

## Analysis of packaging defect on goat milk caramel candy in *Etawa Agroprima*

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### ABSTRACT

Goat's milk has the same benefits as cow's milk. Goat's milk contains many nutrients, especially complete protein from all kinds of essential amino acids. *Etawa Agroprima* is a company engaged in the processing and marketing dairy products. One of the products produced is goat's milk caramel candy. These candies are packaged using candy wrappers and diamond paper, which is covered with paper again, then put into PE plastic, sealed using a sealer, and put in a cardboard box. This packaging is intended to maintain the quality of the candy because the candy is easily runny if left open so that the caramel candy is not easily damaged. Writing this final project aims to determine the types of defects in caramel candy products, the number of defective products for the entire product, and the causes of product defects—analysis of product types and defects using Pareto diagram analysis, while the cause using fishbone diagram analysis. Analysis of the data obtained on *Etawa Agroprima* using the two diagrams shows that the results of the Pareto diagram analysis show three types of defects, including torn packaging 75.56%, damaged packaging 13.33%, and no expiration label 11.11%. Then from the fishbone diagram analysis, it can be seen that the main factor causing defects in goat's milk caramel candy products is the packaging factor. Some root causes include manual production and packaging work, not using modern packaging equipment, contamination by physical contact, etc. Therefore, it is necessary to use automatic packaging tools.

**Keywords:** Caramel candy, Defect packaging, Goat's milk, Pareto diagram, Fishbone diagram

### INTRODUCTION

According to SNI 3141.1:2011 in (Badan Standardisasi Nasional, 2011), milk is a liquid that comes from the udder healthy and clean, obtained by excellent and correct milking methods, as well as the composition of the natural ingredients is not reduced or added anything and yet subjected to any treatment or process except the cooling process without affect purity. In grouping, the quality of goat milk is classified based on the number of somatic lambing cells, total microbial parameters, and fat and dry matter used as criteria for marketing milk fresh goats (Thai Agricultural Standard, 2008). The milk goats contain adequate or excess vitamins, except vitamins C, and D, pyridoxine, and folic acid. Goat milk only contains vitamins B6 and B12 in small quantities, so it is whiter in color than cow's milk (Fathir & Astawan, 2010). Generally, the content of individual fatty acids in goat's milk is greater than that of the *Etawa* breed goat.

Milk caramel candy is a candy that is made using the basic ingredients of milk. The principle of milk caramel is the caramelization reaction that causes it to change from sugar to an amorphous form with a dark brown color. The sugar solution in milk is heated until the water evaporates so that the liquid remains molten sugar liquid (Koswara, 2009). The reaction occurs when the protein component, sugar, and fat are in the process of making milk caramel using high temperatures. Non-enzymatic or Maillard browning reactions that occur during heating and Storage are related to the reaction between the reducing sugar, and the amino acid protein called the Maillard reaction (Estiasih & Ahmadi, 2017).

One of the dairy products at *Etawa Agroprima* has various processed products, one of which is goat's milk caramel candy. Every month, *Etawa Agroprima* can produce more than 1,500 candies. Deviations can occur in these products because the packaging process is still done manually, so damage can occur and cause a short product shelf life. Therefore, to find out the occurrence of irregularities in the processed goat's milk caramel candy product, it is necessary to analyze the types of product defects and the causes of these product defects. The object used is goat's milk candy using Pareto diagram analysis and fishbone diagram.

## RESEARCH METHOD

### Materials

#### *Goat's Milk*

According to Susilorini & Sawitri (2006), milk has sufficient nutritional value complete. Then Mulyono & Sarwono (2006) revealed that the *Etawa* goat is the result of a crossing between the *etawa* goat from India and the *kacang* goat looks like the *etawa* but is smaller as a milk producer (dairy) and beef goat. Characteristics of goat's milk compared to cow's milk is the color of the milk is whiter, milk fat globules are smaller with a diameter of 0.73 – 8.58  $\mu\text{m}$ , contains the mineral calcium, phosphorus, vitamins A, E, and high B complex can be taken by people who are allergic to drinking cow's milk and for people who experience various digestive disorders (lactose intolerance) (Saleh, 2004).

#### *Cow's Milk*

According to Estiasih & Ahmadi (2017), they are chemically composed of 2 (two) components: water, which amounts to 87%, and solids, which constitute 13%. Cow's milk has a high nutritional value because it contains chemical elements needed by the body. Cow's milk consists of water, fat, and lean, dry matter. Lean dry ingredients consist of protein, lactose, minerals, acids, enzymes, and vitamins. Factors that affect milk composition are geography, season, and status of fat nutrition (Susilorini & Sawitri, 2006). The composition of cow's milk, among others, namely 3.6% fat, 3.2% protein, 4.7% lactose, and 0.8%, minerals (Winarno, 2007), are components important for the human body.

