

Strategic Analysis of Application of The Hazard Analysis Critical Control Point on “Bite and Bite Cakes Home Industry” in Sidoarjo, Indonesia

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Strategic Analysis of Application of The Hazard Analysis Critical Control Point on "Bite and Bite Cakes Home Industry" in Sidoarjo, Indonesia

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ABSTRACT

This study presents the analysis of a food safety management system based on Hazard Analysis Critical Point (HACCP) principles and application in the home industry. Bite and Bite Cakes is a kind of private home industry that produces commercial flour-based food baked product and was established since 2017. This business uses social media as e-commerce strategies to promote and sell their products. This study aimed to evaluate and develop the HACCP plan in small food industry from production until distribution. An interview and observation were conducted to collect the data from the owners through directly observed during the production process. Three categories of food safety hazards were founded in brownies production line, specifically at biological, physical, and chemical agents. These concluded hazards showed that several steps are categorized as potential CCP, specifically the raw material receiving, baking, and packaging. Hopefully, these assessments of food safety management system could provide and improve the food safety and quality, especially in-home industry.

Keywords: HACCP, hazard, cake, home industry, food safety

Introduction

Bakery and Cake is a trendy food nowadays. The sweet taste and diverse shapes make it increasingly popular with the community. Cake can be served as a dessert and appetizer. The main ingredient in cake is flour. However, a cake can be varied using a variety of raw materials, in other words, not only using flour to make cakes (Kim et al., 2004).

One of the popular products from "Bite and bite cakes" is Japanese cheesecake (Figure 1), according to the owner of "Bite and Bite Cakes", Cheesecake is one of the world-famous types of cakes. Cheesecake was first made by the Ancient Greeks. In the past, cheesecakes were served to the athletes during the first Olympic Games held in Greece to give them energy. The cheesecake was made using soft cheese from goat's milk or sheep's milk. Along with the development of the bakery industries, cheesecake has been made by using Cream Cheese. This cake is still classified as a cake with a prestigious price, due to its main ingredient being Cream Cheese.

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Figure 1. Japanese Cheesecakes product by “Bite and Bite cakes”

In addition, this factory also accepts orders for birthday cakes, boba cakes, brownies, crazy bananas, cinnamon rolls, and many more.



Figure 2. Cake variation from Bite and Bite Cakes. (Adapted from Instagram “@biteandbitecakes”)

Quality aspects and food safety of bakery products are primary problems in the production and marketing process, particularly about consumers' concern for quality and health that continues to increase. The causes of illness and death caused by food in Indonesia are still high, although the principles of control for these diseases are generally known. Therefore, it is necessary to control the quality of the product from the start of raw materials, processes, and final products. In addition to quality control, it is also necessary to have a risk analysis system that may arise at each stage of production, namely Hazard Analysis Critical Point (HACCP) (Mortimore et al., 2013).

Hazard Analysis Critical Control Point (HACCP) is a food safety assurance system that is based on an awareness that hazards have the potential to arise at various points or stages of production and must be controlled to prevent these hazards. The HACCP system is not a zero-risk food safety guarantee system. However, HACCP is designed to minimize risk food safety hazards in a food production process. There are at least two things, why HACCP is important, including in the cake and bakery industry. First, the problem of food safety is something which not negotiable in food products, and the second thing is the failure to guarantee food security which can lead to the following things: Disease and death of consumers, recall or withdrawal of products, government actions (reprimands to the closure of business licenses), detention and destruction of products, and the most important thing is losing consumer confidence (Mortimore et al., 2013; Gil et al., 2016; Pierson, 2012). The HACCP system also has a lot of advantages for developing the industry,

including small and medium enterprises (Baş et al., 2006; Celaya et al., 2007; Cusato et al., 2014; Fielding et al., 2005; Youn & Sneed, 2003; Walker et al., 2003).

The quality of the product affects consumer purchase decisions. Food quality includes a sufficient nutritional value, free from chemical and microbiology contamination. The quality of food safety done by tests of final products alone cannot guarantee overall quality. Quality food supervision based on preventive principles was regarded as better than the old methods focused on testing the final product in the laboratory. Hence the practice of GMP and HACCP became crucial. Especially the application by food handlers working in the food industry (Priyanto et al., 2022). For that reason, this research aims to analyze the application of the quality control system/HACCP to the process of making the cake in "Bite and Bite Cakes" from raw materials, production up to final products.

Material and Methods

Research method

This study combines the literatures study, site visit and interview with the owner. The literature study was done by reading, analysis, comparing the method for applying the hazard analysis. The site visit was done by visiting the home industry of bite-and-bite cakes in Sidoarjo – Indonesia.

Results and Discussion

Process flow diagram

The production of Japanese cheesecake is explained by the following diagram (Figure 3).

