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The Effect of Ginger Extract on Emulsion Stability, Total Acidity and Sensory Evaluation of Full Fat Mayonnaise

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Abstract**—** *The purpose of this research were to investigate the physicochemical quality and sensory evaluation full fat mayonnaise with varieties of ginger and added with different level. The materials were sunflower oil, egg yolk, vinegar, spices and ginger extract. The methods was laboratory experimental using Nested Completely Randomized Design with 2 factors and 3 replication. The A factor was varieties of ginger (elephant ginger), (emprit ginger) and (red ginger). The B factor was the level of addition (0,5%), (1%) and (1,5%). The variables observed were stability emulsion, total acidity and sensory evaluation (texture, odor, color, taste and overall acceptability) of mayonnaise. Analyzed of variance (ANOVA) will using to analysis the data and followed with DMRT. The result showed that varieties of ginger and different level of addition did not gave significant effect (P>0.05) on sensory evaluation and gave highly significant effect (P<0.01) on stability of emulsion, total acidity and overall acceptable. It could be concluded that the use of 1,5% red ginger gave best quality of mayonnaise.*

Keywords**—** *Mayonnaise, ginger, stability emulsion, total acidity, sensory evaluation*

I. Introduction

Mayonnaise were liquid that had characteristics aciditity and white yellow pale coloured. The mayonnaise commonly used as salad dressing. Mayonnaise made from vegetable oli as dispersed phased and egg yolk as an emulsifier. Full fat mayonnaise has a high oil or fat content. High oil or fat content can cause instability of the emulsion. In addition, some of the problems that arise in full fat mayonnaise are very sour smell and taste. Emulsion instability has several types, namely creaming, flocculation, coalescene and breaking (Khan et al., 2011) as well as sedimentation, inversion phase and ostwald ripening (Tadros, 2013). The addition of stabilizers can help overcome emulsion instability while the addition of materials with aromatic plants such as ginger can overcome organoleptic problems..

Ginger as an aromatic plant contains essential oils. According to Samuel *et al.*, (2015) stated that the content of essential oils in ginger had ranges from 2.58 to 3.72% of the dry matter. Ginger has a strong and distinctive aroma and distinctive spicy taste. According to Muntafiah et al. (2017) zingiberen and zingiberol components which are volatile components in ginger can affect the aroma of ginger. According to Handrianto (2016) the spicy flavor that arises from ginger is influenced by the content of gingerol. The taste and aroma of ginger can be beneficial for the body because of the warmth it causes and the aroma can eliminate the fishy odor in food.Therefore, the purpose of this research is to investigate the possible effect of ginger on the physicochemical quality and sensory evaluation full fat mayonnaise.

II. Materials and Methods

A. Materials

Making ginger extract is done by using the procedure followed by Safitri et al. (2019). Three varieties of ginger, elephant ginger, emprit ginger (emprit) and red ginger are washed with osmosis water, drained and weighed. Ginger is cut into smaller sizes and put in a blender for 3 minutes until crushed and smooth. The ginger extract is poured into a container that has benn given a filter cloth, then squeezed until the pulp is dry. The ginger extract is ready to use.

Mayonnaise is made by following the procedure carried out by Safitri et al. (2019). The spices (sugar, salt, mustard and white pepper powder) are shaken in a container using a mixer at a speed of 1500 rpm for 1 minute. Add egg yolks and whisk until they turn slightly whiter. Add sunflower oil and vinegar alternately until the mayonnaise turns into an emulsion. Add ginger extract according to the treatment and shake again for 2 minutes. Finally, mayonnaise is stored at room temperature (25^0C ± 20^0C) and stored in a closed container for 24 hours. Mayonnaise is already to use.

B. Analyzied Procedure

Emulsion stability procedure followed by AOAC (2005). Centrifuge tube was weighed and note down as (M). Samples weighed as much as 3 gr and note down as (N). The samples were put into a centrifuge tubes and centrifuged for 10 minutes at room temperature with 1500 rpm. Discard the liquid separately and the sediment at the centrifuge tube were weighed and note down as (O). Calculate using a formula:

Emulsion Stability (%) = ((N-O) / (N-M)) x 100

Total acidity procedure followed by AOAC (2005). The samples were weighed as much as 2 gr and note down as (a). Add 20 ml of distilled water and stir until homogeneous and put into Erlenmeyer 50 ml. Drop the pp indicator solution as much as 3 drop on the samples and stir it until homogeneous. Prepare the burette that has benn filled with NaOH up to 50 ml. put down the Erlenmeyer in the burette and note down initial NaOH volume. Drop NaOH solution to the sample until

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it turns pink. Stop the burette and note down the final volume. Then calculate using a formula:
Total Acidity (%) = ((ml NaoH 0,1N x 0,009) / a (gr)) x 100

Observation of emulsion droplet procedure followed by Chatterjee and Paramita (2015) with modification. Emulsion droplet observed with light microscope (Olympus equipped with camera Nikon BX40). The sample, object glass and cover glass were prepared. The samples reviewed above the object glass and covered it with cover glass. The light microscope was prepared with magnification 400 x, and then observed it.