#### *Sugar*

Additional raw materials are sugar; sugar is the simplest carbohydrate for energy sources. Sugar is used to change the taste to be sweet for food or drink. An example of a simple sugar is glucose. It stores energy for use by cells. Sugar such as sucrose is obtained from sugarcane sap, sugar beet, or palm sugar. (Wahyudi & Suryani, 2013).

#### *Margarine*

The second additional raw material besides sugar is margarine. According to Badan Standardisasi Nasional (2002), margarine is a shaped food product. Emulsions, both semi-solid and solid, made from a fat meal or vegetable meal oil with or without modification chemistry, including hydrogenation, interesterification, and through a refining process, as the main ingredient and contains water and permitted food additives.

### Data Analysis

The method used to analyze defects in the packaging of goat's milk caramel candy products at UMKM X was using field observations, interviews, documentation, literature studies, data collection, and data analysis using Pareto and fishbone diagrams.

## RESULT AND DISCUSSION

The object of this observation is a product of goat's milk caramel candy. This product is also superior, such as powdered goat milk at UMKM X. UMKM X can produce more than 2500 candies monthly. The problem that often occurs in producing goat's milk caramel candy is defects in the final product at the packaging stage. Kotler & Armstrong (2012) explain that "packaging involves designing and producing the container or wrapper for a product," meaning the packaging process involves designing and producing activities that protect the product so that the product quality is maintained. According to Halim et al. (2000), defective products are processed products that do not meet the specified criteria. If the product is damaged, it can be repaired, but the repair fee will be higher. Below is a some figure of the types of defects that occur in goat milk caramel candy products which are presented in Figure 1 as:



**Figure 1.** Types of defects that occur in goat's milk caramel candy products; (A) damaged packaging, (B) no expiration label, and (C) torn packaging.

From the image Figure 1, it can be seen that some of the product defects in the goat milk caramel candy packaging at *Etawa Agroprima*. Found a damaged package in the sealing stage; no label has an expiry date stamp on the part side. Torn packaging. Products that are defective in the process. This packaging will then be separated and reprocessed. Packaging materials used in these products are divided into 2, namely. Primary packaging is diamond paper, and secondary packaging is paper with the logo *Etawa Agroprima* and PE plastic. PE plastic is stronger and lighter with low vapor permeability, good resistance to grease, stability to high temperatures, and quite shiny. This type of PE is the best choice of plastic materials, especially for food and drink places such as places to store food (Klein, 2011). Irwan & Haryono (2015) explain that quality control is an engineering activity and management; with that activity, we measure the characteristics of product quality, then compare it with specifications or requirements and take appropriate action treatment if the discrepancy between the actual appearance with the standard. Product quality is very important and maintained at *Etawa Agroprima*. Standards are used to compare products according to company standards or that experience defective products. Product standard Caramel milk candy set includes:

1. Products are clean and not contaminated with foreign objects
2. The packaging is sealed, with no holes or breaks
3. There is an expiration date and a packaging label including brand name, P-IRT code, material composition, net weight, and MUI halal.

The next sorting stage is done by looking at them one by one, sealed packaging. The goal is to determine which part of the sealing is damaged. If it is damaged, it must be set aside, and the packaging replaced new. Then the final stage is the affixing of the expiration date sticker. Defective products without labeling will be immediately corrected by completing labels. Therefore the author tries to analyze the frequent product defects and what factors contributed to them. Product defect data Goat's milk caramel candy is presented in Table I as follows:

**Table I.** Data on product defect of goat’s milk caramel candy.

No	Date	$\Sigma$ Production	Frequency Type of Defect			$\Sigma$ Defect	Percent Defect
			Torn Packaging	Damaged Packaging	No Expiration Label		
1.	16-10-21	245	20	5	1	26	26%
2.	18-10-21	120	12	0	0	12	12%
3.	21-10-21	150	10	0	0	10	10%
4.	22-10-21	150	6	0	0	6	6%
5.	25-10-21	185	3	0	0	3	3%
6.	27-10-21	200	0	0	1	1	1%
7.	29-10-21	140	0	0	2	2	2%
8.	02-11-21	320	2	0	0	2	2%
9.	08-10-21	330	7	5	0	12	12%
10.	11-11-21	327	8	2	6	16	16%
Total Cumulative		2167	68	12	10	90	90%

