

Plan of Haccp (Hazard Analysis and Critical Control Point) System in the Processing of Sponge, Brownies and Cookies

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Abstract

The HACCP system that can be used to ensure quality control of food safety. The arranging of HACCP plan the 7 principles HACCP. The HACCP plant is KWT Giri Wangi with cake, brownies, and cookies products. The HACCP plan done by Giri Wangi farm women group to sponge, brownies, and cookies products. The purpose of implementing HACCP system is to identify, evaluate, and control potential hazards in sponge, brownies, and cookies products. The result this study HACCP system is identify 5 CCP to material prepare and 2 CCP of equipment prepare. At the processing and packaging stages, 3 CCP were identified, namely in the mixing of materials, curing, and packaging. Corrective action taken to control the CCP is to carry out consistent supervision of raw materials and at the production stage.

Keywords: HACCP plan, sponge, brownies, cookies, and groups

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1. Introduction

Indonesia's population continue to increase, in 2018 it has reached 265 million (Detik Finance, 2018). With that population, the need for food continues to grow, both staple food and foodstuffs in the category of snacks/snacks. The development of food product trends is directly proportional to the development of technology, where people begin to recognize various types of food products with a variety of processing processes, such as snack food products/snacks. This is one of the opportunities for food producers, such as Micro Small Business (UKM). Production is an important stage that need attention in ensuring food security. According to Dewanti-hariyadi & Hariyadi (2012) and Pramesti *et al.* (2013), food safety is the steps take so that food products are safe for consumption and free of factors that can cause disease. The method can be used to ensure food safety so that it does not dangerous health is the Hazard Analysis Critical Control Point (HACCP) method (Renosori *et al.*, 2009). The HACCP system is one and ways that can be form to guarantee quality control of food safety. HACCP is a system that identifies, evaluates, and controls real hazards for food safety (Renosori *et al.*, 2009). HACCP system management manages food safety by reducing the danger or risk of biological, chemical, and physical contamination from raw materials, production processes to products ready to be served so that products are safe for consumption (Marlyana *et al.*, 2012). There are 7 HACCP principles according to BSN (1998), 1) determination of hazards and risks; 2) determination of CCP (Critical Control Point); 3) setting critical limits on each CCP; 4) establishment of monitoring at each CCP; 5) establishment of corrective actions; 6) establishment of verification procedures; 7) determination of documentation and records.

The basic principle of the HACCP method must be applied by all food producers, both large scale companie, small and Micro Small Business (UKM). All businesses related to the food industry, the production of catering food or catering services, food for hotels and restaurants, including also in the production of hawker food are required to implement the HACCP system (Renosori *et al.*, 2009). The production of brownies, cakes, and cookies produced by the women farmer groups (KWT) fostered by the Bali Agricultural Technology Assessment Center (BPTP) has not yet applied the principles of the HACCP method. To ensure food safety and maintain the quality standard of the products produced, it is necessary to prevent the possibility of biological, chemical and other contaminants that can interfere, harm and endanger health. Quality control can be done with HACCP (Hazard Analysis Critical Control Point) analysis.

A case study of the plan to implement the HACCP system in the processing of brownies, cakes and cookies was carried out at KWT Giri Wangi, Pempatan Village, Rendang, Karangasem Regency. The results of the analysis of the HACCP system will be use as a guideline for the group in producing brownies, sponge, and cookies products. Why is the HACCP system an option because effective food safety guarantees cannot be expect in the final product quality control (QC). This is because of the limitations of the monitoring and testing process by sampling. Besides the QC process it is very difficult to implement and optimize on group scale due to limited group knowledge (Ramdhan *et al.*, 1998). So the HACCP system is the best alternative because it prioritizes the prevention of food safety hazards starting from raw materials, production processes, packaging to storage.

The research purpose is to apply the HACCP system by using a flow chart to illustrate the flow of the processing of brownies, sponge, and cookies, so as to identify potential dangers to the product.

