6 pH

Sample was prepared and immersed by electrode to take the pH reading, allowing time for the meter to stabilize. Afterwards, the electrode was rinsed with distilled H20 and dried to repeat (duplo) on a fresh portion of the sample.

3.3.4.7 Statistical Analysis

Data analysis was performed with Microsoft Excel 2010 software application. A statistical significance was determined by two paired t-Test (Analysis of variance).
4 RESULTS AND DISCUSSION

4.1 Evaluation of Jamu Gendong Production Process

Results from observation (Table 1) showed that jamu gendong processing from both producers did not meet the standard requirements for good production practices. Almost all standard in the check sheet was violated except for processing water, health and some production area requirements because the producers did not have the basic knowledge of sanitation and good production practices.

Table 1 Observation results

<table>
<thead>
<tr>
<th>Evaluation</th>
<th>Producer A</th>
<th>Producer B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Process Control</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Sanitation</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Personnel Hygiene</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Processing Water</td>
<td>√</td>
<td>√</td>
</tr>
<tr>
<td>Production Tools</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Production Area</td>
<td>x</td>
<td>x</td>
</tr>
</tbody>
</table>

√ means good and x means violated

Process Control

Observation results from both producers almost show the same pattern of processing procedures. Raw materials did not undergo proper cleaning. Although herbs that were used were fresh, most of them still had soil on them and only undergo simple rinsing without having extra effort on removing the soils thoroughly. Worker did not perform a systematic production process. Both producers sometimes tend to go back a production step whenever they forgot something which could lead to cross contamination, no written standardized formula for the extracts were available, carelessness of use of tools/utensils that may lead to contamination and no habits of hand washing. They were not even aware as to why they had to wash hands, meanwhile, the extraction in the filtering process was handled barehanded.

Sanitation

For sanitation, cleaning tools and materials were available such as broom, mop, soap/detergent/sanitizer, brush and wash sponge except for a proper brush to clean the inside of bottles for producer A. During observation, there were an improper tasking of cleaning tools on producer A. Brush that was used to clean the floors of toilet was also used to clean the outsides of bottles and sink. Even though both producers had soap/detergent for cleaning and hand washing, they were not used sometimes.
Personnel Hygiene

Overall, jamu gendong producers were healthy throughout observation. They claim that they do not produce the jamu gendong when they feel ill, not because of contamination concern but mainly because they were not up to the work that needs energy. In general the personnel hygiene of the producers are poor: no special outfit or clean apron to prepare the jamu gendong is available, no bath is taken prior to the production because production time was 2.30/3.00-5.00 AM, no caution with regard to hair and nail especially in producer A. They also shared some habits that may lead to contamination of the jamu gendong: sneezing or coughing without covering the mouth, dipping hands into the jamu gendong to taste. Additionally, no special attention was given to wounds on hands. There were aspects of the workers that comply with good practices, i.e. no excessive jewelry during the production.

Processing Water

Water that was used for cleaning raw materials, tools, utensils and hand were clean water from PAM (water company), and processing water that was used were boiled water. Both producers always start off their production by boiling water and was always boiling throughout the production.

Production Tools

Most tools and utensils were clean, but not all were properly clean. Both producers sometimes tend to keep their wooden pestle to be pooled over night and did not clear them prior to mashing (see Appendix 13, picture 10). Water that was pooled go along with herbs that was mashed.

Production Area

Work area was sometimes not completely clean. Dishes were sometimes accumulated in the sink, left over food splatters on the counters and trash bins accumulated with trash. Trash bin was in a close distance from the processing area and was not covered. Flies was often seen in the processing area. Spider webs on ventilations and ceiling. Producer B had a chicken coop outside of the kitchen/ production area.

The main reason for the producers’ actions and behavior was that they were not aware of hygienic practices for both environment (facilities/establishment) and personnel. Jamu gendong was taught based only on natural instincts and the knowledge and skills that ancestors passed on and has been a tradition from generations to generations in a family (Basyaruddin, 2009), surely environmental and personnel hygiene was not handed down between the generations. Furthermore, jamu gendong has not been properly supervised and controlled considering that there are too many producers vending. According to the Indonesian Health Ministry (2012) jamu gendong are not required to have a permit from the Ministry but should be supervised by the Provincial and the District/City Medical Officer. Unfortunately, it was never been done by those officials because the two jamu gendong producers claimed that they have never heard nor have ever been supervised throughout their jamu gendong career.
Possible microbes based on observation are *Salmonella* sp. and *Staphylococcus* sp. due to poor sanitation of personnel and environmental (garbage) and soil contamination. The fact that raw materials did not undergo proper cleaning and still had soil on them and only undergo simple rinsing. Both producers did not show a well maintenance of hand washing, improper tasking of cleaning tools and trash bins accumulated with trash.

4.2 *Good Jamu Gendong Production Practice (GJGPP) Guideline Development, Implementation and CCP Determination*

Based on the observations and laboratory results that was conducted, guidelines for a Good Jamu Gendong Production Practice was developed and are designed based on the capacity and capability of the jamu gendong producers that practical and easy to follow.

4.2.1 *Good Jamu Gendong Production Practice (GJGPP) Guideline*

In the application of good food production practice is not possible to apply all standards thoroughly for home industry especially jamu gendong industry, for example for reasons of limited capital/financial status, environmental support facilities etc. In this study, Good Food Production practice guidelines are condensed into: the production environment, buildings and facilities, production equipment, water supply, facilities and activities of hygiene and sanitation, pest control, employee health and hygiene and process control according to The Indonesian National Agency of Drug and Food Control (2003). The following are the designed guidelines:

**I. PREPARATION**

A. Worker

- Workers must be in good health.
- Workers who are ill or recovering from an illness and is thought to still carry diseases, should not work
- Workers should always maintain the cleanliness of the body, including the maintenance of skin, hair and nails.
- Nails should not be long and dirty.
- Long hairs should be tied back.
- Workers should wear clean clothes or apron.
- Injured worker must seal the wound with a bandage.
- If the bandage is worn long enough, replace the bandage with a clean bandage.
- Workers should not wear jewelry such as earrings, necklace and ring.
- Wash hands with soap/detergent/sanitizer before production and after handling non-food items that are not clean.
B. Working Area
- Work area should always be clean
- Floor should always be clean from excessive dust, dirt, grease and trash
- The walls must always be clean from excessive dust and grease
- The ceiling must always be clean from excessive dust and cobwebs
- Ventilation must always be clear from excessive dust and cobwebs.
- Production room should be brightly lit or bright enough so that workers can do their job thoroughly.
- Storage of food ingredients and raw materials should be separated with products that are not food items such as detergents.
- Work area must be free of piled garbage.
- Trash bins should be provided and closed/sealed, and should not be too close from the work area, especially raw materials.
- Work area must be free of pests such as rats, flies and other insects.

C. Tools and Utensils
- All tools and utensils i.e. wooden pestle, pot, filter, bottles, knife, spoon and containers must be clean.
- All tools and utensils that are made of metal should be free of rust.
- All tools and utensils i.e. wooden pestle, pot, filter, bottles, knife, spoon and containers should be washed with soap/detergent/sanitizer.
- Tools that are made from wood and stone should be washed with soap/detergent/sanitizer and doused with hot water, such as the pestle and let dry.
- Bottles should be washed well with soap/sanitizer and brushed in and out, and the inside of the bottle should be rinsed with hot water and let dry.
- Water that are used for cleaning should be clean water

D. Raw Materials
- Raw materials must be of good quality.
- Raw materials in the form of rhizomes such as: ginger, turmeric, emulawak and kencur should be sorted, not rotten, not moldy, free of pest such as caterpillars/larva and excessive soil should be rubbed off.
- Raw materials in the form of rhizomes should be washed and clean of manure and soil thoroughly, brushed and blanched or doused with hot water. The water used for production must be boiled water or drinking water
- Only use permitted food additives when necessary.
II. PRODUCTION
- Worker should prevent cross contamination.
- Worker should wash his or her hands before handing food product.
- Worker should wash his or her hands after handling non food product or material that are not clean.
- Worker should not chew, eat, drink or smoke while working.
- Worker should not spit, sneeze or cough at food products.
- Utensils that has fell to the floor should not be used for production unless it has been washed with soap/detergent/sanitizer right after its from the ground.
- Worker should perform a systematic processing procedure by following the flow of production without going back a production step.