Sensory evaluation procedure followed by Susrini (2005). Sensory evaluation uses a descriptive scale with 1 (extremely don't like) – 5 (extremely like) scale. The panelists were uses as much as 5 people with age 30-50 years. The sensory evaluation such as texture, odor, color, taste and overall acceptabiliy were tested.

Data are analyzed using the analyses of variance using one-way anova with Completely Randomized Design (CRD) nested design in Microsoft excel and continued with Duncan Multiple Range Test ($P<0.05$) separated the differences between the means of groups. The A factor were ginger varieties and the B factor were level addition of ginger extract. The sensory evaluation analyzed by descriptive scale and descriptive analyzed.

III. Result and Discussion

The Effect of Variety Ginger on Emulsion and Total Acidity on Full Fat Mayonnaise

The effect of variety ginger on emulsion stability and mayonnaise total acidity shown at Table I.

TABLE I. Effect of variety ginger on emulsion and total acidity on full fat mayonnaise

Treatment	Emulsion stability (%)	Total Acidity (%)
Mayonnaise without treatment	92,80 ± 1,22	0,947 ± 0,035
Commercial Mayonnaise	98,50 ± 0,64	0,833 ± 0,032
Mayonnaise + GGE	$89,71^{a}$ ± 6,97	$0,876^{b}$ ± 0,010
Mayonnaise + EGE	$90,32^{a}$ ± 4,65	$0,843^{a}$ ± 0,010
Mayonnaise + RGE	$94,10^{b}$ ± 1,47	$0,843^{a}$ ± 0,014

Mean values not sharing the same superscripts in a row differ significantly ($P < 0.01$)

Emulsion Stability

The effect of were give significantly different ($P <0.01$) on the stability of the mayonnaise emulsion. According to table I the elephant ginger were the lowest (89.71%) while, the highest emulsion stability was found in mayonnaise with the use of red ginger (94.10%). This result were affected by the oil and water content in mayonnaise (Soekarto, 2013). The essential oil content in each ginger is different, red ginger (3.9%), emprit ginger (3.5%) and elephant ginger (2.5%). According to Hernani and Hayani's research (2001) the water content of red ginger were (81.76%), emprit ginger (92.90%) and elephant ginger (92.50%). High ginger water content will cause emulsion instability, because the stability of the emulsion is influenced by the ratio between water and oil. In addition, the carbohydrate content also affects the stability of the emulsion. Carbohydrates function as a thickener in mayonnaise. The carbohydrate content of ginger affects the stability of the mayonnaise emulsion. Mayonnaise with the addition of red ginger has a high emulsion stability, due to the red ginger contains carbohydrate content of 6.81% while mayonnaise with ginger elephant has a low emulsion stability, because elephant ginger contains carbohydrate content of 3.62%. Carbohydrates function as thickening agents that can help stabilize the mayonnaise emulsion.

Total Acidity

The treatment of ginger variety has a significant effect ($P<0.01$) on mayonnaise total acidity. Mayonnaise total acidity can be expressed as a percent. The purpose of measuring total acidity is to find out the acid value in the mayonnaise. Total acidity can be determined by dripping the amount NaOH of the sample against the sample that has been dropped by the PP (fenolfthalein) indicator until it turns pink. The lower pH value, the higher mayonnaise total acidity and the higher pH value, the lower mayonnaise total acidity.

According to Table I showed that the variety of ginger give significantly difference ($P<0.01$) to the total acidity of mayonnaise. The lowest total acidity was found in mayonnaise with the use of red ginger extract (0.876%) while, the highest total acidity was found in mayonnaise with the use of elephant ginger extract (0.83%) and emprit ginger extract (0.83%). The condition is due to the pH of the different fresh extracts of ginger. The pH of red ginger extract was (5.93), emprit ginger extract (5.83) and elephant ginger extract (5.64). The higher the total acidity value of mayonnaise, the lower the pH value. According to Harjanti (2008) states that acid-base indicator is a substance that can change color if the pH of the environment also changes. According to Andari (2013) stated that weak organic acids or bases can change into two different kinds of shapes and colors, namely colors in the form of ions and colors in molecular shapes and or can change shape at H + concentrations or change at certain pH.

The Effect of Ginger Variety on Sensory Evaluation of Full Fat Mayonnaise

The effect of variety ginger on sensory evaluation such as texture, odor, color, taste and overall acceptability were tested shown at Table II.

