The Effect of Modified *Tape's* starter on Characteristics of *Tape Injin* (*Oryza sativa glutinosa*)

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Abstract. *Tape injin* is a Balinese traditional fermented product made from black sticky rice (*injin*). It's production by using common starter which's usually sold in public market resulting in unstable quality and even fail of *tape injin*. This study aimed to determine the effect of modified *tape*'s starter utilization on characteristic of *tape injin*. The experiment was designed as a randomized block design by using five treatments which were the utilization of 0.6%, 0.9%, 1.2%, 1.5% of modified *tape*'s starter including 0.3% of control. The treatment was repeated 3 times. The parameters observed namely pH, total molds and yeasts, total alcohol, total acid and sensory evaluation (taste, color, aroma, texture and overall acceptance). Data were analyzed by variance, and if found any effect on the treatment, the analysis continued by Duncan's test. The results showed that the utilization of modified *tape*'s starter significantly affect the pH, total alcohol, total acid, flavor, color, aroma, texture and overall acceptance. The utilization of 1.5% modified *tape*'s starter produces the best characteristics of *tape injin* with pH 4.04, total alcohol: 2.77%; total acid: 1.12%, and 6.3 value (be liked) of overall acceptance by sensory evaluation.

Keywords : *fermented product, tape injin, modified starter, balck sticky rice*

I. INTRODUCTION

Black sticky rice is one of the most potential commodities as a source of carbohydrates, antioxidants and bioactive compounds that are important for health. Starch is the main source of carbohydrates found in sticky rice. Inside the black sticky rice contains anthocyanins that act as antioxidants in the body and are able to prevent obesity and diabetes, inhibit tumor cell growth, improve eye vision and as an anti-inflammatory compound that protects the brain from damage (Yanuar, 2009).

Tape is a Indonesian traditional fermented food which make by steaming raw materials, inoculated with the common starter *tape* yeast, then stored or immersed within a certain period of time at room temperature. *Tape* has a soft and juicy texture with a sweet taste, slightly acid and flavorful alcohol. The content of alcohol on the *tape* is about 3-5% with a pH of 4 - 4,05 (Rahman, 1992). *Tape* can basically be made from a variety of raw materials which rich in carbohydrates, generally from cassava and rice. Various types of rice can be used as the raw materials: glutinous rice, black sticky rice which in Bali called by the name of *injin*, and ordinary rice that we use everyday as a staple food. Not only that, Astawan (2004) stated that *tape* can also be made from sorghum, banana, sweet potato and breadfruit.

Black sticky rice which used for *tape* usually called in Bali as *tape injin*, has a natural dye produced by anthocyanins found in black sticky rice. Anthocyanin is the color pigment of red, purple and blue which commonly found in plants. The content of anthocyanin in the black sticky rice is one reason which make *tape injin* is useful for the human body.

Any kinds of *tape* usually made by using starter which available in public market. This starter contain yeast, its called *ragi tape* (yeast for *tape*). Some problems often arise in production of *tape injin* by using this common starter. The quality is unstable and sometimes even failing. Probably it caused by the condition of microbes, mostly yeast which contained in the starter. The commonly used starter in *tape* production, is not known for certain conditions including its quality of the microbial aspect, therefore a good quality starter is needed in the production of *tape injin*. In this study modifications were made by using common starter as a base material in the manufacture of starter for *tape injin* production.

II. RESEARCH METHODS

Materials of modified starter

White sticky rice powder, pepper, chili herbs, garlic, galangal (laos), juice of sugar cane, NKL yeast.

Production of modified starter

The first step of modified starter production is pepper and chili pounded until smooth, then added with garlic and galangal and pounded again until smooth evenly. Spices that have been mashed mixed with white sticky rice flour and stirred until evenly distributed. While stirred, juice of sugar cane added until the material become a dough that is easily formed, but not too wet, then added NKL starter that has been mashed into the dough. The dough formed into a flat sphere with a diameter about 3 cm. The dough that has been formed was placed on a bamboo tray that has been given a base with a broom straw. The dough kept in a safe place for about 24 hours until the microbe grows and breeds. The dough that has been overgrown with microbes dried by drying it under the sun for 3 days. The dried dough is a ready-to-use starter. The starter is stored in a dry place. The starter can be used whenever needed.

