Original Research Article

Improving the Qualities of Low Fat Mayonnaise with Pumpkin Seed Flour (*Cucurbita maxima Duch*)

ABSTRACT

Aims: To obtain the finest percentage of Pumpkin Seed Flour (PSF) in terms of physicochemical properties of Low Fat Mayonnaise (LFM).
Study design: Using a Completely Randomized Design (CRD).
Place and Duration of Study: The research was done at the Animal Product Technology Laboratory, Egg Processing Division, Faculty of Animal Science, Universitas Brawijaya, Malang. The research was done in July-August 2024.
Methodology: The used method is a laboratory experimental by using a CRD and the data were analyzed using ANOVA with 4 treatments and 6 replications. If different results were obtained among the treatments, then followed by Duncan's Multiple Range Test (DMRT). The treatment of adding PSF to LFM was without addition (T0), 1% (T1), 3% (T2), and 5% (T3).
Results: The results of adding PSF retrieved an increase in the parameters of color a* (0.27-0.92), fiber content (0.61-1.15%), carbohydrates (40.70-43.99%), and protein (1.391-2.246%), while color L* (84.81-90.54), color b* (54.96-65.24), fat content (32.18-33.76%), and acidity (0.25-0.46%) decreased, showing a very significant effect ($P<0.01$).
Conclusion: It can be concluded that the best physicochemical properties of LFM are produced by adding 5% PSF.

Keywords: Low fat mayonnaise, pumpkin seed flour, physicochemical

1. INTRODUCTION

Mayonnaise is one of the emulsion products. The emulsion is types of emulsions where oil is the dispersed phase and water is the dispersing phase (o/w). The high public demand for LFM has made mayonnaise created in various variants. LFM is one variant of mayonnaise which is made healthier with lower fat content. This is to make mayonnaise healthier to consumed and reduce the risk of diseases associated with excessive fat consumption according to public demand. However, reducing the fat content when making LFM causes changes in the physicochemical characteristics that make the product less popular with consumers. Therefore, it is necessary to add a stabilizer during the process of making LFM.

Research shows that the addition of stabilizers from natural ingredients can help mayonnaise achieve the desired physicochemical characteristics. Some of them are mayonnaise with natural stabilizers addition in the form of katsuri orange peel flour (Afifah et al., 2024), watermelon rind flour (Evanuarini et al., 2020), and banana peel flour (Evanuarini and Susilo, 2020). One of the natural stabilizers that has not been added is PSF. Some research that has existed is adding PSF to biscuits products (Hussain et al., 2023), wheat bread (Chochkov et al., 2024), and cookies (Gebremariam et al., 2024). There is no research on PSF added to mayonnaise as a stabilizer.

Per 100 g of PSF contains 10.71 g of carbohydrates, 559 Kcal of energy, 30.23 g of protein, 7.81 mg of zinc, and 49.04 g of fat (Iswahyudi et al., 2023). The content of these nutritional can help LFM have a more stable emulsion, thus improving the physicochemical characteristics of LFM. Besides that, the nutritional content of PSF can also increase the nutritional content of LFM so that the addition of PSF can increase the nutritional value and make LFM attractive to consume.

2. MATERIAL AND METHODS

2.1 Material

The ingredients to make LFM are canola oil also vinegar obtained from supermarkets, fresh egg yolks obtained from the Teaching Farm of the Faculty of Animal Science, Brawijaya University, PSF obtained from e-commerce, mustard, sugar, salt, and pepper obtained from supermarkets. The formulation of LFM ingredients starts from 30% canola oil, 20% egg yolks, PSF according to treatment, 40% water, 5% vinegar, 0.5% mustard, 3% sugar, 1% salt, and 0.5% pepper.

2.2 Methods

The used method is a laboratory experimental by using a CRD and the data were analyzed using ANOVA with 4 treatments and 6 replications. If different results were obtained among the treatments, then followed by DMRT.

2.3 Sample Preparation

The process of making LFM begins by mixing the ingredients until homogeneous except for canola oil, egg yolks, PSF, and water. Ingredients that have not been mixed are added little by little alternately until they run out. The treatment of adding PSF to LFM is as follows:
T0 : without adding PSF
T1 : adding 1% PSF of the total formulation
T2 : adding 3% PSF to the total formulation
T3 : adding 5% PSF to the total formulation

2.4 Physichocemical Analysis of the Sample

2.4.1 <u>L*a*b* Color</u>

L*a*b* color analysis was performed by using color reader (AOAC, 2005). Testing was performed by coatingThe pteri cup uses clear plastic. The color reader is attached to the surface of the mayonnaise sample. The color reader is turned on. Measurements are taken by pressing the start button. The values of L*, a*, and b* are obtained, repeated 3 times for each treatment

