

Effect of Coconut Oil and Palm Oil Ratio on the Physical Quality of Mayonnaise

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ABSTRACT

Mayonnaise is a processed food product with an oil-in-water emulsion system, which is one type of sauce made from the main ingredients of vegetable oil with a high concentration of oil, egg or egg yolk, and vinegar. The purpose of this study was to determine the physical quality (yield, pH, and density) of mayonnaise by using the ratio of coconut oil and palm oil. The materials used were quail eggs, coconut oil, palm oil, salt, sugar, and pH buffer. The equipment used were medium- and high-sized bowls, spatulas, plastic cups, freezers, porcelain cups, measuring cups, analytical scales, pycnometers, pH meters, measuring cups, and wire whisks. The research design used a completely randomized design (CRD) with 5 treatments with 5 replications, namely P0 = (100% palm oil + 0% coconut oil), P1 = (75% palm oil + 25% coconut oil), P2 = (50% palm oil + 50% coconut oil), P3 = (25% palm oil + 75% coconut oil), and P4 = (0% palm oil + 100% coconut oil). Parameters observed were pH, yield, and density of mayonnaise. Data analysis used analysis of variance; if a significant effect was found, it continued with the DMRT test. The results showed that the use of coconut oil and palm oil ratio had a significant effect ($P < 0.05$) on the yield of mayonnaise, where the yield between treatment P0 was different ($P < 0.05$) with treatments P1 and P2 but the same ($P > 0.05$) with treatments P3 and P4, and the yield between P1 treatments is the same ($P > 0.05$) with P2 and P3 treatments but different ($P < 0.05$) With P4, the yield between P2 treatments is the same ($P > 0.05$) with P3 and P4 treatments, and the yield between P3 treatments is the same ($P > 0.05$) with P4 treatment. Furthermore, the use of coconut oil and mustard oil ratio had no significant effect ($P > 0.05$) on the pH and density of mayonnaise. The conclusion of this study is that the use of coconut oil and palm oil ratios does not change the pH and density of mayonnaise but can change the yield of mayonnaise. The highest physical quality of mayonnaise yield is found in the use of 25% coconut oil and 75% palm oil.

INTRODUCTION

People of all ages, from young toddlers to elderly adults, frequently use mayonnaise as a condiment to go with foods including pizza, salads, kebabs, burgers, hotdogs, and more. The primary constituents of mayonnaise, a type of condiment, are vinegar, chicken eggs or egg yolks, and vegetable oil. Made from water, salt, sugar, oil, lemon, and egg yolk, mayonnaise is a processed food item with a high oil concentration and an oil-in-water (o/w) emulsion system (Laca et al., 2010).

Egg yolk proteins, specifically lipoproteins, function as emulsifiers in mayonnaise, an oil-in-water emulsion (Gaonkar et al., 2010). The basic process of making mayonnaise involves combining 74% vegetable oil, 14% egg yolk, 9% acid, 2% sugar, and 1% salt with vinegar, sugar, and salt (Shen et al., 2011). Mayonnaise is made up of three primary ingredients: acid solution as the dispersing medium, egg yolk as the emulsifier, and vegetable oil as the dispersing media. To make high-quality mayonnaise, the three primary ingredients must be in harmony.

Generally speaking, vegetable oils such soybean, canola, olive, corn, and palm oils are used in the production of mayonnaise. According to Amertaningtyas and Jaya (2012), between 50 and 75 percent of the basic ingredients used to make mayonnaise are vegetable oils. Wardani (2012) has explored how to make mayonnaise from several vegetable oils, including soybean, coconut, and palm oils. Researchers attempted to examine the quality of mayonnaise made from coconut oil, palm oil, and soybean oil combined with rosella flowers. Vegetable oil is one of the elements that significantly affects the qualities and traits of mayonnaise.

According to Hifzhillah (2023), coconut oil, which is an oil that is extracted from the flesh of coconut fruit, can be utilized to make mayonnaise. Sherliana et al. (2021) claim that coconut oil, a byproduct of processed oleochemicals, has a higher lauric acid content (50–53%) than other vegetable oils. In addition, Pratiwi and Yunus (2018) reported that, in comparison to other vegetable oils including palm, soybean, corn, sunflower seed, and others, coconut oil contains approximately 53% lauric acid, a medium chain fatty acid (MCFA).

