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## Organeleptic Test for Fortified Packaging Milk by Utilizing Calcium from Egg Shell Waste

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### Abstract

In terms of national needs, the necessity for eggs reached 4,742,240 tons employing massive impact on the production of egg shell waste. Nevertheless, packaging milk released in the market contains low calcium and unsatisfies the nutritional needs of adult calcium, namely 1000 mg/day. Therefore, it is necessary to add waste of calcium-rich egg shells so the nutritional needs of calcium can be fulfilled and reduces the egg shell waste at the same time. The research method used is combination of experimental methods, interviews, and literature study. The data is analyzed by using descriptive statistics and non-parametric statistical tests to draw conclusions. Based on the data obtained, the best variation is the milk control with a total value of 580 points, 33 points different from 2:1 variation. The giving of egg shell waste reduces the milk aroma which is preferable for people who dislike its aroma. Through non-parametric statistical tests, it was investigated that there was no significant difference in adding egg shell flour to make fortified milk except for egg shell control. Therefore, egg shell flour can be used as additional material to enrich the calcium, to reduce the milk aroma and the amount of organic waste in Indonesia.

**Keywords:** Calcium, Egg shell waste, Fortified milk, Non parametric statistics, Packaging milk

### Abstrak

Dari sisi kebutuhan nasional, kebutuhan telur mencapai 4.742.240 ton berdampak besar pada produksi limbah cangkang telur. Namun demikian, susu kemasan yang beredar di pasaran mengandung kalsium yang rendah dan belum memenuhi kebutuhan gizi kalsium orang dewasa yaitu 1000 mg/hari. Oleh karena itu, perlu dilakukan penambahan limbah cangkang telur yang kaya kalsium agar kebutuhan nutrisi kalsium dapat terpenuhi sekaligus mengurangi limbah cangkang telur. Metode penelitian yang digunakan adalah kombinasi metode eksperimen, wawancara, dan studi literatur. Data dianalisis dengan menggunakan statistik deskriptif dan uji statistik non parametrik untuk menarik kesimpulan. Berdasarkan data yang diperoleh, variasi terbaik adalah susu kontrol dengan total nilai 580 poin, berbeda 33 poin dari variasi 2:1. Pemberian limbah cangkang telur mengurangi aroma susu yang disukai oleh masyarakat yang tidak menyukai aromanya. Melalui uji statistik non parametrik diketahui bahwa tidak ada perbedaan yang signifikan dalam penambahan tepung cangkang telur untuk membuat susu fortifikasi kecuali pada kontrol cangkang telur. Oleh karena itu tepung cangkang telur dapat digunakan sebagai bahan tambahan untuk memperkaya kalsium, mengurangi aroma susu dan jumlah sampah organik di Indonesia.

**Kata kunci:** Kalsium, Limbah Cangkang Telur, Statistik Non-Paerametrik, Susu Kemasan, Susu Terfortifikasi,

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## INTRODUCTION

Environmental pollution is the entry or inclusion of living things, energy substances, and other components into the environment or changes in the environmental order by human activities or by natural processes so that the quality of the environment drops to a certain level which causes the environment to become less or unable to function anymore<sup>1</sup>. Environmental pollution has impact on health, aesthetics, economic losses, and disruption of ecosystems naturally<sup>2</sup>. Environmental pollution is generally caused by waste from the community, both organic and non-organic waste. One of the wastes that has the potential to pollute the environment is egg shells with the main composition of  $\text{CaCO}_3$  which will become waste and can cause pollution due to microbial activity in the environment<sup>3</sup>.