III. POST PRODUCTION
- All tools and utensils should be cleaned and washed with soap/detergent/sanitizer.
- Working area such as table, floor and wall should be cleaned.
- Table, floor and wall (if possible) should be wiped or mopped with soap/detergent/sanitizer.
- Hands should be washed with soap/detergent/sanitizer.
- Working clothes and apron should be washed daily (after production).
- Avoid water from pooling in tools over night by storing them in a proper way (upside down) and place (dry place).

4.2.2 Guideline Implementation
Developed guidelines were implemented on the producers that has participated since the beginning of the study. The guidelines were implemented carefully resulting an increase in personnel and environmental hygiene practices (documentation of before and after implementation are shown in Appendix 13 and 14). The assessment of the guidelines was through socialization and training the producers regarding the guidelines and carry out a careful supervision throughout the processing to ensure the producers understand and the applicability of the guidelines. During implementation, attention to processing preparation procedures that includes personnel (nail, hair, skin care and intensity of hand washing) and environmental (clean working area, trash bin, floor, table, ceiling, pest) hygiene, processing utensils and raw material handling, processing steps, cross contamination prevention, quality of the water that comes into contact with the food or food surfaces is determined and conditions and cleanliness of food contact...
surfaces and after processing procedures were also carefully implemented and applied based on the developed guidelines. Good health and personal cleanliness of food handlers as well as knowledge of food handling methods are needed for good hygiene practice to be implemented (Vasconcellos 2005).

Through socialization and training, both producers were able to accept the guidelines. They had the initiatives to ask questions regarding basic hygienic practices. Both producers were able to apply GJGPP, but they were only able to follow and apply the guidelines when supervised and controlled. They implemented in an inconsistent manner. Based on microbiological results, product from supervised implementation succeeded to meet the maximum standards, but when they were left alone unsupervised, product microbial load were similar from before implementation. This suggests that both producers lack of inner personnel and environmental hygiene awarenesses, knowledge and motivation.

Based on the producers’ personal records (Appendix 1), it can be concluded that both jamu gendong producers, based on Maslow’s theory of motivation, are basically still striving to satisfy their basic/lower needs, which are biological and physiological needs (air, food, drink, shelter, warmth, sleep, etc) and safety needs (protection, security, order, law, limits, stability, etc). Based on underlying deficiencies, these two jamu gendong producers are forced to do whatever means to fulfill them without further higher need considerations (self-esteem, achievement, mastery, independence, status, dominance, prestige, managerial responsibility, realizing personal potential, creativity, self-fulfillment, seeking personal growth and peak experiences). Lack of self confidence because of their education level, being a jamu gendong producer is the only option, hence, they essentially have no passion for their job. Both producers claim that their monthly earnings does not cover their family needs. With a monthly earning in the range of Rp. 900.000 - 2.000.000, which they have to divide for paying the monthly rent, child education, daily meal and unsuspected needs. As a consequence of a low monthly earnings with high family requirements, they are always in deficiency. Both producers also claim that they do not produce and sell jamu gendong everyday because of parenting responsibility. They only produce jamu gendong when they needed additional income. Insufficient earnings cost a family unsecurity and stability. Being in the level of deficiency needs, their main goal is to fulfill the underlying requirements, far from excellence.

La Motta (1995) defines job performance as the result of motivation and ability, it is the amount of training that is provided to employees/workers that enhances their performance rather than the quality or quantity of education achieved prior to employment (Sheridan et al. 1997). Throughout training, both producers were able to practice the GJGPP well, but they were only able to follow and apply the guidelines when supervised and controlled. Motivation is defined as an internal force/drive, which is based on an individual’s conscious and unconscious needs that drive him/her to achieve a goal or to satisfy an unsatisfied need (Robbins, 1993). Given that both producers are in the deficiency motives, they will unwillingly to achieve excellence. In addition, both producers do not consider food safety as an obligation/priority because almost non of their consumers has ever complained.
Workers are sometimes motivated if a goal is set for them or a reward is provided to them (La Motta 1995). La Motta’s theory is evident from the behaviors of the producers after a reward and a goal is set for them to achieve. Behavior is determined by what motivates them and their performance is the product of both ability level and motivation (Mullins 2007).

### 4.2.3 CCP Determination

Based on the GJGPP, several CCPs were identified in the processing using the CCP decision tree of the HACCP principles and approaches (see Appendix 16). The CCPs identified were sortation and washing (see Figure 5). CCP determination is presented in Appendix 17. The first CCP was sortation. Sortation becomes a CCP because if raw materials did not go through a proper sortation especially rhizomes, potential hazard are microbial contamination. If inadequately practiced or supervised, this operation could be a major source of hazard from spoilage and mold in bad roots caused by poor handling during harvest and post harvest. The second CCP was washing. Rhizomes are also a main concern in washing and becomes a CCP. Remaining soil due to insufficient cleaning need to strictly cleaned from rhizomes to prevent microbial and physical contamination such as rocks/gravel. Rhizomes was seen to still had soils on them even after washing based on observation because they only went through simple rinsing. If poorly practiced, inadequately washed contaminated roots can seed the entire processing line with pathogenic microorganisms due to the nature of the processing that cannot undergo heating.

![Figure 5 CCPs during jamu gendong production](image)

---

1. Diterima Perguruan Tinggi Pertanian melalui bentuk pinjaman darah dan tanah, mempunyai hak untuk mengusahakan tanah dan tanaman dengan cara-cara yang diinginkan dan memenuhi kepentingan agronomi, pertanian, kehidupan keagamaan, penurunan kesehatan, peningkatan kualitas, pertanian atau kegiatan lain.

2. Diterima Perguruan Tinggi Pertanian melalui bentuk pinjaman darah dan tanah, mempunyai hak untuk mengusahakan tanah dan tanaman dengan cara-cara yang diinginkan dan memenuhi kepentingan agronomi, pertanian, kehidupan keagamaan, penurunan kesehatan, peningkatan kualitas, pertanian atau kegiatan lain.
However, in the jamu gendong industry, producers were able to follow and apply GJGPP guidelines only when they were supervised and controlled. Thus it became a distinctive matter in guideline application where GMP and SSOP is still a critical focus even after implementation. This suggest that there needs to be a continuing employee training to improve employee performance.

4.3 Product and Facility Microbiological Evaluation Before and After Implementation

Data obtained showed that products from two jamu gendong producers in Bogor did not meet the acceptable limit of microbial contamination microbial load. Several species were isolated from the products. The bacterial species isolated included *Salmonella* sp. and *Staphylococcus* sp. Sanitation was also evaluated that includes air and jamu gendong bottle sanitation. The microbial limit to be considered safe for consumption according to The Indonesian National Agency of Drug and Food Control (2009) for fruit and vegetable extract should not exceed a maximum of 1x10^4 CFU/ml, *Salmonella* sp. negative/25 ml, and *Staphylococcus aureus* negative/ml.

4.3.1 Product Microbiological Quality

4.3.1.1 Product Total Plate Count

Data on the microbiological analysis on Total Plate Count obtained from investigated products before and after implementation are as presented in Figure 6.
The bacterial counts of investigated products from both producers before implementation obviously exceeded the maximum recommended standards. For producer A, Total Plate Count obtained from beras kencur extract was 7.46 ± 0.8 Log CFU/ml and 6.85 ± 0.6 Log CFU/ml for temulawak extract. While producer B obtained from beras kencur extract was 8.27 ± 0.1 Log CFU/ml and 7.34 ± 0.1 Log CFU/ml for temulawak extract.

Results was supported by the high pH of the product that helps promote microbial growth where pH beras kencur producer A was 6.89, temulawak 7.32, while pH beras kencur producer B was 6.10 and pH temulawak extract producer B was 6.68 (see Appendix 12). Bacteria generally has an optimum pH where their growth can be supported to the maximum, which is 6.5 - 7.5 (Fardiaz 1992). Both investigated products from both producers was obviously within the optimum range. Nevertheless, pH results was different from previous study that was conducted by Apriyanthy (2000), beras kencur and temulawak extract has a pH ranged from 5.05 - 6.67. Different jamu gendong pH was affected by the filtering/extracting treatment/method (Saidi 1986). Considering that jamu gendong has no standardized formula, every jamu gendong producers has their own standard of extracting.