2. Materials and Methods

2.1 Materials

The materials consist of a list of raw materials, supporting materials, production process flowcharts, risk level determination tables, and the CCP decision tree. The concept of HACCP according to the CAC (Codex Alimentarius Commission) consists of 12 steps, in which there are 7 principles of HACCP (Figure 1).

The study began with product characterization and production processes in the Giri Wangi farmer women's group (KWT), Pempatan Village, Rendangs sub-district, Karangasem Regency, Bali Island in Indonesia Country. This group has received training in the processing of modified sweet potato flour and derivative products, which consist of brownies, cakes and cookies from BPTP Bali in 2016 (Sugianyar *et al.*, 2016). Sweet potato flour processing use the modified Herawati and Widowati (2009) method. The fermentation process in sweet potato flour using yeast traditional starter in Bali with a concentration of 1% w/v.

2.2 Methods

The research method uses descriptive method, by examining the analysis of work and activities on an object. Data collection is done through literature studies, interviews, field observations, and checklists.

Analysis is done by registering all hazards contained in raw materials and processing. Next the identified hazards are then tabulated in a table, supplemented by the source of the hazard, the level of risk and preventive measures. Each raw material use and the stage of the process, whether include in the CCP or not is through consideration of the level of risk and based on answers to questions from the CCP decision tree. Raw materials and process steps included in the CCP must be control properly so that they are not harmful to human health. The process that not included in the CCP is called CP, which if not controlled will cause defects for the product as quality defects.

3. Result and Discussion

Guidelines for the preparation of the HACCP system plan are carried out to provide basic information regarding the application of the HACCP system to the Giri Wangi KWT, make it easier for groups to process products according to standards. Before processing the product first, processes sweet potatoes into sweet potato flour by fermentation using 1% w/v yeast traditional in Bali, further referred as modified sweet potato flour. The products produced by the group are processed using modified sweet potato flour, which is substitut with wheat flour (the results of the 2016 BPTP Bali study). The ingredients use in processing brownies, cakes and cookies are presented in Table 1.

Consumers of brownies, cakes and cookies are the general public, from children to parents. Process flow chart for processing brownies, cakes and cookies is presented in Figures 2, 3, and 4. The constraint at the producer level, especially at the group scale is the lack of environmental cleanliness so that food products are polluted by material that can endanger human health. Hazardous materials can be in the form of chemical, physical, and microbiological contamination (Dewanti-hariyadi & Hariyadi, 2012). Hazard identification and analysis is done by looking at the flow chart of the processing of brownies, sponge, and cookies (Table 2). HACCP is carried out to maintain the safety of brownies products, cakes and cookies so that the breeding of bacteria and fungi can be controlled.

Determination of CP is in the stages of employee preparation, forming, cooling, and product storage. Preparation before the production process that must be carried out by employees, including cleaning and health of workers (Afrianto, 2008; Dewanti-hariyadi & Hariyadi, 2012 and Triyanni & Pujitomo, 2012). Hygiene of workers, especially washing hands in the processing of brownies, cakes and cookies, needs attention because microorganisms carried by workers' hands can cause product contamination.

The forming and cooling process is included in CP, because it is a control point to produce products with good quality. Product storage is included in CP, this is because the storage environment is a control point that can affect the shelf life of the product. Brownies products should be stored at cold temperatures, 5-10°C (Indriastuti, 2006) while storage temperatures for sponge products and cookies at room temperature.

Critical Control Point (CCP) for brownies, cakes and cookies can be seen in Table 3. CCP as a step, where control can be carried out to prevent and eliminate food safety hazards or reduce the danger on acceptable level (BSN, 1998). The process of brownies products, cakes and cookies by using a decision matrix, produces 5 CCP. The use of eggs that are not fresh is included in CCP 1, because eggs that have long had poor quality. Fresh eggs are marked by egg whites that are still thick and egg yolks have a round shape. The function of eggs in brownies as softener, binder, aeration (Khotijah, 2015) and eggs can influence the aroma, color and taste of the dough (Astawan, 2009). Control can be done by controlling the material to be used and selecting suppliers of raw materials.