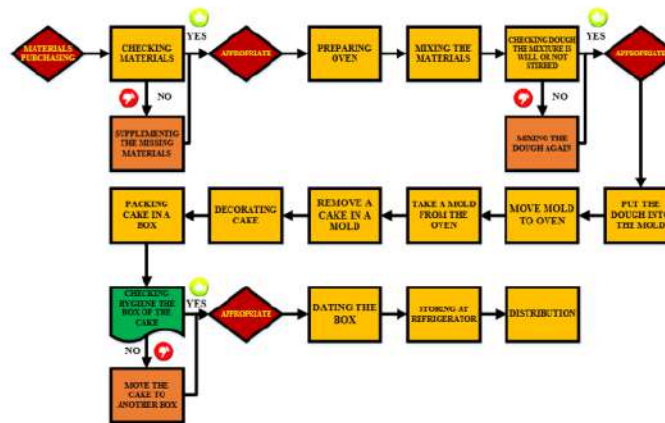


Figure 3. Japanese cheesecake flow diagram

1 Hazard identification and analysis of raw materials and packaging

Hazard identification and analysis include potential physical, chemical, and microbiological hazards to the raw materials and packaging used to make cakes. The identification details are presented in Table 1.

Biological hazards (molds and fungi) have the potential to contain aflatoxin because the types of commodities such as sorghum, rice, corn, and wheat and their derivatives are foodstuffs that can generally be contaminated with aflatoxins (Gil et al., 2016). In addition, one of the factors that can pose a significant danger is the compound produced by *Salmonella* sp., which is commonly found in eggs. *Salmonella* can cause bacterial transmission into the egg by sticking to the surface

of the eggshell (Kim, *et al.*, 2004). The selection of a reliable supplier and inspection of raw materials before use and storage in closed and dry conditions must be made to avoid various physical, chemical, and microbiological contaminations. Then, during the packaging process, PE is used as the primary packaging and the carton is used as secondary packaging. The packaging has the potential of contamination if the plastic monomer migrates into the food, especially when it is heated or in high-temperature conditions. The selection of the right packaging and storing it in clean and dry conditions can prevent the presence of dust or other impurities that are still attached to the package.

Table 1. Hazards identification

Materials	Type of Hazards	Cause of Hazards	Way of Controlling
Flour	Mold, bleach, aflatoxin, foreign matter, gravel, and dust.	<ol style="list-style-type: none"> 1. Inadequate storage. 2. Bleach used. 3. Contamination of the surrounding environment 	<ol style="list-style-type: none"> 1. Choose the right supplier. 2. Checking flour when raw materials arrive 3. Perform screening of raw materials.
Egg	Salmonella, dust and soil.	<ol style="list-style-type: none"> 1. Chicken manure that is still attached to the egg. 2. Contamination of the surrounding environment 	<ol style="list-style-type: none"> 1. Choose the right supplier. 2. Check eggs when coming from suppliers. 3. Washing raw materials with running water.
Sugar	Osmophilic bacteria, gravel, dust, and impurities.	<ol style="list-style-type: none"> 1. Inadequate storage. 2. Contamination of the surrounding environment 	<ol style="list-style-type: none"> 1. Choose the right supplier. 2. Checking sugar when raw materials arrive. 3. Filtering sugar so that foreign objects do not come in.
Butter, Cream Cheese, Fermipan	Dust and impurities	<ol style="list-style-type: none"> 1. Inadequate storage. 2. Food additives used are not suitable or excessive 3. Contamination of the surrounding environment 	<ol style="list-style-type: none"> 1. Choose the right supplier. 2. Check margarine when raw materials arrive.
The Packaging	Cardboard monomers, dust and impurities	<ol style="list-style-type: none"> 1. Chemicals in packaging materials. 2. Contamination of the surrounding environment, 	<ol style="list-style-type: none"> 1. Good and safe packaging selection. 2. Storage of the packaging in a clean and dry place.

Process Determination of Critical Control Points (CCP) in the process of receiving raw materials

The determination of CCP on raw materials is quite important because the quality of raw materials greatly affects the final product, so it is safe for consumption. The determination of CCP in the process of receiving raw materials is presented in the table below. The table shows that the raw materials included in the CCP category are flour and sugar. In flour, the potential biological and chemical hazards can be caused by Aflatoxins that are produced by molds, while the potential physical hazards are caused by gravel. These toxins cannot be eliminated during the stages of the

production process, so they are quite dangerous if consumed and have a direct effect on the safety of the final product. In granulated sugar, the potential physical hazards are found in the form of gravel / small stones, which causes granulated sugar into the CCP category because the gravel cannot be eliminated during the production process stage.