Moreover, jamu gendong microbial growth was supported by its availability of nutrients, water activity and temperature, but also was inhibited by antimicrobial content. The major ingredients in the product offers a rich nutrient media. Previous literatures explained that beras kencur and temulawak extract are rich in starch, and it also contains fat, minerals, vitamins and protein. Although there has not been a literature on jamu gendong water activity, according to Dilbaghi (2007) water activity of fruit juice is in the range of 0.91 – 0.95. Therefore, it is assumed that jamu gendong has a similar value of water activity that supports microbial growth as well. Due to the nature of its processing that cannot undergo heating, beras kencur and temulawak extract are incline to microbial growth. While factors in beras kencur and temulawak extract that prevents are its antimicrobial contents from its herbs and spices. Previous literatures explained that curcuminoinds and essential oils in temulawak has an antibacterial activity while kencur has flavonoids, saponins, polyphenols, and essential oils which has antibacterial and antifungal activity.

The high microbial load was also resulted from producer’s poor production practices. This was supported by evidences in literatures (Apriyanthy 2000 and Wiguna 2001) that beras kencur and temulawak extract are high in microbial load. But results from post implementation shows tremendous microbial load decrease for both product samples became 4.35 ± 0.0 Log
Implementation of GJGPP has resulted in significant decrease in both product (documentation of laboratory results are shown in Appendix 15). Reduction of the microbial load was more practiced in beras kencur compared to temulawak extract. Beras kencur extract reduced 3.1 log CFU/ml for producer A and 4 log CFU/ml for producer B, while temulawak extract reduced 2.6 log CFU/ml for producer A and 3 log CFU/ml for producer B. The high microbial load for both beras kencur and temulawak is caused by poor production practices, which in fact, their actual microbial load are actually not that high because after implementation, production process has been standardized. In this case, beras kencur extract was higher than temulawak extract because microbial growth was not much inhibited by antimicrobial content unlike temulawak extract. After implementation, raw materials went through proper sortation and cleaning, hygienic practices was strictly controled and good production practices was also carefully applied, thus, microbial load was also standardized. Therefore, if all products undergo the same process, the final microbial load will be equal. Microbial load from both producers and both investigated products were in the range of 4.3 – 4.4 Log CFU/ml.

The microbial load of temulawak extract was not as high as beras kencur extract was possibly because temulawak has more anti-microbial activity in its components such as its essential oils and curcuminoids based on literatures. In addition, results was as in accordance based on Apriyanti’s (2000) and Wiguna’s (2001) studies that the microbial load of beras kencur extract was higher than temulawak extract.

Producer B had higher microbial load for both products but also the highest microbial load reduction compare to producer A. However, implemented GJGPP seems to be able to reduce the same level. This is possibly due to the establishment of the producer. Producer B had a chicken coop outside of the kitchen/production area and is also more careless than producer A regarding sanitation practices based on observation.

Based on the results, it suggests that hygienic and good production practices during processing are a major factor in the
microbial contamination of the investigated samples during the period of study. A statistically significance was detected in the before and after implementation treatment for both product on both producers (p < 0.05) as determined by the analysis of variance (t-test).

4.3.1.2 Salmonella sp. and Staphylococcus sp. analysis

Products from both producers were presumptive to be positive in Salmonella sp. and Staphylococcus sp. Data on the microbiological analysis on Salmonella sp. and Staphylococcus sp. obtained from investigated products before implementation are presented on Table 1.

<table>
<thead>
<tr>
<th>Producer</th>
<th>Salmonella sp. /25ml</th>
<th>Staphylococcus sp. MPN/ ml</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Beras Kencur</td>
<td>Temulawak</td>
</tr>
<tr>
<td>Producer A1</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Producer A2</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Producer A3</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Producer B1</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Producer B2</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>Producer B3</td>
<td>+</td>
<td>-</td>
</tr>
</tbody>
</table>

Table 3 Salmonella sp. and Staphylococcus sp. analyses after implementation

<table>
<thead>
<tr>
<th>Producer</th>
<th>Salmonella sp. /25ml</th>
<th>Staphylococcus sp. MPN/ml</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Beras Kencur</td>
<td>Temulawak</td>
</tr>
<tr>
<td>Producer A1</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Producer A2</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Producer A3</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Producer B1</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Producer B2</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Producer B3</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Before implementation, the producer’s behavior based on observation was unacceptable and did not meet the standard requirements for good production practices. Practices that contribute bacterial contamination was often seen during processing, namely lack of hand washing, cross contamination, improper tasking of cleaning and processing utensils. Consequently, the product microbial loads...
from these producers are high in view of the fact that this is a traditional home industry which lack in good production practices and personnel and environmental hygiene.

Microbiological isolation frequencies before implementation for both *Salmonella* sp. and *Staphylococcus* sp. from both investigated product from both producers was 2/3. This was pillared by microbial growth factor in the investigated product and also the high pH of the product that helps promote microbial growth where beras kencur pH for both producers ranged from 6.10 - 6.89 while temulawak was 6.68 - 7.32, whereas the optimum growth pH for *Salmonella* ranged from 4.5 – 9.5 and *Staphylococcus* from 7.0 – 7.5.

Product from producer B had the higher MPN count for *Staphylococcus* analysis as compared to those of producer A. This is possibly due to the establishment of the producer. Producer B had a chicken coop outside of the production area and is also more careless than producer A regarding sanitation practices based on observation. This is evident according to Gotz (2006), *staphylococci* have been isolated from a wide variety of environmental sources such as soil, plant surfaces and products, animal feeds, on the surfaces of cookingware, utensils, furniture, clothing, blankets, carpets, linens, paper currency, can be found occasionally living on different domestic animals or birds (feather), dust and air in various inhabited areas. Botanicals frequently undergo human handling as they are collected, cleaned, pooled, dried, packed and dispensed (Kaume 2012). The presence of *Staphylococcus* in food and herbal products is associated with unsanitary human handling (Kaume 2012) because *Staphylococcus* can be isolated from human skin, mucous membranes (Gotz 2006) and are naturally present in the throat and hair. *Staphylococcus* can also be present in infections, such as cuts in skin, abscesses and facial erupted acne. (Tatini, 1973, Smith et al, 1983).

The isolation of *Salmonella* which usually reside in animal or human intestines and is greatly suspected attributed from the presence of sewage and garbage (Ogugbue 2011), and this is evident based of observation and lab report that producers often has their trash bins piled and placed near their production area and also soil contamination. *Salmonella* causes food-borne infection and typhoid fever (Ekperigin and Nagaraja 1998). They are particularly effective at causing human infections because they can survive a series of harsh conditions which include strong acids in the stomach and the anaerobic and salty environment of the intestine that kill most bacteria. *Staphylococcus* is found in all individuals and usually expelled from the respiratory tract through the nose and mouth. The presence of *Staphylococcus* in food is an indication of environmental and human contamination causes bacteremia and gastrointestinal illnesses (Ogugbue 2011).

The findings explains recent reports of *jamu gendong* outbreaks that occurred in Magelang, Central Java on 2011 (Daryono 2011) and also in Jember East Java on 2007 (Kapanlagi.com 2007). Victims experienced symptoms of poisoning after allegedly
consumed *jamu gendong* that was vended. In general, victims experienced dizziness, nausea, vomiting, complained of abdominal pain and diarrhea. Dilbaghi (2007) explained that staphylococcal food poisoning causes symptoms of salivation, nausea and vomiting, abdominal cramps and diarrhea. Secondary symptoms are sweating, chills, headache and dehydration. While food borne salmonellosis generally produce symptoms which includes nausea, vomiting, abdominal cramps, diarrhea, chills, fever, headache and prostration.

After implementation, all product were negative for *Salmonella* sp. and *Staphylococcus* sp. Data on the microbiological analysis on *Salmonella* sp. and *Staphylococcus* sp. obtained from investigated products after implementation are presented on Table 2.

