Development Ability of Sweet Bread Made from Liquid and Dry Raisin Yeast

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Abstract. Raisin sweet bread is made from wheat flour, water, sugar, salt, margarine, and the sponge dough A which produce from the fermentation of liquid and dry raisin yeast. Raisin yeast is selected because it has 38% of trehalase sugar which related to starch degradation so it indirectly retards the quality of bread stalling. The objectives of this study were to know the development ability of sweet bread and the nutritional value of the best sweet bread with the application of sponge dough A from liquid and dry (coated with 15% skim milk) raisin yeast. This study was an experiment on sweet bread products. The primary data was obtained from 1) the volume development measurement of dough at the initial intermediate proof, final proof, and after baked dough; 2) the proximate test data. Data were analysed descriptively and qualitatively. The results showed that: 1) the development volume of sweet bread dough increased for 37% with the application of sponge dough A processed with fermented liquid raisin yeast compared with other treatment; 2) the nutritional value of sweet bread from the application the sponge dough processed from the liquid yeast fermentation was in carbohydrate-protein, fat, ash and water (%) were respectively 61.30; 7.60; 3.90; 1.72 and 25.47.

1. Introduction
Sweet bread is a product made from the components of wheat flour, yeast, sugar, water, salt and fat through the process of fermentation and baking. The rapid development of technology in the field of food is quite influential on the appearance of contemporary sweet bread. Bread becomes more interesting because it has experienced many innovations both in terms of form, appearance, and content. However, the appearance looks more expanded/bigger, soft, moist, and durable. The volume development is the most significant aspect that change in the development of contemporary sweet bread, because it is supported by the development of a variety of food additives, such as emulsifiers, conditioners, and softeners to improve product quality [1].

Food additives are proven to be able to attract the present bread industry to be used in developing products, so that they can compete in the market, one of which is bread improver. By combining the use of yeast Saccharomyces cerevisiae and these ingredients, the yeast activity increases and the elasticity of gluten bounds becomes more stronger so that when there’s an increase in CO₂ gas, the CO₂ can still be accommodated by the dough due to an increase in gluten elasticity. This has an impact on larger volumes with a softer results. This is one of the reasons for the bakery industry now tends to improve its products by using chemical food additives to improve quality while reducing the relatively cheaper production costs. As a result, the quality of commercial bread today actually tends to be unhealthy and less safe for consumption.

Nature has provided a lot of natural yeast that found in fruits, which is shown from the change into acidic after not being consumed for a long time one of them is raisin yeast. The smell of alcohol-
like acid is the proof that natural yeast exist in fresh fruit with its ability to break down carbohydrates in the fruit into sugar and alcohol. Through the spontaneous fermentation process of raisin yeast, liquid yeast can be produced for use produce in making of sweet bread with various advantages, such as trehalose content with a sweetness level of 38% compared to sucrose which affects: 1) the ability to absorb water is low so it’s not moist and shrinks easily like sugar cane so it has a longer soft texture. 2) stable at high temperatures and acid so that the color doesn’t change easily; 3) product resistance at low temperature storage; 4) resistance to protein denaturation; 5) able to change compounds in bread to be simpler so that it is easier to digest; 6) has a unique taste and aroma that produced from metabolism process of microorganisms during fermentation; and 7) increase shelf life because various microorganisms can increase acidity and produce antibacterial compounds in the dough [2]

Natural yeast from raisins has been found by a Korean baker named Sangjin Ko [3]. But so far the use of raisins yeast has not been much studied and researched. The results of research in first year (1) showed that sweet bread made from starter dough A from liquid raisin yeast by the sponge dough method, gave the best results on tenderness, pores, flavours, volume development, and preferences compared to those made from liquid yeast bananas, papayas, and dates [4]. On this basis, liquid raisin yeast is potential enough to be used as a sweet bread developer agent. For this reason, the stability of liquid raisin yeast needs to be maintained during processing and storage, because it determines the end results as a bread development agent characterized by its ability to ferment optimally. The stability of liquid raisin yeast during storage of culture in a fresh state can’t be maintained for a long time, so it is necessary to encapsulate it.