Production of tape injin

The black sticky rice (70g) and white sticky rice (30g) was mixed and clean by washing. Then it was drain and steamed for 15 minutes. After its cold, the mixed black and white sticky rice was sprinkled with modified starter that has been smoothed. The *tape* was maturated for 3 days.

Experimental design

The experiment was design as Randomized Block Design (RAK). The treatment consists of 5 level of utilization of modified starter: 0.6%, 0.9%, 1.2%, 1.5% including 0.3% of control (the common starter). Each treatment was repeated 3 times to obtain 12 experimental units. The diversity of the data was analyzed, and if there is a significant effect, it followed by Duncan multiple comparison test.

The parameters

The measurement of the degree of acidity (pH) was performed using the pH Meter Schott Instruments (AOAC, 1990). Calculation of total mold and yeast by pouring method (pour plate) according to Fardiaz (1993). The alcohol content was determined by the method of distillation (Abdul Wahid and Suprapto 1975). The determination of total acid was determined by neutralization titration method (Ruck, 1963). Sensory properties were tested using hedonic tests (Soekarto, 1985).

III. RESULT AND ANALYSIS

pH of *tape injin*

The variance analysis showed that the treatment affect significantly ($P < 0.01$) to the pH of *tape injin.*

Table 1. Degree of acidity (pH) for *tape injin* treated by utilization of modified starter.

Utilization of modified starter (%)	Average
0,6	4,34 a *)
0,9	4,24 a
1,2	4,12 ab
1,5	4,04 b

The same letter on the back of the average pH value shows no significant differences at the Duncan test level of 5%.

Utilization of common starter 0.3% resulting in pH value of 4.64. Table 1 shows that increase in utilization of the modified starter resulting in lower pH value. Fermentation produce volatile acids, including lactic acid, acetic acid, formic acid, butyric acid and propionate acid. The concentration of starter interacts with the fermentation process, increase concentration resulting in higher acidity of the material, this lead to decrease of pH *tape* (Desrosier, 1988). The higher concentration of starter used in fermentation of *tape injin* resulting more carbohydrates were converted into glucose, alcohol, acetic acid and other compounds.

Total mold and yeast of tape injin

The variance analysis showed that the utilization of modified starter not affect significantly to total mold and yeast including the utilization of common starter (0.3%). The addition of herbal chili can stimulate the growth of all microbes contained in the starter, while the addition of garlic and galangal can also inhibit the growth of microbes in starter (Saono, 1981). According to Ko (1982), not all microbes that have been found in starter are important for the fermentation of starch-containing materials into *tape*. Each of the microbes contained in the starter has different functions. The amilolytic mold is functioning in the process of saccharification and production of alcohol. Amilolytic yeast serves for saccharification and aroma production, therefore, although the number of mold and yeast is not different but in the liveliness and role of each type of microbe is different.

Total alcohol of tape injin

The variance analysis showed that the utilization of modified starter affect significantly to the total alcohol of *tape injin*. Utilization 0.3% of common starter resulting in 1.70% alcohol. Table 2 shows that alcohol increase linearly to concentration of modified starter utilization. During fermentation the mold actively break down the starch into sugar which is then converted into alcohol by yeast. Increase concentration of modified starter lead to higher mold and yeast in the *tape injin*.

Table 2. Total alcohol for *tape injin* treated by utilization of modified starter.

Utilization of modified starter (%)	Average
0,6	4,34 a *)
0,9	4,24 a
1,2	4,12 ab
1,5	4,04 b

The same letter on the back of the average alcohol value shows no significant differences at the Duncan test level of 5%.

Table 3. Total acid for *tape injin* treated by utilization of modified starter.

Utilization of modified starter (%)	Average
0,6	0,70 b *)
0,9	0,79 b
1,2	0,88 a
1,5	1,12 a

The same letter on the back of the average alcohol value shows no significant differences at the Duncan test level of 5%.