The danger that can be controlled at CCP 2 is supervising workers. Workers must use gloves, hair net and aprons to maintain the cleanliness of the product so that it does not endanger the health of consumers (Hawwa, 2016; Triyanni & Pujitomo, 2012 and Dewanti-hariyadi & Hariyadi, 2012). CCP 3 is the danger of foreign matter when mixing materials, this can be controlled and prevented by sorting the material to be used. The process of

covenant enters CCP 4 with danger, the possibility of microbial growth occurs when the temperature of the covenant is not optimal. And packaging is included in CCP 5. The purpose of packaging is to control the growth of bacteria and fungi by applying sanitation to workers and maintaining packaging cleanliness. Control can be done by means of officers who come in direct contact with the product should use gloves (Triyanni & Pujitomo, 2012).

The Control Point (CP) or the critical limit, presented in Table 4, is the maximum or minimum value for physical, biological or chemical hazards that the critical control point must control to prevent, eliminate or reduce the level of danger acceptable so that the product can be categorized as safe from the hazard (Marlyana *et al.*, 2012).

Establishment of monitoring procedures or monitoring at the CCP is the stage of observation or measurement carried out in a planned manner to obtain appropriate data documentation, to check the critical limits in control. Determination of the critical boundary observation procedures include what (who), who (who), where (where), when (when), and how (how) monitoring is carried out (Zahria, 2018). Monitoring procedures for processing brownies, sponge, and cookies products are presented in Table 5.

Determination of corrective actions carried out by the HACCP team, if the results of monitoring on the CCP occurs a critical boundary deviation (loss of control). Corrective action procedures are needed to ascertain the cause of the deviation and determine effective steps to prevent the same recurrence.

Verification procedure has not been carried out on KWT Giri Wangi, because it will only apply the preparation of the HACCP plan. Verification action is taken to ensure that the HACCP system plan that will be implemented is really appropriate to prevent the emergence of hazards that can harm health (Zahria, 2018).

The procedure for recording documentation is carried out to collect written data compiled in the form of forms. This document is used for inspection purposes and to study damage that results in irregularities and find suitable corrective actions (Zahria, 2018). Documents that must be completed, consisting of monitoring documents, corrective action documents, and verification documents. However KWT Giri Wangi only has monitoring documents, because the HACCP system plan has only reached the stage of the plan/proposal. The correction and verification action document can be completed if the group has implemented the CCP monitoring procedure (critical control point).

4. Conclusion

The plan for applying the HACCP study to the process of brownies, sponge cakes and cookies that will be applied to KWT Giri Wangi, includes :

- The danger identified by using the HACCP system in processing brownies, sponge, and cookies products consists of bacterial growth at the employee preparation stage. Bacterial and fungal growth at the material preparation, equipment, packaging and storage stage. The danger of cross-contamination occurs at the stage of mixing all materials and oven.
- Analysis of CCP determination using a decision matrix identifying 5 CCP. In the preparation phase of materials and equipment there are 2 CCPs, namely eggs not fresh and do not use gloves, hair net, and aprons. At the processing and packaging stages, there are 3 CCPs, mixing, packing and packaging stages.
- Corrective action used to control CCP is to carry out consistent supervision of raw materials and production stages.

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Author Contributions

Main contributor : Wayan Trisnawati. The HACCP plan research design method was carried out by Wayan Trisnawati. The design of processing sponge products, brownies, and cookies was carried out by Wayan Trisnawati, Made Sugianyar and Ketut Ari Tantri Yanti. Data analysis was carried out by Wayan Trisnawati. Paper writing is done by Wayan Trisnawati. This paper has been approved by all authors.

