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## IMPACT OF CALCIUM CHLORIDE ON THE CHEESE YIELD DURING SWISS CHEESE MANUFACTURING PROCESS

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**Abstract:** This study is focus on the impact of calcium chloride on the cheese yield and sensory properties during Swiss cheese manufacturing process. Therefore, a research plan was developed to change the amount of calcium chloride and tested for the yield in grams and sensory analysis using Friedman 5 point scale test. It was revealed that the calcium chloride addition is having a positive correlation and the optimum level of adding calcium chloride in cheese was 0.02% and while having decreasing rate of yield when it was increase beyond 0.02%. also, sensory properties of the cheese revealed that the 0.02% of calcium chloride was having good sensory and organoleptic properties and there was a taste issue observed when the calcium chloride increased beyond 0.02%. Therefore, it can be concluded that the calcium chloride is having a strong linkage between casein protein and it induces the reaction rate while increase the yield of the cheese and the sensory qualities of Swiss cheese manufacturing process.

**Keywords:** Swiss cheese, calcium chloride, Friedman 5 point scale test, process, casein protein, cheese.

**Introduction.** The cheese-making process consists of removing a major part of the water contained in fresh fluid milk while retaining most of the solids. Since storage life increases as water content decreases, cheese making can also be considered a form of food preservation through the process of milk fermentation. The fermentation of milk into finished cheese requires several essential steps: preparing and inoculating the milk with lactic-acid-producing bacteria, curdling the milk, cutting the curd, shrinking the curd (by cooking), draining or dipping the whey, salting, pressing, and ripening (Achaw & Danso-Boateng, 2021).

Cheese is a solid food which made from the curdled milk of cows, goats, sheep, buffalo or other mammals. The milk is coagulated by using some combination of rennet (or rennet substitutes) and we add some acidification Bacteria which acidify the milk and play a role in provide a proper pH for acting of rennet and defining the texture and flavor of most cheeses. Some cheeses also feature molds, either on the outer rind or throughout. There are hundred of types of cheese produced all over the world. Different styles and flavors of cheese are the result of using different species of bacteria and moulds, different levels of milk fat, variations in length aging, differing processing treatments (cheddaring, pulling, brining, mould wash) and different breeds of cows, sheep, or other mammals (Angelidis, 2015)

Swiss cheese is the generic name in Australia, New Zealand, Canada and the United States, for several related varieties of cheese, all of which resemble the Swiss Emmental. Some types of Swiss cheese have a distinctive appearance, as the blocks of the cheese are riddled with holes known as "eyes". Swiss cheese is known for its nutty, bittersweet taste (Stephanie Clark, 2008).