Encapsulation in food processing is a method to transform components in liquid form into solid particles and protect the material from environmental influences [4]. Encapsulation is a process or technique for coating to protect the core in the form of an active compound either in the form of small solid, liquid, gas particles by using a protective layer or in a specific protective matrix that can break down the active compound failure [5,6]. Sensitive components such as moulds/yeasts can encapsulated to increase viability and shelf life [7]. Encapsulation technology developed on mould/yeast is able to protect it from damage caused by unfavourable environmental conditions by the processing (heat, oxidation and pH variations). Encapsulation can be applied on a dry food products during storage processes. The advantage of encapsulated mould/yeast will last longer because it’s already in the form of powder and easier to use [6]. The encapsulation process will be succeed if the encapsulated material has a relatively high cell viability. Thus we need a preservation method to keep up yeast viability which should range from 107 to 109cfu/g, so that it still has the same physiological properties as before the encapsulation [8].

Before encapsulation it is necessary to make mould/yeast suspension in a growth medium, which is expected to be a source of nutrition for mould/yeast so that, the number of mould/yeast live meets the requirements for application in food products. The intended growth medium are a coating material. Commonly used protective/coating agents can be derived from gum, carbohydrates, and proteins such as skim milk, lactose, sucrose, maltodextrin, alginate, arabic gum, starch, agar, gelatin, carrageenan, albumin, casein. The coating material is the material used to coat the core material (active compounds) with specific purposes such as covering up unpleasant odours and tastes, protection against environmental influences, increasing stability and preventing evaporation. The use of coating material for encapsulation needs to be considered, because each material has a different character and not necessarily in accordance with the encapsulated core material. Several research showed a different results between a difference material of encapsulation, that is protein-based and polysaccharides-based. The use of encapsulation based on protein gives better resistance results than encapsulation based on polysaccharides which actually produce a rough texture on the microcapsules produced or applied to the product [9]. Protein-based skim milk used as a coating material in the encapsulation process is an ideal and inexpensive protector [10].

Skim milk utilization as coating material in the mould/yeast encapsulation process is carried out by the freeze drying method. This method uses a low temperature and pressure that is carried out for long-term preservation of several types of fibrous fungus. The freeze drying method has advantages that harmless for yeast activity and will have nutritional characteristics and good organoleptic quality [11]. In addition, the freeze drying method is suitable for food products manufacture in the form of
powder with very small particle sizes, has a low water content reaching 2-4%, and has a large surface area.

In the cooling stage before drying, the water in the cell crystallizes so that the cell dehydrated and its covered by a viscous barrier. The cells will embedded to form fur patterns in ice crystals. During the first drying process, the temperature is reduced so that the protective layer becomes more viscous and eventually changes shape to resemble a layer of glass. The glass layer thickens, so the liquid in the molecule doesn’t move. In the first drying, evaporation of ice crystals occurs when the ice crystals leave a layer of glass connected to the channel. When the temperature rise slowly, the drying process continues in the second stage. Then there is a change of frozen water into steam (sublimation) from the glass layer which makes the glass layer become thicker. In the last stage, when the humidity is 1-2%, the solution media thickens at room temperature.

Through the application of freeze drying technology, it is able to prove that liquid raisin yeast is quite potential to be developed further, considering that raisin yeast in liquid form tends to decrease its rate of activity during the storage process. Consider with it, liquid raisin yeast was developed in the form of dry yeast for durability and stability during storage and distribution. The results of research in the second year showed that liquid raisin yeast from the encapsulation of 15% skim milk can be transformed in the form of dried yeast raisins through the freeze drying technique and applied as a proofing agent in making of sweet bread. However, dry raisin yeast has a lower development ability after being applied as a leavening agent in sweet bread products [12]. Through the assessment of the shelf life of liquid and dry raisin yeast at cold temperatures with glass bottle packaging in the third year of research, liquid raisin yeast produced with a shelf life that has development ability on sweet bread product in a relatively optimal, healthier to be consumed with organoleptic quality, nutrition, and shelf-life [13].