Table 2. CCP determination

Materials	Raw Material	Are there any dangers? (P1) Yes: to P2 No: Not CCP	Can the production process eliminate danger? (P2) Yes: to P3 No: CCP	Cross-contamination of other facilities or products cannot be controlled? Yes: CCP No: Not CCP	Information
Flour	Mold, bleach, aflatoxin, foreign matter, gravel, and dust	Yes	No	-	CCP
Egg	Salmonella, dust and soil.	Yes	Yes	No	Not CCP
Sugar	Osmophilic bacteria, gravel, dust, and impurities.	Yes	No	-	CCP
Butter, Cream Cheese, Fer- mipan	Dust and impurities	Yes	Yes	No	Not CCP
The Packag- ing	Dust and impurities	Yes	Yes	No	Not CCP

Hazard identification of the production process

Hazard identification and analysis include potential physical, chemical, and microbiological hazards in the production process of Japanese cheesecake. The process is presented in Table 3.

Table 3. Hazards identification on production process.

Process	Type of Hazards	Cause of Hazardz	How to control
Weighing of raw materials and preparation for batter mixing	Broken eggshells, aflatoxins, microbial contamination from raw materials.	1. Prevention of careless eggshells. 2. Expired use of raw materials. 3. Improper storage of raw materials.	1. Checking the raw material before use. 2. Periodic checking of raw materials. 3. Proper storage of raw materials.
Mixing batter	Contamination from tools, and dust.	1. Contamination due to poor maintenance. 2. Contamination by air dust.	Wash equipment regularly before and after production so that cross contamination cannot occurs between batch of production.
Pouring the batter	Contamination from tools.	Physical contamination due to lack of equipment maintenance, causing rust.	Periodic device washing and tool replacement if it is corroded.
Baking	Contamination by mold.	Imperfect baking causes conditions that allow mold to grow.	Baking is consistently done at the right temperature and time.
Taking a cake from the pan	Dirt and dust.	Contamination can occur when moving the cake from the baking pan to the cooling rack.	Minimization of product contact with contaminants.
Packaging	Dust and microorganisms.	Poor packaging makes it prone to contamination.	Minimization of contamination by checking periodically.
Cooling down	Dirt and air dust.	Contamination can occur due to poor layout, mixing of storage shelves and cooling shelves.	Separation between cooling rack and storage rack.

Determination of Critical Control Points (CCP) in the production process

In the process of making cake, there are various physical, chemical, and biological hazards discovered. The determination of the CCP at the stages of the production process is important to determine the critical point so that control efforts can be taken to reduce the potential danger. The outline is presented in Table 4. Several stages of the production process that include in the CCP category are the receipt of raw materials, baking, and packaging. At the reception of raw materials, the potential biological and chemical hazards are caused by the presence of toxic aflatoxins that are produced by mold on the raw material for flour. Meanwhile, the potential physical hazards at the stage of receiving raw materials are caused by gravel, dirt, dust, etc. The aim of receiving material process is to eliminate/reduce the potential hazards contained in raw materials to a safe level by passing the selection of these raw materials, so that is safe to be consumed. At the baking stage, it can be classified into the CCP because this process is specifically designed to reduce the potential danger present in the batter by heating the product at the baking process. In the packaging process, the potential dangers are found in the form of E. coli contamination and impurities that cannot be eliminated / reduced in the next process, because this process is the

final stage in the production process. Other stages of the production process are not included in the CCP, because they can be minimized, so the potential hazards are not so significant.

1
Table 4. Determination of Critical Control Points (CCP) in the production process

Process	Hazard Identification	Are there any dangers? (P1) Yes: to P2 No: Not CCP	Are there any precautions? (P2) Yes: to P3 No: Not CCP	Process specifically designed to reduce the danger? (P3) Yes: CCP No: to (P4)	Is the danger increase to insecure limits? (P4) Yes: to P5 No: Not CCP	Further processing can reduce the danger (P5) Yes: No CCP No: CCP	Inf.
Weighing of raw materials and preparation for batter mixing	Bacteria, gravel Aflatoxin gravel, dust	Yes	No	Yes	-	-	CCP
Mixing batter	Contamination from tools, dust	Yes	Yes	No	Yes	Yes	Not CCP
Pouring the batter	Contamination from tools, dust	Yes	No	No	Yes	Yes	Not CCP
Baking	Contamination from tools, dust	Yes	Yes	Yes	-	-	Not CCP
Taking a cake from the pan	Dirt from the oven ceiling, dust	Yes	Yes	Yes	-	-	CCP
Packaging	E. coli	Yes	Yes	No	Yes	Yes	CCP
Cooling down	Dust, dirt	Yes	No	-	-	-	Not CCP

Conclusion

There are various aspects of cake production, such as; raw materials, packaging, and materials for processing that are identified as potential hazards. The potential hazards are majority specified in terms of biological, physical, and chemical. This study concludes that are 3 stages in making cakes that are considered CCP, namely: the acceptance process of raw materials, baking, and packaging. Those CCP could be beneficial for the further development of this food industry. Finally, this study reveals that the HACCP system is possible to apply at “bite and bite cakes” in Sidoarjo Indonesia, and suggests implementing this system shortly.

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