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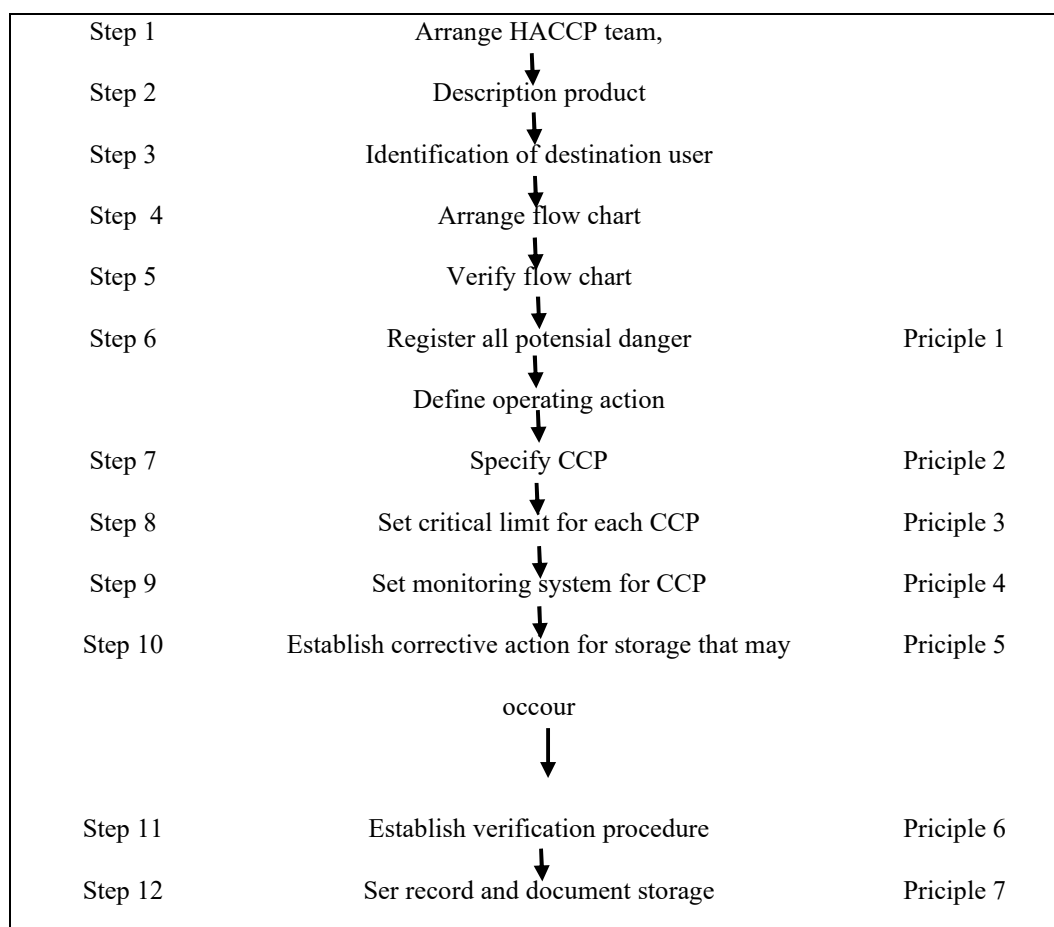


Figure 1. Basic concept of HACCP (BSN, 1998)

Table 1. Ingredients used in the processing of brownies, cakes and cookies

Brownies	Cake	Cookies
Wheat flour, modified sweet potato flour, eggs, sugar, salt, cake emulsifier, vanilla powder, cocoa powder, baking powder, vegetable oil, and dark chocolate.	Egg white, egg yolk, granulated sugar, margarine, developer, milk powder, flour, modified sweet potato flour, baking powder, and vanilla	Refined sugar, butter, margarine, essence, egg yolks, cornstarch, wheat flour, and modified sweet potato flour