2. Materials and Methods

2.1. Ingredients and equipment
Ingredients used in sweet bread manufacture from liquid and dry raisin yeast have the same formulation consisting of: wheat flour (100%), sponge dough A from liquid raisin yeast (80%), mineral water (8%), margarine (5.5%), castor sugar (21.5%), and salt (1.35%). Equipment used include: glass jars, digital scales, spatulas, stainless steel spoon and plate, enamel-coated pans, ice tongue, dough mixers, dough bowls, dough cutters, scrapper, aluminium foil moulds, deck ovens, bread rack.

2.2. Sweet bread production
Sweet bread was produced through a series of procedures that begin with the activities of weighing ingredients, mixing, cutting-dividing, rounding, intermediate proofing, moulding, final proofing, baking and cooling [14]. Sweet bread made from liquid and dry raisin yeast is made separately. The manufacturing process was carried out in the same stages, beginning with the mixing process of ingredients consisting of high protein flour (100%), sponge dough A from liquid raisin yeast or dry raisin yeast (80%), castor sugar (80%) and mineral water (8%). The ingredients were mixed until they begin to less-sticky and then add margarine and salt. The dough was kneaded again until it becomes less sticky and more glossy as it develops a skin, which is shown from the formation of a thin film membrane that is not easily torn when the dough is stretched. The dough was then rised for 20 minutes, then cut into pieces and formed into dough pieces weighing 50 grams. The dough pieces were allowed to enter the intermediate proof stage for 20 minutes. The dough is then punching down, and moulded in 6×5×4 cm aluminium foil. The dough have done final proofing process, for liquid raisin yeast reaches 9 hours while for dry raisin yeast reaches 22 hours. In the last stage the dough was baked at a temperature 180˚C for 25 minutes.
3. Results and discussion

3.1. Volume development of sweet bread data with an application of sponge dough a made from fermented liquid and dry (coated with skim milk 15%) raisin yeast

Sweet bread from sponge dough A with fermented yeast from raisin liquid and dry yeast is made with the help of a square shape mould with a size of 6×5×4cm. Data on volume development (cm) of sweet bread made from fermented liquid and dry (coated with material of skim milk 15%) raisin yeast sponge dough A are presented in Table 1.

| Raisin Yeast Type | Volume Development (cm) | Repeated Volume Development (cm) |
|-------------------|-------------------------|----------------------------------|
|                   | Initial dough           | Final dough                       | Sweet bread after baked |
|                   |                        |                                  | Initial dough           | Final dough     | Sweet bread after baked |
| Liquid            | 6x5x1                  | 7.5x6.5x5                        | 7.5x6.5x6 Los           | 6x5x1           | 7.5x6.5x6 Los            |
| Dry (Skim 15%)    | 6x5x1                  | 7x6.5x4                         | 7x6.5x4.2               | 6x5x1           | 7x6.5x4.2               |

According to Table 1, related to the volume of data on the dough development of sweet bread dough, as a result of an application of sponge dough A with liquid and dry (coated with skim milk 15%) raisin yeast obtained by the mean as presented in Table 2.

Table 2. Volume development of sweet bread dough from different types of yeast (cm³)

| Raisin Yeast Type | Volume development dough | Volume development dough (repeated) | Volume development dough |
|-------------------|--------------------------|-------------------------------------|--------------------------|
|                   | Initial dough            | Final dough                          | Initial dough           | Final dough     | Volume development dough (repeated) |
| Liquid            | 30                      | 268.12                              | 30                       | 268.12         | 238.12                        |
| Dry (skim milk 15%) | 30                      | 182                                 | 30                       | 182            | 152                           |

According to Table 2 the development volume of sweet bread dough resulting from an application of sponge dough A with liquid and dry (coated with skim milk 15%) raisin yeast gives a very different volume development. Sweet bread that was proofed from raisin liquid yeast showed a greater development volume that is 238 cm³, compared to the results of the development of sweet bread derived from raisin dry yeast with skim milk coating 15% which reached only 152 cm³ or 63.86%. The difference in the results of the development of sweet bread derived from the use of sponge dough A with liquid and dry raisin yeast was influenced by the results of the total development test of mould-yeast colonies that are in different amounts. The results of the total yeast mould colonies test on liquid and dry raisin yeast with storage treatment at cold temperatures (2 - 4°C) in a glass bottle packaging are presented in Table 3.