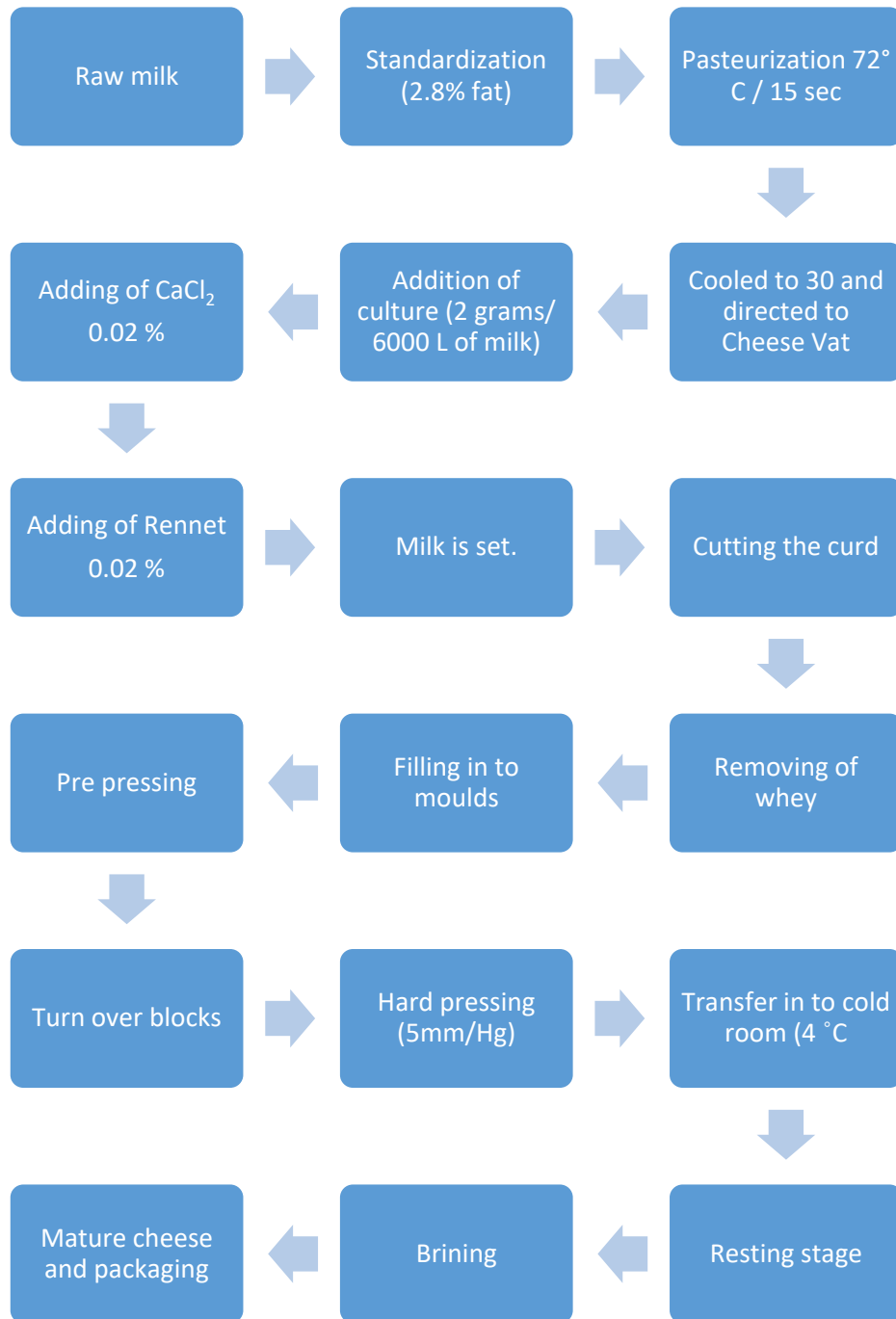
Addition of CaCl<sub>2</sub> is a step to induce the curdling time in cheese manufacturing process. Because the CaCl<sub>2</sub> has an ability increase the rennet enzyme reaction rate and ultimately increase the cheese yield. Therefore, the research was conducted to identify the impact of adding CaCl<sub>2</sub> during processing and test the outcome by testing the final cheese yield, sensory properties and microbial quantities (Kamleh et al., (2012);

**Methodology & empirical analysis.** Swiss cheese was manufactured using the flow char given in Fig 1. In here whole milk with 4% fat and skim milk with 0.1% fat was taken for this, in standardization, "Pearson Square" method was used. Which was ease to use and got the required sample in a good manner, because, there were only two nutrients to be balanced. The calculation so that was useful to maintain this method. At the cheese vat area, Pasteurization of Milk to 72°C to 15 seconds was done in continuous method by Plate Heat Exchanger.

The Pasteurization, the milk may be passed through a standardizing separator to adjust the fat-to-protein ratio of the milk. In some cases the cheese yield is improved by concentrating protein in a process known as ultra filtration. The milk is then inoculated with fermenting microorganisms, calcium chloride and rennet, which promote curdling.

Therefore, the CaCl<sub>2</sub> addition was changed while maintaining the other standards as constant to identify the impact of calcium chloride on final yiled of the cheese. Therefore, calcium chloride percentage was set as 0%, 0.01% 0.02%, 0.03% and 0.04% names a T0 to T4