The decrease in isolation was due to the application of hot water and soap rinse which aids in the removal of dirt and fecal matter and deals extended exposure of bacterial cells. *Staphylococcus* and *Salmonella* are susceptible to heat treatment and most sanitizing agents (Gotz 2006).

### 4.3.1.3 Microbial Air Quality Of Processing Area

Data on the microbiological air contamination are presented on Table 4. Results on air sanitation before and after implementation showed a slight decrease of 0.1 - 0.2 Log CFU/ml, however, a statistically significance was not detected in the before and after implementation treatment for both producers (p < 0.05) as determined by the analysis of variance (t-test). This suggest that the effect of implemented GJGPP on the environmental microbial load was not as significant as to personnel hygiene and good production practices.

<table>
<thead>
<tr>
<th>Implementation</th>
<th>Producer A</th>
<th>Producer B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before</td>
<td>4.15 ± 0.1a</td>
<td>4.13 ± 0.1a</td>
</tr>
<tr>
<td>After</td>
<td>3.92 ± 0.1a</td>
<td>4.05 ± 0.1a</td>
</tr>
</tbody>
</table>

Values represent mean ± standard deviation (density/hr/m²). Different letter on the same column indicate that the mean difference is significant when p ≤ 0.05

### 4.3.1.4 Jamu Gendong Bottle Sanitation Total Plate Count

Data on the microbiological *jamu gendong* bottle sanitation are presented on Table 5. Before implementation for producer A, Total Plate Count obtained from beras kencur extract bottle was 7.81 ± 0.2 Log CFU/ml and 8.00 ± 0.2 Log CFU/ml for temulawak extract bottle. While producer B obtained from bottle beras kencur extract was 6.57 ± 0.1 Log CFU/ml and 6.43 ± 0.2 Log CFU/ml for temulawak extract. This is considered high because based on observation, these producers rarely clean their bottles properly.
before filling, they only rinse with water without the application of soap/sanitizer and proper cleaning utensils. In addition, there has not yet been a study evaluating jamu gendong bottles before.

Table 5  Jamu gendong bottle sanitation Total Plate Count

<table>
<thead>
<tr>
<th>Implementation</th>
<th>Producer A</th>
<th>Producer B</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Beras Kencur</td>
<td>Temulawak</td>
</tr>
<tr>
<td>Before</td>
<td>7,81 ± 0,2a</td>
<td>8,00 ± 0,2a</td>
</tr>
<tr>
<td>After</td>
<td>4,49 ± 0,0b</td>
<td>4,29 ± 0,2b</td>
</tr>
</tbody>
</table>

Values represent mean ± standard deviation. Different letter on the same column indicate that the mean difference is significant when p ≤ 0.05

After implementation, microbial load for bottles decreased to be in the range of 4,59 ± 0,1 - 4,29 ± 0,2 CFU/ml. A statistically significance was detected in the before and after implementation treatment for both product on both producers (p < 0.05) as determined by the analysis of variance (t-test). The decrease in microbial load was promoted by the application of hot water and soap/detergent cleaning method which deals extended exposure of bacterial cells.

Producer A had the highest microbial load for both product bottles but also the highest microbial load reduction compare to producer B. This is possibly due to producer B has a suitable brush for cleaning bottles while producer A does not. But even though producer B had a suitable brush, she sometimes does not properly clean the bottles based on observation. Beras kencur extract bottle reduced 3,32 log CFU/ml and temulawak extract bottle reduced 3,71 log CFU/ml for producer A. While Beras kencur extract bottle for producer B reduced 1,98 log CFU/ml and temulawak extract bottle reduced 2,13 log CFU/ml. There was only a slight difference of microbial load of temulawak extract bottle and beras kencur extract bottle.

5 CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

The results obtained from this study showed that beras kencur and temulawak extract exceeded the maximum recommended standards and that its production did not meet the standard requirements for good production practices. This is exacerbated by the poor production practices, lack of hygienic practices during processing, and are also encouraged by the high pH of the product,
Moreover, *jamu gendong* microbial growth was supported by its availability of nutrients, water activity and temperature, but also was inhibited by antimicrobial content.

Due to the nature of its processing that cannot undergo heating, Critical Control Points that has been identified in the processing were sortation and washing. Almost all standard of good production practices was violated. There was no standardized processing procedures, no written standardized formula for both temulawak and beras kencur extract, poor personnel hygienic habits, and poor production practices.

Reductions of TPC of both beras kencur and temulawak extract was observed, respectively, following implementation of GJGPP. Product microbial load succeed to decrease near enough the maximum recommended standards and were negative in *Salmonella* sp. and *Staphylococcus* sp. Results on air sanitation before and after implementation showed a slight decrease, therefore environmental hygiene practices was not as critical as personnel hygiene.

Beras kencur extract had the higher microbial load compare to temulawak extract from both producers. Producer B had the higher microbial load for both products but also the highest microbial load reduction compare to producer A. Producer B had also the higher microbial load for both product on the *salmonella* analysis compare to producer A. While producer A had the highest microbial load for both product bottles but also the highest microbial load reduction compare to producer B.

5.2 Recommendations

The findings suggest that there should be a continuing research on the optimization of the guideline design and practices. A focus on the serving of the product on field for vendor practices in order to ensure safety and consumer protection. Microbial contamination during sale as safety is of particular concern with ready-to-drink beverage products that may pose potential risks for public health especially for vulnerable people.

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3. A summary of the findings of the study.

4. A conclusion and recommendations for future research.

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CHAPTER 1.2.1


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Petcharak, P. 2002, The Assessment of Motivation in the saint Paul Hotel Employees, Thesis paper of Master Degree, University of Wisconsin Stout


**APPENDICES**

Appendix 1 *Jamu gendong* producer questioner

### Producer A

<table>
<thead>
<tr>
<th>Name</th>
<th>:</th>
<th>Tari</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>:</td>
<td>29</td>
</tr>
<tr>
<td>Education</td>
<td>:</td>
<td>High school</td>
</tr>
<tr>
<td>Monthly family earning</td>
<td>:</td>
<td>Rp. 1.000.000 – Rp. 2.000.000</td>
</tr>
<tr>
<td><em>Jamu gendong</em> earning/sale</td>
<td>:</td>
<td>Rp. 50.000 – Rp. 70.000</td>
</tr>
<tr>
<td>Children</td>
<td>:</td>
<td>2</td>
</tr>
<tr>
<td>Husband’s job</td>
<td>:</td>
<td>Hotel employee (bell boy)</td>
</tr>
<tr>
<td>Have ever heard of supervision</td>
<td>:</td>
<td>No</td>
</tr>
<tr>
<td>Have ever been supervised</td>
<td>:</td>
<td>No</td>
</tr>
</tbody>
</table>

### Producer B

<table>
<thead>
<tr>
<th>Name</th>
<th>:</th>
<th>Sumiyem</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>:</td>
<td>45</td>
</tr>
<tr>
<td>Education</td>
<td>:</td>
<td>Elementary school</td>
</tr>
<tr>
<td>Monthly family earning</td>
<td>:</td>
<td>Rp. 900.000 – Rp. 1.500.000</td>
</tr>
<tr>
<td><em>Jamu gendong</em> earning/sale</td>
<td>:</td>
<td>Rp. 50.000 – Rp. 70.000</td>
</tr>
<tr>
<td>Children</td>
<td>:</td>
<td>2</td>
</tr>
<tr>
<td>Husband’s job</td>
<td>:</td>
<td>Bakso vendor</td>
</tr>
<tr>
<td>Have ever heard of supervision</td>
<td>:</td>
<td>No</td>
</tr>
<tr>
<td>Have ever been supervised</td>
<td>:</td>
<td>No</td>
</tr>
</tbody>
</table>
Appendix 2 Evaluation check sheet producer A before implementation

<table>
<thead>
<tr>
<th>No</th>
<th>Process control</th>
<th>Repetition</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Raw materials go through the process of sorting and proper cleaning</td>
<td>X X X</td>
</tr>
<tr>
<td>2</td>
<td>Workers perform a systematic production process</td>
<td>X X X</td>
</tr>
<tr>
<td>3</td>
<td>Utensils that have been contaminated are reused</td>
<td>√ √ √</td>
</tr>
<tr>
<td>4</td>
<td>Workers show a well maintenance of hand washing</td>
<td>X X X</td>
</tr>
</tbody>
</table>

**Week 1:**
Raw materials did not undergo proper cleaning. Although herbs that was used were fresh, most of them still had soil on them and only undergo simple rinsing without having extra effort on removing the soils. Producer did not perform a systematic production process. Producer tend to go back a production step leading to a cross contamination such as when she was mashing, she was not sure of the amount of herbs that she was mashing, so she went to get a fresh herb that was not cleaned and only rinsed them, then was put together with the herbs that was mashed before. Utensils that has fallen to the ground was sometimes reused without the effort of washing prior to reusing. Producer did not show a well maintenance of hand washing. She was not even aware as to why she had to wash hands, meanwhile, the extracting in the filtering process was handled barehanded.