According to Table 3, it showed that the treatment of making raisin dry yeast through the process of encapsulation of liquid raisin yeast by selecting the type of coating material of skim milk 15% through freeze drying method was appropriate. It is proven that the viability value of dry yeast raisin were at equivalent level to liquid raisin yeast that is 108. Lactose in skim milk is able to provide good protection. This is due to the lactose constituent components namely glucose and galactose which are simpler and have a low molecular weight, so that lactose can enter mould or yeast cells and provide protection from the 2 sides of the cell membrane during the freeze drying process [15].

However, the freeze drying method still influenced mould/yeast microorganisms in maintaining their ability to live. Dry raisin yeast produced from the encapsulation process with the addition of a coating material of skim milk 15% showed a viability value of 1.5x108. Although this value is below
the viability value of liquid raisin yeast, which is 1.5x10^8. However, the viability value of dry raisin yeast is still above the recommended viability standard limit, which is 10^7-10^9 cfu/g.

Table 3. Total yeast-mould test data on liquid and dry raisin yeast results of cold temperature storage in glass bottle packaging (per month)

| Raisin Yeast Type | Month | Total Yeast-Mould Average (CFU/mL sample) |
|-------------------|-------|-----------------------------------------|
| Liquid            | 0     | 1.7x10^8                                |
|                   | 1     | 1.2x10^8                                |
|                   | 2     | 2.3x10^7                                |
|                   | 3     | 4.1x10^7                                |
| Dry (Skim 15%)    | 0     | 1.5x10^8                                |
|                   | 1     | 9.1x10^6                                |
|                   | 2     | 1.5x10^6                                |
|                   | 3     | -                                       |

The decrease in cell viability might be caused by freezing and drying during freeze drying process. The freezing process caused the cell to lose its stability, so that it could be easily damaged during drying. The main factor that cause failure from yeast mould cells drying might be due to osmotic shock with membrane damage and displacement of hydrogen bonds that affect the nature of the hydrophilic macromolecules in cells [16].

In its application as a proofing agent, the results of the total mould-yeast test showed a significant influence in growing sweet bread dough. This is shown from the results of sweet bread dough made from raisin liquid yeast has the most ideal development ability, which is characterized by better tenderness compared to sweet bread made from dry raisin yeast with coating material of skim milk 15%. Sweet bread dough from liquid raisin yeast proved to meet increased development up to 1.5 times.

The increase in the volume development in sweet bread made from fermented liquid raisin yeast sponge dough A showed a significant difference in the ability to increase the volume of sweet bread dough compared with dry raisin yeast (coated with 15% skim milk) indicated by the cavity parameters. Pores or cavities between cells that showed the large amount of CO\(_2\) trapped in the dough due to the fermentation process of the Zymase enzyme when breaking down sugar in the dough. CO\(_2\) trapped in the dough will produce a consistency frothy (porous like foam) dough in which the dough forms thousands of tiny bubbles. Thus the formation of CO\(_2\) in the fermentation process is very important because the gas produced will form a foam-like structure, so that the heat flow into the dough could take place quickly during baking. The heat that enters the dough will cause CO\(_2\) and water vapour pushed out of the dough because of the expanding nature of the gas so that it indirectly becomes a source of strong pressure to push the elastic gluten cell wall [8]. Small holes that has leaven behind by the CO\(_2\) subsequently form pores in the bread which will give softness to the bread. Thus the work of yeast in breaking down sugar into CO\(_2\) and alcohol will have an effect on increasing the volume of sweet bread dough.

Based on Table 1, related to the results of the application of sponge dough A from fermented liquid and dry raisin yeast coated with skim milk 15% showed the volume development of sweet bread after baking with the final proofing value as presented in Table 4.