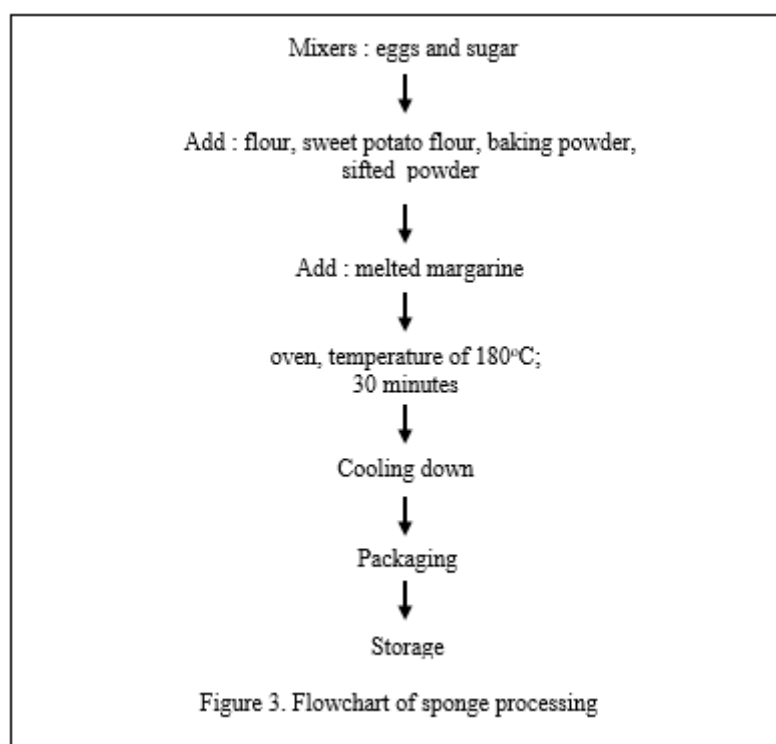
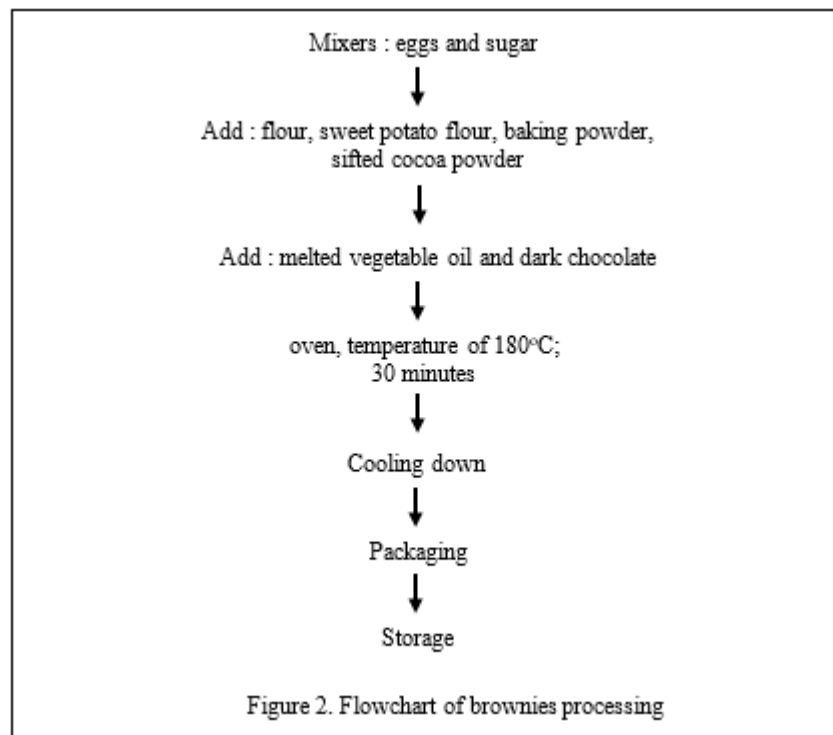


Table 2. Identification and analysis of hazards on brownies, sponge, and cookies products

No	Step of process	Source of Danger	Source of Danger Critical/Potential Danger	Chances for Hazard (L/M/H)*	Are the Real Potential Dangers (Yes = entering the CCP decision tree)	
					Yes	No
1.	Employee preparation	- Do not wash hands	Bacterial growth	M		√
2.	Preparation of materials and equipment	- Washing equipment less clean - Raw materials past the expiration date - Eggs are not fresh - Weighing materials and processing do not use hair net gloves, and aprons	Bacterial and fungal growth	M	√ - Eggs are not fresh - Do not wear gloves, hair net, and aprons	
3.	Mixing all ingredients	- There is foreign matter when mixing ingredients - Do not use gloves so there are foreign objects mixed	Cross contamination occurs	M	√ - There is foreign matter in the dough	
4.	Mintage	- Mold is not clean and rusty	Cross contamination occurs	M		√
5.	Oven	- Oven temperature is not stable	Cross contamination occurs	L	√ - Mushroom growth because the temperature is not optimal	
6.	Cooling and removal from the mold	The cooling area is not clean	Cross contamination occurs	M		√
7.	Packaging	- Do not use gloves, hair net, and aprons - Unclean / hygienic packaging containers	Bacterial and fungal growth	L	√ - Worker's sanitation and packaging conditions	
8.	Storage	- Storage is not clean enough - Storage time	Bacterial and fungal growth	M		√