**Analysis of the Pareto Diagram**

Yemima (2014) states that a Pareto diagram is a bar graph and a line graph depicting comparisons between data types against the whole. Using the Pareto diagram, you can see which problem is dominant so that they can know the priority of problem-solving. Data product defects have been totaled by type, then sorted from the highest to the lowest frequency. Product defect frequency results can be presented in Table II below:

**Table II.** Defective frequency of goat’s milk caramel candy product for one month.

No	Type of Defect	Frequency
1	Torn packaging	68
2	Broken packaging	12
3	No expiration label	10
Total		90

The data that has been sorted is then searched for percentages and percentages cumulatively; from the calculation results obtained data and results are presented in Table III and Figure 2 as follows:

**Table III.** Pareto Diagram Data 3 types of defects from goat’s milk caramel candy product.

Type of Defect	Frequency	Percentage	Cumulative Percentage
Torn packaging	68	75.56%	75.56%
Damaged packaging	12	13.33%	88.89%
No expiration label	10	11.11%	100%
Total	90	100%	

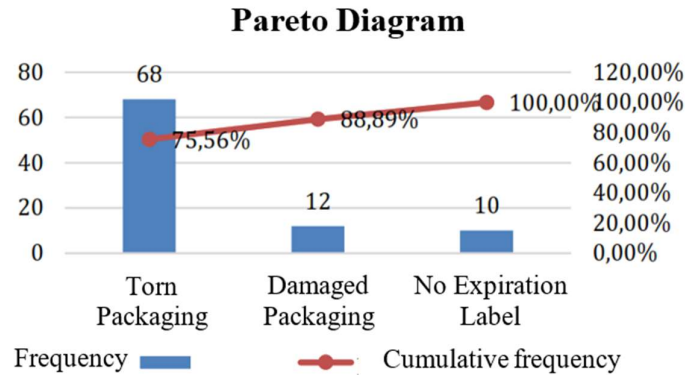
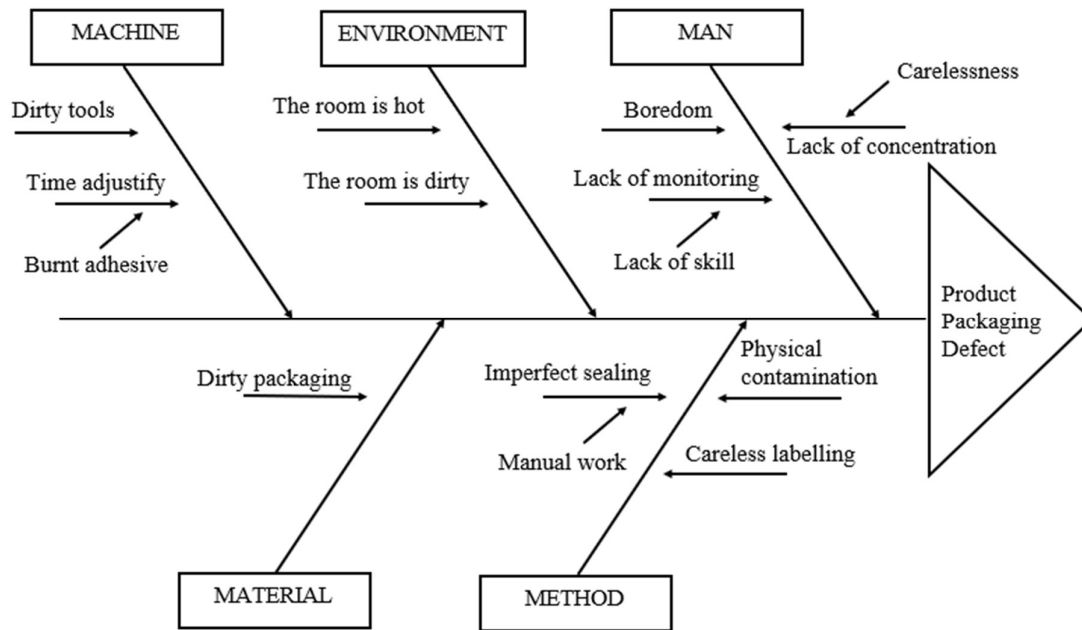


Figure 2. Pareto diagram of 3 defects from goat's milk caramel candy product.