Eggs are an important source of protein for humans in everyday life. With various processes such as boiling, frying and steaming, eggs become a simple food that is quite delicious<sup>4</sup>. In terms of national needs, the need for eggs in Indonesia currently reaches 4,742,240 tons which has an impact on the large amount of eggshell waste production. So far, eggshell waste has not been used optimally. The eggshell is only used as a handicraft product. Whereas 97% of the calcium

content in eggshells has the potential as an additional ingredient extracted for food minerals<sup>5</sup>. Egg shells are also composed of 94% calcium carbonate, 1% magnesium carbonate, 1% calcium phosphate and 4% organic matter, especially protein<sup>6</sup>. The composition of egg shells in general consists of 1.6% water and 98.4% dry matter, namely 95.1% minerals and 3.3% protein<sup>7</sup>.

Calcium is one of the essential minerals that has an important role in the body, namely as a major component in forming bones and teeth<sup>8</sup>. Calcium needed every day ranges from 1200 mg / day for ages 10-18 years, 1100 mg / day for the 18-29 year age group, while for those over 29 years it's 1000 mg / day . One source of calcium that is generally used by Indonesians comes from cow's milk. However, in general Indonesian people experience lactose intolerance (digestive disorders). Cow's milk contains a lot of lactose so that generally Indonesian people cannot meet their calcium needs from cow's milk so it is necessary to look for other alternative drinks<sup>9</sup>. Meanwhile, other packaged milk circulating in the market contains relatively low calcium and tends to have insufficient calcium nutritional needs.

In addition, one of the most vulnerable health problems in Indonesia is cholesterol and calcium

deficiency. The data states that the level of cholesterol sufferers in Indonesia is 70%. The number of people suffering from calcium deficiency disease in Indonesia is much greater than the latest data from the Ministry of Health, which set a figure of 19.7% of the entire population. Therefore, we need a food industry that provides foods with low cholesterol levels with high calcium levels<sup>10</sup>. To meet calcium needs, it is necessary to add egg shell waste which is rich in calcium so that the nutritional needs of calcium can be met.

Therefore, this research will conduct an experiment entitled "Organeleptic Test of Fortified Packaged Milk Using Calcium from Eggshell Waste". The eggshell flour will be combined with packaged flour to get the best variety in order to get the best fortified milk in terms of taste, aroma and color. This research aims to investigate the effect of eggshell waste in terms of aroma, color and taste in packaged milk mixtures and to investigate the optimal variation between egg shell waste and packaged milk in order to obtain the best milk formulation rich in calcium in terms of aroma, color and taste.

## METHODOLOGY

### *Research Type*

This type of research is a type of quantitative experimental

research using a combination of experimental methods, observation and literature studies. The research began with a literature study of egg shell waste and made fortified milk using the internet and continued with observations to obtain judgement of respondents.. With the combination of these methods, maximum results will be obtained both quantitatively and qualitatively.

### *Tools and Materials*

Tools which have been used within this research are beaker glass, funnel, tablespoons, tissue, filter paper, measuring cup, ordinary glass, strainer, blender, strainer, spatula, pan, erlenmeyer, basin. For the material, this research requires many materials like egg shell waste, packaging milk powder and water.

### *Research Variables*

The independent variable is the variable that affects or causes the change or the emergence of the dependent variable<sup>11</sup>. The independent variables in this study were egg shell waste and packaged flour which were varied based on composition. Variations were made as much:

1. Egg shell : packaged milk (1: 1)
2. Egg shell : packaged milk (1: 2)
3. Egg shell : packaged milk (2: 1)
4. Egg shell flour control
5. Packaged milk control

The dependent variable is the variable that is affected or that is the result, because of the independent variable<sup>11</sup>. The dependent variable in this study is the milk which are seen based on the taste, aroma and texture of milk.

### ***Research Steps***

This research was conducted in three stages, the first stage was the preparation stage including egg shell waste to form egg shell flour. The second stage is the stage of mixing step of packaging milk powder and egg shell waste or another name fortified milk. The third stage is the testing phase in the form of interviews with fortified milk. The research stages are described as follows.

### ***Preparation phase***

The details of the preparation stages are described as follows: First, egg shell wastes are collected and all white membrans are surely removed. Next, all egg shell waste are washed, rinsed and later boiled about 30 minutes. Afterthat, egg shell waste must be dried because it must be mashed for obtaining egg shell flour.