**Week 2:**
There was not any difference from last week’s observation.

**Week 3:**
Still there was not any difference from the previous weeks. This is assumed that this is her natural habit of processing.

Where √ means yes and X means no.
### Sanitation

<table>
<thead>
<tr>
<th>No</th>
<th>Description</th>
<th>Repetition</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Proper cleaning tools and materials are available (brushes, mops, soap, brooms)</td>
<td>X X X</td>
</tr>
</tbody>
</table>

**Week 1:**
Other cleaning tools and materials were available except for a proper brush to clean the inside of bottles. There were an improper tasking of cleaning tools. Brush that was specialized as a cleaning tool for the bathroom was also used to clean the outsides of bottles and sink.

**Week 2:**
There was not any difference from last week’s observation.

**Week 3:**
Still there was not any difference from the previous weeks. Proper cleaning tools are needed.

Where √ means yes and X means no

### Production tools

<table>
<thead>
<tr>
<th>No</th>
<th>Description</th>
<th>Repetition</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>All production tools and utensils are properly clean before use</td>
<td>X X X</td>
</tr>
</tbody>
</table>

**Week 1:**
Most tools and utensils were clean, but not all were properly clean. Producer sometimes tend to keep her wooden pestle to be pooled overnight and did not clear them prior to mashing. Water that was pooled go along with herbs that was mashed.

**Week 2:**
There was not any difference from last week’s observation.

**Week 3:**
Still there was not any difference from the previous weeks. This is assumed that this is her natural habit of processing.

Where √ means yes and X means no
<table>
<thead>
<tr>
<th>No</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Water used for production are clean water, boiled or drinking water.</td>
</tr>
</tbody>
</table>

**Week 1:**
Water that was used for cleaning raw materials, tools, utensils and hand were clean water/tab water, and processing water that was used were boiled water. Producer always start off her production by boiling water and always was boiling throughout the production.

**Week 2:**
There was not any difference from last week’s observation.

**Week 3:**
Still there was not any difference from the previous weeks. This is assumed that this is her natural habit of processing.

Where √ means yes and X means no.

<table>
<thead>
<tr>
<th>Processing water</th>
<th>Repetition</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Water used for production are clean water, boiled or drinking water</td>
<td>√</td>
</tr>
</tbody>
</table>
### Personnel hygiene

<table>
<thead>
<tr>
<th>Repetition</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
</tr>
<tr>
<td>Workers work in a good health</td>
</tr>
<tr>
<td>Workers work in a clean manner (have washed their hands/bathe, wear clean clothes)</td>
</tr>
<tr>
<td>Workers always wash their hands (before, during and after production)</td>
</tr>
<tr>
<td>Workers wear jewelry</td>
</tr>
<tr>
<td>Worked smoke, eat, drink, spit, cough/sneeze into the food during processing</td>
</tr>
<tr>
<td>If workers are injured, workers wear gloves/clean bandage</td>
</tr>
<tr>
<td>Workers maintain their nails, hair and skin care</td>
</tr>
</tbody>
</table>

### Description:

**Week 1:**
Producer explained that she always work in good health because of the energy that is required for the job, and if she feels some what ill, she tend to not work for the day. If her hands are wounded, she rarely pay attention to it, depending on how severe the wound is. Producer produce jamu gendong before dawn, around 2:30/3:00 AM in the morning to 5:00 AM. The last bath she took was the previous afternoon. Producer rarely wash hands and have a habit of having processing cloths that are only washed 2-3 times a week. Producer did not wear excessive hand jewelry, only her wedding ring that she claimed was unable to take off. Producer sometimes was not aware of her own actions. She sometimes cough/sneeze into the food and even dip her fingers in the extract to have a taste or by accident. Producer tend to be more careless about nail care but pays very much attention to hair and skin care. She had long hair and always tied them before production.

**Week 2:**
There was not any difference from last week’s observation.

**Week 3:**
Still there was not any difference from the previous weeks. This is assumed that this is her natural habit of processing.

---

Where √ means yes and X means no
<table>
<thead>
<tr>
<th>No</th>
<th>Production area</th>
<th>Repetition</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Work area is clean (table, floor, wall)</td>
<td>x √ √</td>
</tr>
<tr>
<td>2</td>
<td>Ceiling is maintained (spider web, dust free)</td>
<td>x x x</td>
</tr>
<tr>
<td>3</td>
<td>Ventilation is maintained</td>
<td>x x x</td>
</tr>
<tr>
<td>4</td>
<td>Production area is bright/well lit</td>
<td>√ √ √</td>
</tr>
<tr>
<td></td>
<td>Raw materials storage area is separated from the final product and non-food</td>
<td></td>
</tr>
<tr>
<td></td>
<td>products</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Free from standing/puddle of water</td>
<td>√ √ √</td>
</tr>
<tr>
<td></td>
<td>Free from accumulated trash</td>
<td>x x x</td>
</tr>
<tr>
<td></td>
<td>Trash can/bin available</td>
<td>√ √ √</td>
</tr>
<tr>
<td></td>
<td>Trash can/bin are covered</td>
<td>x x x</td>
</tr>
<tr>
<td></td>
<td>Trash can/bin is in an adequate distance from processing area</td>
<td>x x x</td>
</tr>
<tr>
<td></td>
<td>Free of pests (rodents, insects/its feces)</td>
<td>x x x</td>
</tr>
</tbody>
</table>

Description:

**Week 1:**
Work area was sometimes not completely clean. Dishes were sometimes accumulated in the sink, left over food splatters on the counters and trash bins accumulated with trash. Trash bin was in a close distance from the processing area and was not covered. Flies was often seen in the processing area. Spider webs on the ventilation and ceiling.

**Week 2:**
There was not any difference from last week’s observation. But work area was not as dirty as last week.

**Week 3:**
Work area was clean this week, no accumulated dishes in the sink. But trash bin is still accumulate and flies and spider webs are still on the ventilation and ceiling.

Where √ means yes and X means no
### Process control

<table>
<thead>
<tr>
<th>No</th>
<th>Description</th>
<th>Repetition</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Raw materials go through the process of sorting and proper cleaning</td>
<td>√</td>
</tr>
<tr>
<td>2</td>
<td>Workers perform a systematic production process</td>
<td>√</td>
</tr>
<tr>
<td>3</td>
<td>Utensils that have been contaminated are reused</td>
<td>x</td>
</tr>
<tr>
<td>4</td>
<td>Workers show a well maintenance of hand washing</td>
<td>√</td>
</tr>
</tbody>
</table>

Where √ means yes and X means no

### Description:

**Week 1:**
This is my first implementation report, we went through the guidelines together and she seems to be a little confused at first, but it turned out that she was a quick learner and everything went well. We clipped our nails together and I even showed her how to put on an apron that I bought for her which she was not familiar with. She has a high curiosity, always asking questions like “what is the function of hot water?” and “why do we have to wash hands so often?” all the little things that sometimes surprises me. I was so grateful that she was willing to cooperate. Producer has shown a great progress throughout training. Raw materials undergo proper cleaning. Producer perform a systematic production process. Producer show a well maintenance of hand washing. No more contaminated utensil reuse.