Information : * = L (Low), M (Medium), H (High)

Table 3. Determination of CCP based on the decision tree on brownies, cakes and cookies

Step of Process	The Danger	Q1.	Q2.	Q3.	Q4.	CCP	Note from HACCP's Team
Preparation of materials and equipment : Eggs are not fresh	Bacterial growth	Y	T	Y	T	CCP 1	Conduct supplier specifications
Preparation of materials and equipment : Do not use gloves, hair net, and aprons	Bacterial and fungal growth	Y	T	Y	T	CCP 2	Supervision of the production process
Mixing all ingredients	Cross contamination	Y	Y	T	T	CCP 3	Supervision of the production process
Oven	Cross contamination	Y	Y	T	T	CCP 4	Set the stove's flame and duration of oven
Packaging	Bacterial and fungal growth	Y	Y	T	T	CCP 5	Maintain worker sanitation and packaging hygiene

Source : Primary data processed, 2019

Information :

- Q1 = Are there any precautions for the hazard found? ; If not = not CCP, If yes = next question
- Q2 = Are the stages specifically designed to eliminate or reduce the danger that might occur to an acceptable level? ; If not = next question, If yes = CCP
- Q3 = Can contamination with identified hazards exceed acceptable levels? , if not = not CCP, if yes = next question
- Q4 = Will the next stage eliminate the identified hazard or reduce the likelihood of its occurrence to an acceptable level? ; if not = CCP, if yes = not CCP
- Y = yes ; T = no

Table 4. Critical limits on the HACCP control system

No CCP	Step of process/CCP	The Danger	Critical Limits	Corrective action
1	Material and equipment preparation: eggs are not fresh	Bacterial growth	- Fresh egg - Storage of eggs at cold temperatures, 5-10°C with humidity > 70%	- Returning eggs to suppliers - Provide direction to the supplier
2	Preparation of materials and equipment : Do not use gloves, hair net, and aprons	Bacterial and fungal growth	Using production equipment : gloves, hair net, and aprons	Supervision must be carried out consistently
3	Mixing all ingredients	Cross contamination	There is no dirt and foreign matter in the raw material	Supervision of the production process
4	Oven	Cross contamination	Oven temperature of 180°C for 30 minutes	Supervision must be carried out consistently
5	Packaging	Bacterial and fungal growth	- Applying sanitation and using special clothing for production - Packaging must be done carefully	Control of the sanitation process and the packaging process

Source : Primary data processed, 2019

Table 5. CCP monitoring procedures

No	The stages of the CCP process	Monitoring procedures at each CCP				
		<i>What</i>	<i>How</i>	<i>Where</i>	<i>Who</i>	<i>When</i>
1	Material and equipment preparation : eggs are not fresh	Chicken egg	Egg freshness check	Production place	Workers who are responsible for receiving raw materials	When the raw materials arrive at the processing location
2	Material and equipment preparation : don't use hair net gloves, and aprons	Completeness of work attributes	Implement applicable SOPs	Production place	Workers in the production process	At the time of the production process
3	Mixing all ingredients	Sorting raw materials	Supervision of cleanliness of raw materials	Production place	Workers in the production process	During the production process
4	Oven	Oven temperature	Monitor temperature using a thermometer	Production sites in the oven/room	Workers in the production process	During the production process
5	Packaging	Sanitary and packaging hygiene	Monitor the sanitary conditions and cleanliness of the packaging	Product packaging	Workers in the packaging process	Each packaging process

Source: Primary data processed, 2019