### ***Variation Making Stage***

The details of the stages of making variations are described as follows: First prepare egg shell flour and packaging milk. Then, the mass of egg shell flour and packaging milk

were measured using analytical scales. Furthermore, the variation in the composition is adjusted by ratio of 1: 1, 2: 1, 1: 2, egg control and milk control (without egg shell waste additional). All variations are mixed with hot water and stirred as one.

### ***Testing Phase***

The details of the fortified milk testing stages are described as follows: fortified milk and research questionnaires were prepared in advance. Research questionnaires and fortified milk were presented to the panelists to be assessed in terms of taste, aroma and color aspects. Assessments were made for all variations of fortified milk. Research data for each variation of fortified milk were obtained and non-parameter statistical tests in this case Kruskal Wallis test and Mann Whitney U were performed.

### ***Research Method***

#### ***Organoleptic Test***

Organoleptic testing is a test that uses the human senses as the main tool in measuring the acceptability of products. Organoleptic testing has an important role in determining the quality and quality of products. In this study, organoleptic testing has been carried out related to the influence of egg shell flour on the taste, aroma and color parameters of donuts. Organoleptic testing has been carried out on 40 respondents

with interview techniques and provided assessments on a likert scale ranging from (1) very less to (6) excellent<sup>12</sup>. All respondents are classified by those rating scales to the information according to their scores. Respondents will be asked to rate the aroma, color and taste indicator to verify the best fortified milk based on organoleptic test.

### *Descriptive Statistics*

Descriptive statistics are a type of statistics used to describe related activities of collecting, structuring, summarizing, presenting data to make it more meaningful. Descriptive statistics are limited to providing a description or general description of the characteristics of the object under study without the intention of generalizing the sample to the population. The mean (mean) and standard deviation are part of the descriptive statistics used to report the results of research measurements<sup>13</sup>.

### *Kolmogorov Smirnov Test*

The Kolmogorov Smirnov test is a widely used normality test, especially after the existence of many statistical programs in circulation. The advantage of this test is that it is simple and does not cause differences in perception between one observer and another, which often occurs in normality tests using graphs. The basic concept of

Kolmogorov Smirnov's normality test is to compare the data distribution (which will be tested for normality) with the standard normal distribution. The standard normal distribution is data that has been transformed into a Z-Score form and assumed to be normal. In drawing the conclusion, if the significance is below 0.05 it means that there is a significant difference, and if the significance is above 0.05 then there is no significant difference. The application to the Kolmogorov Smirnov test is that if the significance is below 0.05, it means that the data to be tested has a significant difference from the standard normal data, it means that the data is abnormal<sup>14</sup>. In their tests, the author used SPSS version 17 to facilitate work in terms of data processing.

### *Kruskall Wallis Test*

The Kruskal Wallis test is a ranking-based nonparametric test whose purpose is to determine whether there are statistically significant differences between two or more groups of independent variables on dependent variables that scale numerically data (intervals/ratios) and ordinal scales. This test is identical to the OneWay Anova Test in parametric testing, so this test is an alternative to the One Way Anova test if it does not meet assumptions such as normality assumptions. Apart from being an

alternative test, another use is as an extension of the Mann Whitney U Test test, where we know that the test can only be used on 2 groups of dependent variables. While Kruskal Wallis can be used in more than 2 groups for example 3, 4 or more. Kruskal Wallis is a non parametrical test. Because this test is a non-parametric test in which the assumption of normality can be violated, there is no need for a normality test for example the shapiro wilk or lilliefors test<sup>15</sup>.

## RESULT AND DISCUSSION

This research aims to to investigate the effect of eggshell waste in terms of aroma, color and

taste in packaged milk mixtures and to investigate the optimal variation between egg shell waste and packaged milk in order to obtain the best milk formulation rich in calcium in terms of aroma, color and taste. In order to determine it, questionnaires were given to 40 respondents to judge each variation of sample. In this study, data were obtained from distributing questionnaires to 40 respondents. These respondents assessed using a Likert scale, namely (1) very bad (2) bad (3) moderate (4) good (5) very good (6) best. After distributing the data, the following research results were obtained The result can be briefly seen in table 1.