Emulsifiers and stabilizers are necessary to maintain the stability of the emulsion because water and oil cannot mix (Angkadjaja et al., 2014). According to Muchtadi (2010), the egg yolk is employed as an emulsifier in the production of mayonnaise because it contains lecithin, cholesterol, and lecithoprotein—surface active ingredients. Whereas cholesterol tends to create water-in-oil (w/o) emulsions, lecithin promotes the production of oil-in-water (o/w) emulsions. A variety of fowl, including laying hens, free-range chickens, ducks, and quail, can produce eggs. Although there is currently no research on utilizing quail egg yolks to make mayonnaise, quail eggs are superior to other poultry eggs in terms of protein and fat content since they have a 13.1% protein content and an 11.1% fat content (Listyowati, 2009).

METHODOLOGY

This research was conducted with the following steps:

How to make mayonnaise

How to make mayonnaise in this study using ingredients of coconut oil, palm oil, quail eggs, salt and sugar. The stages of making mayonnaise refer to the method of Prabowo et al, (2020) and have been modified with the following stages:

1. The first step is to stir 40 g of quail egg yolk using a mixer at medium speed for 1 minute until it changes color and is well mixed.
2. Then added salt as much as 2 g and sugar as much as 15 g, stirred again using a mixer for 1 minute until the salt and sugar dissolve.
3. Still mixing using a mixer, then add coconut oil and palm oil according to the treatment (namely 0%, 25%, 75% and 100%) little by little until well mixed.
4. After the mayonnaise dough is formed, it can be packaged using plastic cups for storage and parameter observation.

Research Design

The experimental design used in this study was a completely randomized design (CRD) with 5 treatments and 5 replicates. The treatment is the ratio of palm oil to coconut oil, which consists of:

P0: 100% palm oil + 0% coconut oil

P1: 75% palm oil + 25% coconut oil

P2: 50% palm oil + 50% coconut oil

P3: 25% palm oil + 75% coconut oil

P4: 0% palm oil + 100% coconut oil

The mathematical model used in this study (Steel and Torrie, 1993) is:

$$Y_{ij} = \mu + \tau_i + \varepsilon_{ij}$$

Description:

Y_{ij} = observed value for i-th treatment and j-th replication

μ = general mean

τ_i = treatment effect

ε_{ij} = gallate effect of i-th treatment and j-th replication

Observed Parameters

The parameters observed in this study are the physical quality of mayonnaise including: pH, yield and density

Data Analysis

The data obtained were analyzed by variance analysis (Anova), if there was a significant effect on the parameters observed then further tests were carried out with Duncan's further test (Steel and Torrie, 1993).

RESEARCH RESULT

The results of research on the effect of the ratio of coconut oil and palm oil on the physical quality (pH, yield and density) of mayonnaise have varying

average values. The average pH, yield and density of mayonnaise using the ratio of coconut oil and palm oil can be seen in Table 1.

Table 1. Average pH, Yield and Density of Mayonnaise Using Coconut Oil and Palm Oil

Treatment	Parameters		
	pH	Yield (%)	Density (g/cm ³)
P0	6,33 ± 0,12	47,27 ± 3,24 ^b	43,37 ± 0,40
P1	6,35 ± 0,06	53,01 ± 2,54 ^a	43,20 ± 0,44
P2	6,42 ± 0,07	51,77 ± 2,97 ^{ac}	43,47 ± 0,87
P3	6,43 ± 0,05	49,27 ± 5,23 ^{abc}	43,61 ± 0,63
P4	6,46 ± 0,02	47,31 ± 1,06 ^{bc}	43,87 ± 0,89

Notes: Different lowercase superscripts in the same column indicate significant differences (P<0.05).

pH Mayonnaise

The results of the analysis of variance showed that the use of coconut oil and palm oil ratio had no significant effect (P>0.05) on the pH of mayonnaise. This is because vegetable oils consisting of coconut oil and palm oil have an average pH above 7. This is in accordance with the opinion of Amertaningtyas and Jaya (2011) that the concentration of vegetable oil at the lowest to highest level does not affect the pH of mayonnaise, because vegetable oil has an alkaline pH, where vegetable oil is included in the alkaline fat group, so it does not affect the pH of mayonnaise. Furthermore, the results of research by Onasis et al. (2022) also showed that the use of vegetable oil does not affect the pH of mayonnaise because vegetable oil has an alkaline pH. According to Wibisono et al. (2020) palm oil has a pH value of around 5-11 and tends to be in alkaline conditions, and coconut oil has a pH value of 7-8 (Sherliana et al., 2020).