Based on the analysis of the Pareto diagram, it can be seen that the type of defect is the most dominant by looking at the cumulative value. It can be seen that the dominant defects in there were 68 torn packages with a percentage of 75.56%, 12 types of broken packaging with a percentage of 13.33%, and the packaging had no exp labels or Expired 10 with a percentage of 11.11%. Presentation found the highest by packaging in torn as much as 75.56%. Hence the packaging in torn must be done for priority repairs. Polyethylene packaging has impermeable properties to water and moisture and a good degree of density so that water does not easily enter the food. Polyethylene packaging has water and gas permeability, and surface area packaging affects the amount of gas well besides its small surface area, causing a longer product shelf life Julianti & Nurminah (2006). During the packaging process, it was found that some damage would affect the products it contains. From these data, compared with the value, the total production of caramel candy is 2,167, and the number of product defects is relatively few, namely as many as 90 packages. Although said a little Defective product packaging must be repaired immediately and replaced with the same new packaging.

#### Analysis Diagram Fishbone

Analysis Fishbone diagram reveals that goat's milk products have three defects. This disability is caused by several factors underlying packaging defects in milk caramel candy products goat; according to (Putra & Kurniawati, 2019), a fishbone diagram is an analytical method to identify quality problems, including four types of materials or equipment, labor, and methods.



**Figure 3.** Fishbone diagram of the causes of product packaging defect.

The fishbone diagram above shows that the causal factors for product defects come from human effects (man). Method, machine, materials, and the environment. The following is a factor analysis of the causes of defects in goat milk caramel candy products at *Etawa Agroprima*:

1. Man
  - a. Lack of skill. Less skilled in operating the tool as well as in the processing, which is very influential with product defects that occur. For example, making candy caramel should have to stir 1 ½ hours, but equalizing the process of making powdered milk takes up to 2 hours of production.
  - b. Lack of concentration. In a day, workers can manufacture various types of products. This causes the workers fatigue, especially if there are many orders and requires extra energy, so the concentration is dispersed, which causes forgetting to attach the expiration label.
  - c. Carelessness. This worker’s carelessness occurs due to causes. The main thing is the lack of production monitoring, so product deviation occurs.
2. Methods
  - a. Careless in labeling. Only two people do it manually in pasting labels, so the process takes a long time. For that, workers are in a hurry to attach labels, and sometimes some packages have missed no label attached.
  - b. Imperfect sealing. Sealing packaging could be better due to a lack of fitting in setting the timer on the sealer so that the packaging is easily torn or not glued. Because every worker is doing it manually, then it's possible that they are Tired and need more focus.
  - c. Manual working. Workers manually carry out almost all product packaging on *Etawa Agroprima*. The cause is the need for more automated packaging equipment resources, especially electricity, but also the limitations of machine tools.
  - d. Physical contamination. This physical contamination can occur due to frequent times there being a direct touch from the hand; even though we use gloves during the packaging process does not cover it is possible if there is an improvement in packing using direct hand.

3. Machine
  - a. Sealer and Time Adjustify are easy to replace. The sealer in *Etawa Agroprima* is a hand sealer with a manual timer setting. Base section sealer is easily damaged, so the insulation must be added to the paper so that the packaging is easy to glue during sealing.
  - b. Dirty equipment. In the production process, sanitation and hygiene are very important things. We recommend that the tool is cleaned before and after use; in addition to maintaining cleanliness, the tool is also to maintain performance so that it can last longer.
4. Materials
  - a. Dirty packaging. At the time of packaging, the packaging of milk candy. These goats often have dust due to slippery and plastic falling to the floor. Then the sealing process will be hampered by gluing both sides of the package.
5. Environment
  - a. The room is dirty. The rooms at *Etawa Agroprima* are indeed narrower. In some rooms, workers have to be as much as possible and take advantage of the narrow space to complete their tasks. The space for workers is very limited. This matter can affect the process of production.
  - b. Hot room. Because the room is cramped and there are many workers, make the room warm. This room only has fan 2 for the production area. Hot room temperature. This greatly affects the performance of workers.

## CONCLUSION

Based on the factors, it can be seen that the main cause. The defect of this product is the processing method, such as the manual processing process. Matter This greatly affects the packaging results. Cause work is still on this manual resulted in an imperfect sealing process and physical contamination of the product. Suggestions for improvement to overcome these problems are Labor is not in a hurry in the packaging process, so that not rushing the packaging process UMKM X added labor so that packaging time does not take too much time excess and minimizes product defects. The workforce understands work instructions and trains as much as possible skills with tools by monitoring each morning, and employees attend skills training. Hence, the installation process goes smoothly, and the location of the packing room is not saturated with changing the position of the table or packaging tools to process convenient packaging.

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