Notes :
L* = 0-100 (the higher the score, the brighter it is)
a* = -127 to 128 (the lower the score the more close to green, the higher the score the more close to red)
b* = -127 to 128 (the lower the score the more close to blue, the higher the score the more close to yellow)

2.4.2 <u>Fiber Content</u>

Fiber content testing was carried out using the gravimetric method (AOAC, 2005).The mayonnaise sample was weighed and extracted using a soxhlet. Dried and put into a 500 ml measuring cup. Add 50 ml of 1.25% H_2SO_4 solution. Simmered for 30 minutes using a cooler. Add 50 ml of 3.25% NaOH and continue to boil for 40 minutes. Filtered with a Buchner funnel containing dried and known-weighted ashless filter paper. Washed the sediment on the filter paper with 96% ethanol, hot water, and hot 1.25% H2SO4. Put into a cup of known weight and dried at 105ºC. Cooled and weighed until constant weight. Calculated using the following formula:

$$(\%)\ \text{Fiber Content} = \frac{\text{W fiber (g)}}{\text{W sample (g)}} \times 100\%$$

2.4.3 Carbohydrate Content

Testing of carbohydrate levels using the Luff Schoorl method (AOAC, 2005). The test was carried out using a Luff Schoorl solution containing ($CuSO_4$), potassium sodium tartrate, and sodium carbonate. Furthermore, titration was carried out using sodium thiosulfate solution ($Na_2S_2O_3$) until the solution became clear. After that, it was calculated using the following formula:

$$(\%)\ \text{Carbohydrate Content} = \frac{\text{(V blank} - \text{V sample) x Thiosulfate Factor x 1000}}{\text{W sample (g)}}$$

Notes :

V blank = volume $Na_2S_2O_3$ which is used for blank titration

V sampel = volume $Na_2S_2O_3$ which is used for sample titration

Thiosulfat Factor = calculated based on concentration and Luff Schoorl solution

2.4.4 Protein Content

Kjeldahl method was performed to analyzed the protein content (AOAC, 2005). The testing process was carried out through 3 stages, namely destruction, distillation, and titration. After that, it was counted using the next formula:

$$(\%)\ \text{N} = \frac{\text{(a} - \text{b) (N NaOH) (Ba N)}}{\text{w sample x 1000}} \times 100\%$$

Total protein = % N x fk N (6.25)

Notes :

A = amount of sample titrations

B = amount of blank titrations

N = normality of NaOH

Ba N = atomic weight of hydrogen (14.008)

% N = nitrogen content

2.4.5 Fat Content

Fat content testing was carried out using the Babcock method (AOAC, 2005). The test conducted by inserting a 5 ml LFM sample into a centrifuge tube and then inserted into a spinner. Rotated for 10 minutes at 200 rpm, after which the sample was inserted into a measuring cup. Hot distilled water with a temperature of 60ºC was added to scale 25 and left for 15 minutes. The fat volume is measured using a vernier caliper and calculated using the following formula:

$$(\%)\ \text{Fat Content} = \frac{\text{V scale}}{\text{V sample}} \times 100\%$$

2.4.6 Acidity

Acidity testing is carried out using the acid-base titration method (AOAC, 2005). The test begins by put the titrant into the burette. Put the analyte into the Erlenmeyer flask. Add a few drops of acid-base indicator (methyl orange) to the analyte. The titrant is dripped little by little into the analyte. Stop titration when the color of the analyte changes. Calculated using the following formula:

$$Ma \times Va \times a = Mb \times Vb \times b$$

Information :
Ma = molarity of acid solution (M)
Va = volume of acid solution (ml)
a = valence of acid solution
Mb = molarity of base solution (M)
Vb = volume of base solution (ml)
b = valence of base solution

3. RESULTS AND DISCUSSION

3.1 L*a*b* Color

L*a*b* color is a test carried out to detect color changes that occur in the product due to the addition of formulation. The results of the average L*a*b* color values of LFM by the addition of PSF can be found in Table 1. Based on Table 1, the larger the PSF percentage added, the lowest the L* and b* color values and the higher the a* color value of LFM. This is because the added PSF contains chlorophyll which produces a dominant green and carotenoid in the form of lutein which contribute to yellow and green colors which causes the brightness level to decrease, the level of a* value shows a positive value which means it is slightly towards red, and the level of b* value which also shows a positive value which means the product tends to have a yellow color. The L*a*b* color value produced is higher than previous studies where mayonnaise with the use of different fruit flours produced L* color values in the range of 80.38-85.80, a* color values within the range (-2.37) -0.59, and b* color values within the range of 9.43-19.45 (Vieira et al., 2023).

3.2 Fiber Content

Fiber content is a test conducted to determine the amount of total dietary fiber in a product. The results of the average fiber content of LFM by the addition of PSF can be found in Table 1. Based on Table 1, the larger the PSF percentage added, the higher the fiber content of LFM. This can occur due to the distribution of fibers from PSF in LFM, causing an increase in the overall fiber content of LFM. In addition, fibers such as pectin and polysaccharides interact with water and form gels that can increase fiber content in LFM. This value is comparable to previous studies which stated that the fiber content in mayonnaise with pumpkin flour addition in the range of 0.00-0.90% (Nidhal et al., 2022).