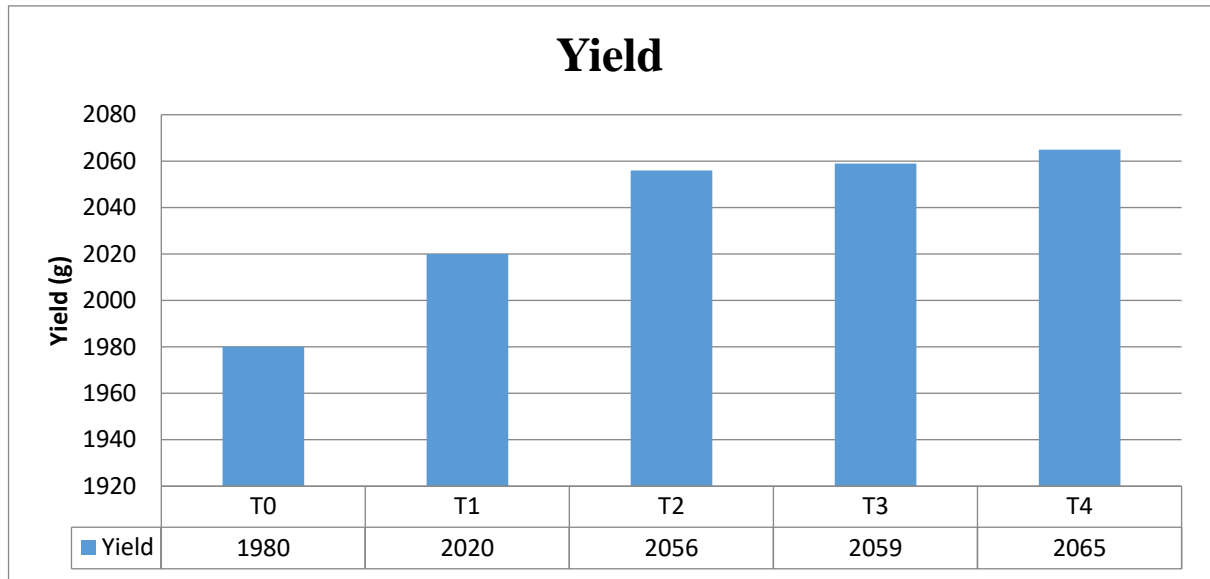
Ingredients	T0	T1	T2	T3	T4
Milk - L	10	10	10	10	10
Rennet enzyme - mg	2	2	2	2	2
Starter culture - ml	20	20	20	20	20
Calcium Chloride – mg	0	1	2	3	4



**Fig 1.** Swiss Cheese Manufacturing Process

**Results.**

<b>Cheese indicators</b>	<b>T0</b>	<b>T1</b>	<b>T2</b>	<b>T3</b>	<b>T4</b>
Yield (g)	1980	2020	2056	2059	2065



**Improved Milk Coagulation:** Calcium chloride is often added to milk before rennet is introduced during the cheese-making process. It helps strengthen the calcium bonds between casein proteins in the milk, leading to better coagulation. When milk coagulates more efficiently, it results in a higher yield of curds, the solid component of cheese.

**Increased Curd Firmness:** The addition of calcium chloride enhances the firmness and strength of the curds formed during coagulation. This means that a greater proportion of the milk solids are retained in the curd, resulting in a higher yield of cheese.

**Reduction of Milk Sensitivity:** When using pasteurized milk, calcium chloride can assist overcome problems with the quality of the milk. Pasteurization can lessen the milk's natural calcium level, which could result in a weaker curd and less cheese produced. Cheese manufacturers may make up for this shortfall and improve coagulation, which raises production, by adding calcium chloride.

**Consistency in Yield:** Using calcium chloride helps to make cheese that yields more consistently from batch to batch. Cheese manufacturers may acquire more consistent outcomes and reliably get the necessary volume of cheese from a given quantity of milk by stabilizing milk coagulation and curd formation.

**Benefits to the economy:** A higher cheese yield allows for the production of more cheese from a given quantity of milk. By making the most use of raw resources and raising total production efficiency, this can help cheese makers monetarily.

Since calcium chloride improves milk coagulation, curd hardness, and consistency during the cheese-making process, it generally has a beneficial effect on cheese production. To prevent unwanted effects on the finished cheese product, cheese manufacturers must carefully regulate the amount of calcium chloride utilized.

**Conclusions.** The research results indicate that the addition of calcium chloride to milk effectively improves the coagulation process in Swiss cheese production.  $\text{CaCl}_2$  enhances the firmness of the cheese by strengthening the calcium bonds between casein proteins in the milk, which allows a greater amount of milk solids to be retained in the

curd. The reduction of natural calcium content caused by pasteurization, which can lead to coagulation problems, is overcome by adding  $\text{CaCl}_2$ . In the study, increasing the  $\text{CaCl}_2$  content from 0% to 0.04% consistently improved cheese yield, with the highest yield observed at 0.04%  $\text{CaCl}_2$ . This, in turn, increases the efficient use of raw materials, production stability, and economic benefits. However, the amount of  $\text{CaCl}_2$  must be carefully controlled to prevent excessive quantities from negatively affecting the quality of the final product.

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