**Table 1.** The Result of 40 Respondents

NO	Variation	Taste	Texture	Aroma
1	Milk Control	198	190	192
2	1:1 Variation	147	155	161
3	2:1 Variation	193	178	176
4	1:2 Variation	140	153	158
5	Egg Shell Flour	93	87	85

Information:

40 – 73: Very Bad

74 – 107: Bad

108 – 141: Enough

142 – 175: Good

176 – 209: Very Good

210 – 240: Best

In the table above, it can be seen that the highest value of all parameters, namely 580 (very good), is milk control followed by 2: 1 variation with a value of 547 (very good). If examined further, the addition of eggshell powder did not

differ significantly in the variations of 1: 2, 2: 1 and 1: 1, but variations in egg control were quite different. This will be proven in non-parametric statistical tests. The addition of eggshell powder can disguise the smell of milk for respondents who do

not really like the aroma of milk. Therefore, the addition of eggshell powder can be an alternative solution for packaged milk so that it

can still get a high calcium content with a mild milky aroma see in table 2.

**Table 2. Chi Square table for Kruskal Wallis Test**

<b>Chi-Square Statistics</b>	103.598
<b>Probability</b>	0.000

The table above informs that testing the differences in giving egg shell flour to the taste, color and aroma of fortified milk produces a Chi-square test statistic of 103.598 with a probability of 0.000. It can be seen that the probability < alpha (5%), so that H0 is rejected. Therefore, it can be stated that there is at least one pair of treatments giving egg shell flour to the taste, color and aroma of fortified milk which is significantly different.

To determine the effect of giving egg shell flour on the taste, color and aroma of fortified milk which was significantly different, it was carried out using the Mann Whitney test with the criteria that if one pair of treatments produced a probability ≤ level of significance (alpha = 5%), it could be stated that there was a difference in the effect of giving egg shell flour to the taste, color and aroma of fortified milk which was significantly different see **Table 3.**

**Table 3. All Parameters Aspect for All Variations to Milk Control**

Parameter	Variation			
	Egg control	Variation 2:1	Variation 1:2	Variation 1:1
Mann- Whitney U	822.5	110.0	466.50	544.50
Wilcoxon	1812.5	1100.0	1456.50	1534.50
Z	-1.382	-7.37	-4.55	-4.01
Asymp.Sig	.167	.000	.00	.00

The results of the above analysis indicate that the average value of taste, texture and aroma assessment in fortified milk, in the control group milk is the highest and

significantly different from the average assessment of taste, color and aroma in egg controls. However, it was not significantly different from the taste, color and aroma ratings of

the milk variations 1:2 , 2:1 and 1:1. With no significant difference, the addition of egg shell flour can be used as an alternative solution to still get the high calcium content from packaged milk with a mild milky aroma.

On the other hand, due to usage of waste, it does not affect much cost production for processing egg shell waste into egg shell flour. Processing egg shell waste only requires drying process by using sun shine which is not adding any cost of production but only its duration. However, using additional egg shell waste increase the profits because it can tune down the milky aroma compared to normal donuts. Therefore, by applying egg shell waste in packaging milk will rise the profit and will not affect much the cost of production.

## CONCLUSION

The addition of eggshell powder can reduce the aroma of milk which causes the aroma diminished. The most optimal variation in this study is the milk control variation of 580 points (very good) followed by 2 : 1 variation (powdered milk : egg shell powder) with a value of 547 points (very good). There was no significant difference between control variations, 1:2, 2:1, 1:1 but there were

significant differences between control eggs. This research requires more iterations are needed in this study to produce better research results. In addition, this research is needed regarding the calcium content in fortified milk through clinical testing laboratories to obtain detailed content results.

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