3.3 Carbohydrate Content

Carbohydrates are nutrients that can be the main source of energy for the human body. The results of the average carbohydrate content of LFM by the addition of PSF can be found in Table 1. Based on Table 1, the larger the PSF percentage added, the higher the carbohydrate content of LFM. This is because per 100 g of PSF there are 10.71 g of carbohydrate nutrients so that the more PSF is added, the higher the carbohydrate content will be (Iswahyudi et al., 2023). The carbohydrate content is much higher when compared to previous studies. Reduced fat mayonnaise with apple peel flour addition of as a stabilizer produces a carbohydrate content of 2.63-5.81% (Evanuarini and Susilo, 2024).

3.4 Protein Content

Protein content is a chemical analysis carried out to determine the protein content of a product. The results of the average protein content of LFM by the addition of PSF can be found in Table 1. Based on Table 1, the larger the PSF percentage added, the higher the protein content of LFM. This is because PSF contains 30.23 g of protein per 100 g of PSF. This value is smaller when compared to the value of previous studies. Mayonnaise with the addition of soybean oil produces a protein content value of 4.55% (Rihansjah, 2023).

3.5 Fat Content

Fat content is an important analysis for mayonnaise because it is made from oil. The average result of LFM fat content with PSF addition can be found in Table 1. Based on Table 1, the larger the PSF percentage added, the lowest the fat content of LFM. This can happen because the nutritional content of PSF is composed of non-fat solid components, thereby reducing the proportion of fat in the product and becoming lower when more PSF is added. Reduced fat mayonnaise with watermelon rind flour addition as a stabilizer produces a fat content value ranging from 51.90-71.94% with the highest value being the control mayonnaise (Evanuarini et al., 2020). Another study stated that LFM with tomato peel nanopowder addition as a natural antioxidant produces a fat content value ranging from 34.05-70.68% with the highest value being the control mayonnaise (Evanuarini et al., 2023).

3.6 Acidity

Acidity in the product can extend the shelf life because it can cause microbial damage that contaminates the product. The results of the average acidity value of LFM by the addition of PSF can be found in Table 1. Based on Table 1, the larger the PSF percentage added, the lowest the acidity value of LFM. This is because PSF has a pH value that tends to be close to neutral which can have an effect on reducing the concentration of acid in a product. The acidity value is smaller when compared to previous studies. Reduced fat mayonnaise with watermelon rind flour addition as a stabilizer produces an acidity value ranging from 0.63-0.94% (Evanuarini et al., 2020). Another study stated that mayonnaise with apple peel flour addition as a stabilizer produces an acidity value ranging from 0.66-0.90% (Evanuarini and Susilo, 2024).

Table 1. Physicocemichal Quality of LFM with PSF Addition

Variable	Treatments			
	T0 ± SD	**T1 ± SD**	**T2 ± SD**	**T3 ± SD**
Lightness (L*)	90.54 ± 0.56^{c}	88.36 ± 0.64^{b}	87.42 ± 0.53^{b}	84.81 ± 0.36^{a}
Redness (a*)	0.27 ± 0.11^{a}	0.37 ± 0.08^{a}	0.67 ± 0.12^{b}	0.92 ± 0.12^{c}
Yelowness (b*)	65.24 ± 0.63^{d}	60.31 ± 0.45^{c}	59.06 ± 0.65^{b}	54.96 ± 0.72^{a}
Fiber Content (%)	0.61 ± 0.05^{a}	0.85 ± 0.03^{b}	1.07 ± 0.02^{c}	1.15 ± 0.02^{d}
Carbohydrate (%)	40.70 ± 0.45^{a}	41.80 ± 0.19^{b}	42.22 ± 0.29^{a}	43.99 ± 0.28^{a}
Protein Content (%)	1.39 ± 0.07^{a}	1.77 ± 0.09^{b}	1.97 ± 0.05^{c}	2.24 ± 0.07^{d}
Fat Content (%)	33.76 ± 0.05^{d}	32.82 ± 0.11^{c}	32.48 ± 0.06^{b}	32.18 ± 0.03^{a}
Acidity (%)	0.46 ± 0.05^{a}	0.39 ± 0.02^{a}	0.31 ± 0.01^{b}	0.25 ± 0.02^{c}

Note : $^{a, b, c, d}$ Different superscripts in the same column indicate a highly significant effect (P<0.01)

4. CONCLUSION

In this research, it was concluded that the best L*a*b* color value, fiber content, carbohydrate content, protein content, fat content, and acidity were found in LFM with the addition of PSF with an addition of 5%.

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