Based on Table 4, sweet bread produced from liquid and dry raisin yeast with coating material of skim milk 15% showed a difference in enhancement development of the dough after baking. The rate of enhancement in the development of sweet bread from liquid raisin yeast showed the highest enhance in final volume development, which was 292.5 cm\(^3\), compared to sweet bread products derived from dry raisin yeast. Sweet bread produced from dry raisin yeast and coated with material of skim milk 15% has an enhancement value for volume of the dough to reach 191.1cm\(^3\). However, both of them still showed an increase in the value of development after going through the baking process.
The final value of the development of the volume of sweet bread from the application of raisin liquid yeast reached 2.7 times or 37% of sweet bread produced from raisin dry yeast. Thus this is in accordance with the concept of dough development where the dough should still show changes in enhancement for volume development after baking [14]. This happens because the heat that enters the dough will cause CO$_2$ and water vapour to be pushed out of the dough because of the expanding nature of the gas, so that it indirectly becomes a source of strong pressure to push the elastic gluten cell wall.

Table 4. Sweet bread volume development final value (after baking) from liquid and dry raisin type yeast with coated with skim milk 15% (cm$^3$)

| Raisin Yeast Type | Volume Development(cm$^3$) | Volume Development (Repeated)(cm$^3$) | Sweet Bread Volume Development after Baking | Sweet Bread Volume Development (Repeated) | Final Value of Sweet Bread Volume Development after Baked |
|------------------|---------------------------|--------------------------------------|--------------------------------------------|------------------------------------------|-----------------------------------------------------|
|                  | Final Proofing Dough      | Sweet after Baking                   | Sweet Bread after Baking                   | Sweet Bread after Baking                 | Final Proofing Dough                                 |
| Liquid           | 30                        | 268.12                               | 292.5                                      | 292.5                                   | 24.38                                               |
| Dry (skim 15%)   | 30                        | 182                                  | 191.1                                      | 191.1                                   | 9.1                                                 |

3.2. **Sweet bread proximate test data with application of liquid raisin yeast**

Based on the calculation of the final value of the development of sweet bread volume from raisin liquid and dry (coated with skim milk 15%) yeast as presented in Table 4, it showed that the final optimal volume development of sweet bread comes from liquid raisin yeast. Sweet bread from liquid raisin yeast then proximate tests were performed to determine the nutritional value of protein, fat, carbohydrates, ash and water (Table 5).

Table 5. Sweet bread nutrition of raisin liquid yeast and *Saccharomyces cerevisae* yeast by 100 g

| Component          | Sweet Bread Nutrition (%) |
|--------------------|---------------------------|
|                    | Raisin Yeast              | *Saccharomyces cerevisae* Yeast |
| Water              | 25.4755                   | 27.2615                        |
| Ash (Total Mineral)| 1.7200                    | 2.4573                         |
| Protein            | 7.6016                    | 7.4195                         |
| Fat                | 3.9010                    | 5.8133                         |
| Carbohydrates      | 61.3018                   | 57.0484                        |

The best sweet bread proximate test results from the application of sponge dough A with fermented raisin liquid yeast have superior nutritional content in terms of protein, fat, carbohydrates, ash and water. compared to sweet breads made from *Saccharomyces cerevisae* yeast (Table 5). However, if referred to the standard of sweet bread according to SNI 01-3840-1995, the fat content of sweet bread made from raisin liquid yeast is 1.30% and the results will increase more in the *Saccharomyces cerevisae* yeast to 1.93%.

4. **Conclusions**

The final value of the increased in volume development of sweet bread dough made from the application of sponge dough A with fermented raisin liquid yeast reaches 37% of sweet bread produced from dry raisin yeast and coated with skim milk 15%. Sweet bread nutrition associated with carbohydrates, proteins, fats, ash and water (%) the application of sponge dough A with fermented liquid raisin yeast is 61.30; 7.60; 3.90; 1.72 and 25.47. According to the finding of this study, it was
necessary to develop a non-spontaneous type of fermentation to increase the value of yeast viability in the results of liquid raisin yeast fermentation to apply better dough development in sweet bread production.

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