**Week 2:**
There was not any difference from last week’s observation. Still showing progress

**Week 4:**
Last week I wanted to experiment with our producer, I wanted to know how she will do if I did not supervised her in the production, but it turned out that the lab results are similar as before implementation (bad). But this week I came to supervise and she followed the guidelines like she did in week 1.
<table>
<thead>
<tr>
<th>No</th>
<th>Sanitation</th>
<th>Repetition</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Proper cleaning tools and materials are available (brushes, mops, soap, brooms)</td>
<td>√</td>
</tr>
</tbody>
</table>

**Description:**
- **Week 1:** cleaning tools are all specialized now and available
- **Week 2:** There was not any difference from last week’s observation.
- **Week 4:** Still there was not any difference from the previous weeks.

Where √ means yes and X means no

<table>
<thead>
<tr>
<th>No</th>
<th>Production tools</th>
<th>Repetition</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>All production tools and utensils are properly clean before use</td>
<td>√</td>
</tr>
</tbody>
</table>

**Description:**
- **Week 1:** All tools and utensils were clean
- **Week 2:** There was not any difference from last week’s observation.
- **Week 4:** All tools and utensils were clean

Where √ means yes and X means no
### Processing water

<table>
<thead>
<tr>
<th>No</th>
<th>Description</th>
<th>Repetition</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Water used for production are clean water, boiled/drinking water</td>
<td>√ √ √</td>
</tr>
</tbody>
</table>

**Week 1:**
Water that was used for cleaning raw materials, tools, utensils and hand were clean water/tab water, and processing water that was used were boiled water.

**Week 2:**
There was not any difference from last week’s observation.

**Week 4:**
Still there was not any difference from the previous weeks. This is assumed that this is her natural habit of processing.

Where √ means yes and X means no

### Personnel hygiene

<table>
<thead>
<tr>
<th>No</th>
<th>Description</th>
<th>Repetition</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Workers work in a good health</td>
<td>√ √ √</td>
</tr>
<tr>
<td>2</td>
<td>Workers work in a clean manner (have washed their hands/bathe, wear clean clothes)</td>
<td>√ √ √</td>
</tr>
<tr>
<td>3</td>
<td>Workers always wash their hands (before, during and after production)</td>
<td>√ √ √</td>
</tr>
<tr>
<td>4</td>
<td>Workers wear jewelry</td>
<td>x x x</td>
</tr>
<tr>
<td>5</td>
<td>Workers smoke, eat, drink, spit, cough/sneeze into the food during processing</td>
<td>x x x</td>
</tr>
<tr>
<td>6</td>
<td>If workers are injured, workers wear gloves/clean bandage</td>
<td>- - -</td>
</tr>
<tr>
<td>7</td>
<td>Workers maintain their nails, hair and skin care</td>
<td>√ √ √</td>
</tr>
</tbody>
</table>

**Week 1:**
Producer has practiced a good sanitation procedure. Producer has to be reminded to wash hands.

**Week 2:**
There was not any difference from last week’s observation.

**Week 4:**
Producer still has to be reminded to wash hands.

Where √ means yes and X means no
<table>
<thead>
<tr>
<th>No</th>
<th>Production area</th>
<th>Repetition</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Work area is clean (table, floor, wall)</td>
<td>✓ ✓ ✓</td>
</tr>
<tr>
<td>2</td>
<td>Ceiling is maintained (spider web, dust free)</td>
<td>✓ ✓ ✓</td>
</tr>
<tr>
<td>3</td>
<td>Ventilation is maintained</td>
<td>✓ ✓ ✓</td>
</tr>
<tr>
<td>4</td>
<td>Production area is bright/well lit</td>
<td>✓ ✓ ✓</td>
</tr>
<tr>
<td></td>
<td>Raw materials storage area is separated from the final product and non-food products</td>
<td>✓ ✓ ✓</td>
</tr>
<tr>
<td>5</td>
<td>Free from standing/puddle of water</td>
<td>✓ ✓ ✓</td>
</tr>
<tr>
<td>6</td>
<td>Free from accumulated trash</td>
<td>✓ ✓ ✓</td>
</tr>
<tr>
<td>7</td>
<td>Trash can/bin available</td>
<td>X X X</td>
</tr>
<tr>
<td>8</td>
<td>Trash can/bin are covered</td>
<td>✓ ✓ ✓</td>
</tr>
<tr>
<td>9</td>
<td>Trash can/bin is in an adequate distance from processing area</td>
<td>✓ ✓ ✓</td>
</tr>
<tr>
<td>10</td>
<td>Free of pests (rodents, insects/its feces)</td>
<td>✓ ✓ ✓</td>
</tr>
</tbody>
</table>

**Description:**

**Week 1:**
Work area was clean, no accumulated dishes in the sink. Trash bin was not accumulated with trash, but there was still a few flies and cobwebs on the ventilation and ceiling.

**Week 2:**
There was not any difference from last week’s observation.

**Week 3:**
Work area was completely clean.

Where ✓ means yes and X means no.
Appendix 4 Evaluation check sheet producer B before implementation

<table>
<thead>
<tr>
<th>Process control</th>
<th>Repetition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Raw materials go through the process of sorting and proper cleaning</td>
<td>x  x  x</td>
</tr>
<tr>
<td>Workers perform a systematic production process</td>
<td>x  x  x</td>
</tr>
<tr>
<td>Utensils that have been contaminated are reused</td>
<td>√  √  √</td>
</tr>
<tr>
<td>Workers show a well maintenance of hand washing</td>
<td>x  x  x</td>
</tr>
</tbody>
</table>

**Week 1:**
- Raw materials did not undergo proper cleaning (most of them still had soil on them and only underwent simple rinsing).
- Producer did not perform a systematic production process.
- Producer did not show a well maintenance of hand washing.

**Week 2:**
There was not any difference from last week’s observation.

**Week 3:**
Still there was not any difference from the previous weeks. This is assumed that this is her natural habit of processing.

<table>
<thead>
<tr>
<th>No</th>
<th>Sanitation</th>
<th>Repetition</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Proper cleaning tools and materials are available (brushes, mops, soap, brooms)</td>
<td>√  √  √</td>
</tr>
</tbody>
</table>

**Week 1 :**
Cleaning tools and materials were available but was not put into a good use.

**Description:**
- **Week 2 :**
  There was not any difference from last week’s observation.
- **Week 3 :**
  Still there was not any difference from the previous weeks.

Where √ means yes and X means no
### Production tools

<table>
<thead>
<tr>
<th>No</th>
<th>Description</th>
<th>Repetition</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>All production tools and utensils are properly clean before use</td>
<td>X X X</td>
</tr>
</tbody>
</table>

**Week 1:**
Most tools and utensils were clean, but not all were properly clean. Producer sometimes tend to keep her wooden pestle to be pooled overnight and did not clear them prior to mashing. Water that was pooled go along with herbs that was mashed (same behavior as producer A).

**Week 2:**
There was not any difference from last week’s observation.

**Week 3:**
Still there was not any difference from the previous weeks. This is assumed that this is her natural habit of processing.

### Processing water

<table>
<thead>
<tr>
<th>No</th>
<th>Description</th>
<th>Repetition</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Water used for production are clean water, boiled/drinking water</td>
<td>√ √ √</td>
</tr>
</tbody>
</table>

**Week 1:**
Water that was used for cleaning raw materials, tools, utensils and hand were clean water/tab water, and processing water that was used were boiled water. Producer always start off her production by boiling water and always was boiling throughout the production (same behavior as producer A).