Table 1 shows that the pH of mayonnaise with the use of various ratios of coconut oil and palm oil ranged from 6.33 to 6.46. This means that the pH of mayonnaise in this study is higher than the normal pH value of mayonnaise in general. As the opinion of Gaonkar et al. (2010) that the normal pH of mayonnaise is 3.70-4.

However, the pH of mayonnaise in this study was in an acidic condition due to the addition of lime in making mayonnaise, so that the mayonnaise became slightly acidic. The pH value of mayonnaise that was not affected was due to the use of lime in each treatment in the same amount, so the acidic flavor produced was also the same between treatments. In accordance with the opinion of Amertaningtyas and Jaya (2011) that acids added to food can reduce pH, such as the addition of vinegar or lemon can cause mayonnaise to become more acidic.

Mayonnaise yield

Yield is the ratio between the initial weight and the final weight of mayonnaise. The results of the analysis of variance showed that the use of coconut oil and palm oil ratio had a significant effect ($P < 0.05$) on mayonnaise yield. This is because coconut oil and palm oil have high yields, so when added to food ingredients it will affect the yield of mayonnaise. According to Sari and Rusmanida (2023) the yield of palm oil reaches 21%, while the research of Firdana and Dewi (2021) that the yield of coconut oil is 17.22-22.22%.

The results of the Duncan test showed that the yield in the P0 treatment was significantly different ($P < 0.05$) with P1 and P2 but not significantly different ($P > 0.05$) with P3 and P4. The yield in the P1 treatment was not significantly different ($P > 0.05$) with P2 and P3 but significantly different ($P < 0.05$) with P0 and P4. The yield in the P2 treatment was not significantly different ($P > 0.05$) with P3 and P4, while the yield in the P3 treatment was also not significantly different ($P > 0.05$) with the P4 treatment. The ratio of 75% coconut oil and 25% palm oil (P1) gave the highest yield ($53.01 \pm 2.54\%$), followed by P2 ($51.77 \pm 2.97\%$) and P3 ($49.27 \pm 5.23\%$). The lowest yield was in the treatment of 0% coconut oil and 100% palm oil (P0 = $47.27 \pm 3.24\%$) and the treatment of 100% coconut oil and 0% palm oil (P4 = $47.31 \pm 1.06\%$).

The use of coconut oil and palm oil as a dispersion medium even with different ratios causes sufficient compound components that can be extracted into mayonnaise. According to Rizkyani et al. (2020) that the higher the concentration of solvents affects the degree of acidity which results in increased protein solubility. Increased protein solubility causes the yield obtained to be greater.

Table 1. shows that the mayonnaise yield value ranged from 47.27% to 53.01%. This shows that the yield value of mayonnaise with various comparisons of coconut oil and palm oil is still within the normal range. According to Juliana et al. (2023) the average yield of mayonnaise is 68.75% to 78.07%. Furthermore, Usman et al. (2015) stated that the characteristics of mayonnaise are caused by the characteristics of each vegetable oil used. Each type of vegetable oil has different characteristics depending on the fatty acid content contained therein.

Density of Mayonnaise

Based on the results of analysis of variance showed that the use of coconut oil and palm oil ratio had no significant effect ($P > 0.05$) on the density of mayonnaise. This is because the ratio of coconut oil and palm oil does not affect the mass per unit volume of mayonnaise, but the mass is more related to the emulsifier used. Table 1. shows that the density values of mayonnaise in this study ranged from 43.20 ± 0.44 g/cm² in P1 to 43.87 ± 0.89 g/cm² in P4. This condition is due to the emulsifier used in making mayonnaise is quail eggs which are less than optimal for use as an emulsifier, so the density of mayonnaise does not show any change.

CONCLUSIONS AND RECOMMENDATIONS

Conclusion

Based on the results of the study, it can be concluded that the use of the ratio of coconut oil and palm oil does not change the pH and density of mayonnaise but can change the yield of mayonnaise. The highest physical quality of mayonnaise yield is found in the use of a ratio of 25% coconut oil and 75% palm oil.

Recomendations

There needs to be further research related to the use of coconut oil and palm oil in making mayonnaise, but by using different emulsifiers, such as chicken egg yolks.

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