Table 4. Average Value of Sensory Evaluation for *Tape Injin* on Utilization of Modified Starter

Starter utilization (%)	Average value of sensory assessment					
	Hedonic					Scoring
	Taste	Color	Flavor	Texstur	Overall acceptance	Softenes
0,6	4,9 b*)	5,3 b *)	4,8 c *)	4,9 bc *)	4,8 b *)	4,2 c *)
0,9	4,8 bc	5,4 ab	5,1 bc	4,9 c	5,0 b	4,5 b
1,2	4,8 c	5,5 a	5,2 b	5,0 b	5,4 b	4,5
1,5	6,5 a	5,7 a	6,3 a	6,3 a	6,3 a	5,5 a

The same letter on the back of the average alcohol value shows no significant differences at the Duncan test level of 5%.

Total acid of tape injin

The variance analysis showed that the utilization of modified starter affect significantly (P <0.05) to the total acid of *tape injin*. Table 3 shows that increase utilization of modified starter resulting in higher of the total acid. The acid which produced by using 0.3% of common starter was 0.64%.

The increase of total acid associate with alcohol content (Rachmawati, 2001). The increase in total acid due to the formation of organic acids as the final result of fermentation. These organic acids are the result of oxidation of alcohols that arise during the fermentation process such as acetic acid which produced by Acetobacter which is often present in common starter.

Sensory evaluation

Sensory assessment conducted by 15 panelists who recognize *tape injin*. The sensory properties of *tape injin* which analyzed by using variance analysis resulting in the average value which showed in Table 4. Sensory value for utilization of common starter (0.3%) as the control for taste, color, flavor, texture and overall acceptance were 4.3; 5.3; 4.5; 4.0 and 4.5 respectively.

The variance analysis showed that the treatment affect significantly to the taste of *tape injin*, with the higher sensory value: 6.5 (utilization of 1.5% modified starter). The *tape injin* dominated by sweet and alcoholic taste. *Acetobacter aceti* is considered influence the acid taste of fermentation product like *tape* (Buckle, et al.,1987).

The variance analysis showed that the treatment affect significantly to the color of *tape injin*, with the higher sensory value: 5.7 (utilization of 1.5% modified starter). The color of *tape injin* become dull and not fresh, it considered due to degradation of the components during fermentation (Jonsen, 1984).

The variance analysis also showed that the treatment affect significantly to the flavor of *tape injin*, with the higher sensory value: 6.3 (utilization of 1.5% modified starter). According to Winarno (1997), the flavor determines the delicacy of a product. The flavor come up due to the presence of volatiles compound derived from the product that can be detected by the sense of smell (Rachmawati, 2001). The flavor of *tape injin* related to the content of alcohol and total acid as the result of fermentation process. These acids are produced in further fermentation processes such as acetic acid and other organic acids (Wood, 1998). According to Supriyantono (1995), strong flavor is caused by a large number of flavor-forming compounds. Flavor-forming compounds are formed during the process of fermentation which is derived from the results of hydrolysis of glucose and oxidation of alcohol that is the volatile compound. This means increased levels of alcohol and total acid can increase the flavor of *tape injin*.

The variance analysis showed that texture was affected significantly by the treatment, with the higher sensory value: 6.3 (utilization of 1.5% modified starter).

The texture is influenced by the moisture content. According to Syarief and Halid (1993) water is an important component in food because water can affect harshness, appearance, taste and nutritional value. Changes of texture occur during the fermentation process. The texture of the *tape injin* is softened or wrinkled. The hardening process occurs because of the drying of the outer layer of the *tape*. Soft texture occurs due to fluid formation as a by-product of the fermentation process. The liquid comes out of the glutinous tissue so that the texture becomes soft, in addition to making the texture softer also results in the shrinkage of tissue that causes wrinkles (Jonsen, 1984).

The variance analysis showed that the treatment affect significantly to the overall acceptance of *tape injin*, with the higher sensory value: 6.5 (utilization of 1.5% modified starter). All the sensory aspect which evaluated here affected by the treatment significantly. The panelists prefer utilization of 1.5% of modified starter for *tape injin* production.

IV. CONCLUSSION

Base on the result obtained in this study, some points can be concluded, the starter for production of *tape injin* which modified from common starter can affect significantly the properties of *tape injin* (pH, total mold and yeast, alcohol content, total acid and sensory). Utilization of 1.5% of modified starter for *tape* injin production resulting in preferred characteristic of *tape injin* with pH 4.04, total alcohol: 2.77%; total acid: 1.12%, and 6.3 value (be liked) of overall acceptance by sensory evaluation.

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