**Week 2:**
There was not any difference from last week’s observation.

**Week 3:**
Still there was not any difference from the previous weeks. This is assumed that this is her natural habit of processing.
### Personnel hygiene

<table>
<thead>
<tr>
<th>Description</th>
<th>Repetition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Workers work in a good health</td>
<td>√</td>
</tr>
<tr>
<td>Workers work in a clean manner (have washed their hands/bathe, wear clean clothes)</td>
<td>x</td>
</tr>
<tr>
<td>Workers always wash their hands (before, during and after production)</td>
<td>x</td>
</tr>
<tr>
<td>Workers wear jewelry</td>
<td>x</td>
</tr>
<tr>
<td>Workers smoke, eat, drink, spit, cough/sneeze into the food during processing</td>
<td>√</td>
</tr>
<tr>
<td>If workers are injured, workers wear gloves/clean bandage</td>
<td>x</td>
</tr>
<tr>
<td>Workers maintain their nails, hair and skin care</td>
<td>x</td>
</tr>
</tbody>
</table>

Where √ means yes and X means no

**Description:**

**Week 1:**
The last bath she took was the previous afternoon (same behavior as producer A). Producer rarely washes hands and work with whatever cloth she has on. Producer did not wear excessive hand jewelry. Producer sometimes was not aware of her own actions. She sometimes cough/sneeze into the food and even dips her fingers in the extract by accident. Producer was careless about hair care and often wears her hair down throughout production but was very careful about nail care. Producer had a wound on her left hand and it was not covered.

**Week 2:**
There was not any difference from last week’s observation. Producer still had a wound on her left hand and it was still not covered.

**Week 3:**
Still there was not any difference from the previous weeks. This is assumed that this is her natural habit of processing.
<table>
<thead>
<tr>
<th>No</th>
<th>Production area</th>
<th>Repetition</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Work area is clean (table, floor, wall)</td>
<td>x</td>
</tr>
<tr>
<td>2</td>
<td>Ceiling is maintained (spider web, dust free)</td>
<td>x</td>
</tr>
<tr>
<td></td>
<td>Ventilation is maintained</td>
<td>x</td>
</tr>
<tr>
<td>3</td>
<td>Production area is bright/well lit</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>Raw materials storage area is separated from the final product and non-food products</td>
<td>✓  ✓</td>
</tr>
<tr>
<td>4</td>
<td>Free from standing/puddle of water</td>
<td>✓</td>
</tr>
<tr>
<td>5</td>
<td>Free from accumulated trash</td>
<td>x</td>
</tr>
<tr>
<td>6</td>
<td>Trash can/bin available</td>
<td>✓</td>
</tr>
<tr>
<td>7</td>
<td>Trash can/bin are covered</td>
<td>x</td>
</tr>
<tr>
<td>8</td>
<td>Trash can/bin is in an adequate distance from processing area</td>
<td>x</td>
</tr>
<tr>
<td>9</td>
<td>Free of pests (rodents, insects/its feces)</td>
<td>x</td>
</tr>
</tbody>
</table>

**Week 1:**
Work area was not completely clean. Trash bin was in a close distance from the processing area and was not covered. Flies was often seen in the processing area. Cobwebs on the ventilation and ceiling.

**Week 2:**
There was not any difference from last week’s observation. But work area was not as dirty as last week.

**Week 3:**
Work area was clean this week, no accumulated dishes in the sink. But trash bin is still accumulate and flies and spider webs are still on the ventilation and ceiling.

*Where ✓ means yes and x means no*
Appendix 5 Evaluation check sheet producer B after implementation

### Process control

<table>
<thead>
<tr>
<th>Description</th>
<th>Repetition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Raw materials go through the process of sorting and proper cleaning</td>
<td>√ √ √</td>
</tr>
<tr>
<td>Workers perform a systematic production process</td>
<td>√ √ √</td>
</tr>
<tr>
<td>Utensils that have been contaminated are reused</td>
<td>x x x</td>
</tr>
<tr>
<td>Workers show a well maintenance of hand washing</td>
<td>√ √ √</td>
</tr>
</tbody>
</table>

**Week 1:**
Producer has shown a great progress throughout training. Raw materials undergo proper cleaning. Producer perform a systematic production process. Producer show a well maintenance of hand washing. No more contaminated utensil reuse.

**Week 2:**
There was not any difference from last week’s observation. Still showing progress.

**Week 3:**
Still there was not any difference from the previous weeks. Still showing progress. I did not want to experiment on behaviors, so it was fully supervised.

### Sanitation

<table>
<thead>
<tr>
<th>No</th>
<th>Sanitation</th>
<th>Repetition</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Proper cleaning tools and materials are available</td>
<td>√ √ √</td>
</tr>
<tr>
<td></td>
<td>(brushes, mops, soap, brooms)</td>
<td></td>
</tr>
</tbody>
</table>

**Description:**

**Week 1:**
There was not any difference from last week’s observation.

**Week 2:**
There was not any difference from last week’s observation.

**Week 3:**
Still there was not any difference from the previous weeks.

Where √ means yes and X means no
Where √ means yes and X means no

<table>
<thead>
<tr>
<th>No</th>
<th>Processing water</th>
<th>Repetition</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Water used for production are clean water, boiled/drinking water</td>
<td>√ √ √</td>
</tr>
</tbody>
</table>

Week 1:
Water that was used for cleaning raw materials, tools, utensils and hand were clean water/tab water, and processing water that was used were boiled water.

Week 2:
There was not any difference from last week’s observation.

Week 3:
Still there was not any difference from the previous weeks.

<table>
<thead>
<tr>
<th>No</th>
<th>Production tools</th>
<th>Repetition</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>All production tools and utensils are properly clean before use</td>
<td>√ √ √</td>
</tr>
</tbody>
</table>

Week 1:
All tools and utensils were clean.

Week 2:
There was not any difference from last week’s observation.

Week 3:
All tools and utensils were clean.

Where √ means yes and X means no
<table>
<thead>
<tr>
<th>No</th>
<th>Production area</th>
<th>Repetition</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Work area is clean (table, floor, wall)</td>
<td>√  √  √</td>
</tr>
<tr>
<td>2</td>
<td>Ceiling is maintained (spider web, dusk free)</td>
<td>x  √  √</td>
</tr>
<tr>
<td>3</td>
<td>Ventilation is maintained</td>
<td>x  √  √</td>
</tr>
<tr>
<td>4</td>
<td>Production area is bright/well lit</td>
<td>√  √  √</td>
</tr>
<tr>
<td>5</td>
<td>Raw materials storage area is separated from the final product and non-food products</td>
<td>√  √  √</td>
</tr>
<tr>
<td>6</td>
<td>Free from standing/puddle of water</td>
<td>√  √  √</td>
</tr>
<tr>
<td>7</td>
<td>Free from accumulated trash</td>
<td>√  √  √</td>
</tr>
<tr>
<td>8</td>
<td>Trash can/bin available</td>
<td>√  √  √</td>
</tr>
<tr>
<td>9</td>
<td>Trash can/bin are covered</td>
<td>x  x  x</td>
</tr>
<tr>
<td>10</td>
<td>Trash can/bin is in an adequate distance from processing area</td>
<td>√  √  √</td>
</tr>
<tr>
<td>11</td>
<td>Free of pests (rodents, insects/its feces)</td>
<td>x  √  √</td>
</tr>
</tbody>
</table>

Week 1:
Work area was clean, trash bin was not accumulated with trash, but there was still a few flies and cobwebs on the ventilation and ceiling.

Week 2:
There was not any difference from last week’s observation. But no more flies and cobwebs on the ventilation and ceiling.

Week 3:
Work area was completely clean.

Where √ means yes and X means no
## Personnel hygiene

<table>
<thead>
<tr>
<th>Description</th>
<th>Repetition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Workers work in a good health</td>
<td>√</td>
</tr>
<tr>
<td>Workers work in a clean manner (have washed their hands/bathe, wear clean clothes)</td>
<td>√</td>
</tr>
<tr>
<td>Workers always wash their hands (before, during and after production)</td>
<td>√</td>
</tr>
<tr>
<td>Workers wear jewelry</td>
<td>X</td>
</tr>
<tr>
<td>Workers smoke, eat, drink, spit, cough/sneeze into the food during processing</td>
<td>X</td>
</tr>
<tr>
<td>If workers are injured, workers wear gloves/clean bandage</td>
<td>-</td>
</tr>
<tr>
<td>Workers maintain their nails, hair and skin care</td>
<td>√</td>
</tr>
</tbody>
</table>

### Week 1:
Producer has practiced a good sanitation procedure. Producer has to be reminded to wash hands.

### Week 2:
There was not any difference from last week’s observation. Producer still has to be reminded to wash hands.

### Week 3:
Still there was not any difference from the previous weeks. Producer still has to be reminded to wash hands.

Where √ means yes and X means no.
## Appendix 6 Product microbiological evaluation Total Plate Count data

<table>
<thead>
<tr>
<th>Producer</th>
<th>Before Implementation</th>
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<tbody>
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<td>Period</td>
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</tr>
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<td></td>
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</tr>
<tr>
<td>A</td>
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<tr>
<td>Beras Kencur</td>
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<td>1</td>
</tr>
<tr>
<td></td>
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<tr>
<td></td>
<td>2</td>
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</tr>
<tr>
<td></td>
<td>2</td>
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<tr>
<td></td>
<td>u2</td>
<td>1</td>
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<td>2</td>
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<td>B</td>
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### Appendix 7 Analysis of variance of product Total Plate Count

#### t-Test: Paired Two Sample for Means

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<tr>
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</tr>
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<tr>
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</tr>
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<td>t Critical one-tail</td>
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### Appendix 8 *Jamu gendong* bottle microbiological evaluation Total Plate Count data

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<th>After Implementation</th>
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<td>$4.32 \times 10^7$</td>
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Appendix 9 Analysis of variance of *jamu gendong* bottle Total Plate Count

**t-Test: Paired Two Sample for Means**

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<tr>
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### Appendix 10 Air microbiological evaluation Total Plate Count data

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<td>9.8×10^3</td>
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<td>29 24</td>
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<td>7.2×10^3</td>
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<td>77 63</td>
<td>32 48</td>
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<td>92 81</td>
<td>36 34</td>
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<td>47 43</td>
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<td><strong>u3</strong></td>
<td>53 59</td>
<td>19 20</td>
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## Appendix 11 Analysis of variance of Air Total Plate Count

### t-Test: Paired Two Sample for Means

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<thead>
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<th>Variable 1</th>
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<td><strong>P(T&lt;=t) one-tail</strong></td>
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<td><strong>Critical one-tail</strong></td>
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### Appendix 12 Product pH

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</thead>
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<td>7.32</td>
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<tr>
<td>Producer B</td>
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<td>6.68</td>
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**IMPLEMENTATION**

<table>
<thead>
<tr>
<th>Producer</th>
<th>pH Beras Kencur</th>
<th>pH Temulawak</th>
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</thead>
<tbody>
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<td>Producer A</td>
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<tr>
<td>Producer B</td>
<td>5.91</td>
<td>6.85</td>
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</table>
Appendix 13 Observation pictures of producer A

Picture 1 work area producer A

Picture 2 Trash bin before implementation

Picture 3 Trash bin after implementation

Picture 4 work area before implementation

Picture 5 work area sanitizing before implementation without sanitizer

Picture 6 work area sanitizing after implementation with sanitizer
1. Dilengkapi air bersih, sabun, dan pengencer (berkualitas baik).
   - Disiapkan alat untuk pengeringan.
   - Peralatan keselamatan yang penting.

2. Dilengkapi makanan dan minuman yang sehat dan bergizi.

- Jangan lupa untuk mempersiapkan alat pengaduk seperti spoon, spatula, dll.

---

**Picture 7** work area sanitizing after implementation

**Picture 8** hand washing before implementation without sanitizer

**Picture 9** hand washing after implementation with sanitizer

**Picture 10** wooden pestle pooled overnight

**Picture 11** utensil cleaning with only simple rinsing (before implementation)

**Picture 12** utensil cleaning with sanitizer (after implementation)
1. Picture 13 utensil cleaning with sanitizer (after implementation)

2. Picture 14 utensil cleaning with hot water (after implementation)

3. Picture 15 utensil cleaning with sanitizer (after implementation)

4. Picture 16 work area sanitizing (after implementation)

5. Picture 17 bottle sanitizing with sanitizer (after implementation)

6. Picture 18 bottle sanitizing (after implementation)

7. Picture 19 bottle sanitizing with hot water (after implementation)

8. Picture 20 temulawak washing with only simple rinsing
80

Picture 21 cleaning utensil sanitizing (after implementation)

Picture 22 temulawak washing with effort on eliminating soil (after implementation)

Picture 23 worker before implementation

Picture 24 worker after implementation (clean apron on)

Picture 25 mashing process

Picture 26 mashing process

Picture 27 extracting process

Picture 28 filtering temulawak
Picture 29 bottling process
Appendix 14 Observation pictures of producer B

Picture 30 work area producer B

Picture 31 trash bin before implementation

Picture 32 work area cleaning after implementation

Picture 33 work area sanitizing after implementation

Picture 34 worker before implementation

Picture 35 worker after implementation (clean apron on)
Picture 36 wooden pestle cleaning
with only simple rinsing
(before implementation)

Picture 37 wooden pestle cleaning
with sanitizer (after implementation)

Picture 38 wooden pestle cleaning
with hot water (after implementation)

Picture 39 bottle cleaning with only
simple rinsing

Picture 40 bottle cleaning

Picture 41 bottle cleaning with
hot water (after implementation)
Picture 44 utensil cleaning with simple sanitizer (after implementation)

Picture 45 temulawak washing (after implementation)

Picture 46 hand washing before implementation

Picture 47 hand washing with sanitizer after implementation

Picture 42 utensil cleaning with simple sanitizer (after implementation)

Picture 43 utensil cleaning with simple sanitizer (after implementation)

Picture 41 utensil washing (before implementation)
1. Dilengkapi alat dan bahan untuk pelaksanaan prosesifikasi, memastikan kebersihan alat danarea kerja.

2. Melakukan sanitasi pada area kerja setelah produksi.
Appendix 15 Pictures of laboratory results

Picture 55 product Total Plate Count analysis

Picture 56 Bottle Total Plate Count analysis
Picture 57 positive *staphylococcus* BP agar analysis

Picture 58 air contamination analysis
Picture 59 positive *salmonella* BSA, XLDA and HEA agar

Picture 60 positive TSIA and LIA agar slants
Appendix 16 CCP Decision Tree
<table>
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<tr>
<th>Step</th>
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<th>Chance</th>
<th>Severity</th>
<th>Control measures / Precautions</th>
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<tr>
<td>CCP</td>
<td>Sortation of rhizomes</td>
<td>Physical (gravel)</td>
<td>Poor handling during harvest and post harvest</td>
<td>(H, M)</td>
<td>Supervision. yes</td>
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<tr>
<td>CCP</td>
<td>Washing of rhizomes</td>
<td>Microbiological (spoilage and mold in bad roots)</td>
<td>Poor handling during harvest and post harvest</td>
<td>(H, L, M)</td>
<td>Supervision. yes</td>
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Appendix 18: Three tubes MPN table
AUTHOR BIOGRAPHY

Ranti Rizka Ramadhini was born in Bogor on April the 1st 1991. She graduated from Price-Harris Elementary School, Wichita Kansas USA in 2002 then continued her study at Coleman Middle School up to the 7th grade and returned to Indonesia to continue middle school in SMPN 4 Bogor up to the year 2005, and finished high school in SMAN 5 Bogor by the year 2008. After graduating high school, Ranti continued college in Bogor Agricultural University and majored in Food Science and Technology. Author had a passion for children and later took child development and education classes.

Throughout her college years, she was much involved in the faculty and department theater club as head and director and have successfully lead the organization to excellence in achieving 1st place winner in many art competitions from the year 2010 to 2012. In the year 2009, Author received full grant Program Kreativitas Mahasiswa entrepreneurship. In the year 2010 to 2011, author as also Head of MARKIBIMO (Mari Kita Bikin Movie) division in an organization called Telisik Pangan. In the year 2011 Author earned second place winner in UNIVATION business competition (functional food business proposal) on food technology and culinary arts in a national seminar of Healthy Snack On Local Ingredients With Balanced Nutrition, Padjajaran University in Bandung. In the year 2012, Author was accepted as presenter in an international seminar held by UNIKA University in Semarang.

Author was also active outside of campus, she became a freelance English tutor for business conversation (beginner – advance level) in the year 2010 and later taught science as well for elementary to junior high level. In the year 2012, Author was a teacher in Pijar Center, English substitute teacher in SMP Bina Sejahtera Bogor and an assistant facilitator in Sekolah Alam Bogor.