TABLE II. Effect of variety ginger on emulsion and total acidity on full fat mayonnaise

Treatment	Organoleptic				
	Texture	odor	Colour	taste	Accep-tability
Mayonnaise without treatment ($P0^{-}$)	4,20 ± 0,20	3,87 ± 0,30	3,67 ± 0,30	3,33 ± 0,42	4,33 ± 0,23
Commercial Mayonniase ($P0^{+}$)	4,33 ± 0,31	4,07 ± 0,30	2,53 ± 0,90	2,33 ± 0,31	4,27 ± 0,41
Mayonnaise + GGE	4,29 ± 0,15	4,11 ± 0,21	3,56 ± 0,11	4,07 ± 0,06	$4,31^{ab}$ ± 0,09
Mayonnaise + EGE	4,04 ± 0,25	4,04 ± 0,05	3,49 ± 0,06	3,89 ± 0,24	$4,09^{a}$ ± 0,25
Mayonnaise + REG	4,36 ± 0,10	4,20 ± 0,11	3,38 ± 0,10	4,11 ± 0,10	$4,42^{b}$ ± 0,05

Mean values not sharing the same superscripts in a row differ significantly ($P < 0.01$);

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Texture

Base on table II the result give was not significant different (P> 0.05) on the texture of mayonnaise. Mayonnaise with fresh red ginger extract had the thickest texture. The texture of with the addition of red ginger extract (4,36 ± 0,10) were best result. The texture of mayonnaise is influenced by different liquid ginger extracts. Mayonnaise with ginger elephant has the most liquid texture when compared with other treatments. The texture of mayonnaise is influenced by the high water content in the ginger extract. The water content of elephant ginger extract is 92.50%. Mayonnaise with ginger emprit has a texture that is not too watery. This condition caused by the water content of emprit ginger extract of 92.50% and carbohydrate content of 4.59%. The carbohydrate content of ginger extract helps form mayonnaise texture. Mayonnaise with red ginger extract has the best texture value. This is because the water content in red ginger extract is the lowest at 85.76% and the high carbohydrate content is 6.81%, so the texture is the most dense and thick. In addition commercial mayonnaise has the highest texture when compared to other mayonnaise. According to Gaonkar *et al.* (2010) polysaccharides, gums or starches and thickeners will improve the texture and viscosity of mayonnaise. This is because commercial mayonnaise uses other additives such as modified starch. Modified starch is a stabilizer in food that functions as a water absorber, while the texture of the mayonnaise will become more stable because a lot of water is bound by carbohydrates.

Odor

According to Table II type of ginger were not significantly different (P> 0.05) to the odor of mayonnaise. The preferred mayonnaise odor is mayonnaise with the addition of red ginger extract. Mayonnaise with the treatment of adding fresh extracts of ginger emprit has a smell that is doesn't liked by panelists, because the smell of ginger is too pungent. Generally, sour-scented mayonnaise derived from vinegar. Vinegar functions as a liquid phase and gives flavor and odor typical to mayonnaise. According to Silfia and Sri (2014), the taste and aroma of food can be influenced by vinegar as an organic acid. Mayonnaise with the addition of ginger extract has a distinctive aroma of ginger. This is caused by the different ginger essential oil content in each type of ginger. According to Samuel *et al.* (2015), red ginger essential oil contains 2-58-3.71% of its dry weight while the oleoresin content in ginger is about 3% of its dry weight. In addition, volatile components such as zingiberen and zingiberon will affect the aroma of mayonnaise.

Untreated mayonnaise has a strong vinegar odor compared to other mayonnaise, while commercial mayonnaise is more acidic and has an egg odor. This is because the fat contained in mayonnaise will affect the smell of mayonnaise. According to Mun *et al* (2009) states that mayonnaise in the presence of thickening agents, vinegar and high fat content will affect the odor.

Color

According to Table II the variety of ginger was not significantly different (P> 0.05) to the color of mayonnaise, but physically the mayonnaise had a different color in each treatment. Mayonnaise with the addition of red ginger extract has the darkest color when compared to other treatments. The color of mayonnaise with the addition of fresh extracts of elephant ginger has a color that is preferred liked by panelists. The yellow color in mayonnaise is influenced by ingredients such as mustard and egg yolk. Mayonnaise with the addition of red ginger extract has the darkest color, this is because the red ginger extract color is the darkest and the brownish compared to other ginger extracts so that it will affect the color of mayonnaise. Mayonnaise with the addition of elephant ginger extract has the brightest color when compared to other extract mayonnaise. This is because the color of elephant ginger extract has the brightest and most yellow color compared to other ginger. But in the opinion of Liu and Xu (2007) stated that mayonnaise with a darker color favored by panelists.In addition, Commercial Mayonnaise has the whitest color. This is due to the addition of starch, mayonnaise color will be whiter. Mayonnaise without treatment is mayonnaise without any additional ingredients, so the color of the mayonnaise is the yellowest among the other treatments.

Taste

According to Table II the result was not significantly different (P> 0.05) on the taste of mayonnaise, but physically the taste of mayonnaise was different between treatments. Mayonnaise with the addition of emprit ginger extract has the spicy flavor among the treatments. The taste of mayonnaise with the addition of red ginger extract is preferred by panelists because of its taste which is not too spicy and not too pungent. Mayonnaise with elephant ginger extract has a non-spicy taste. According to Handrianto (2016) states that the taste of ginger is affected by the content of gingerol. According to Setyawan's research (2002), the total essential oil contained in red ginger is 83.35%, elephant ginger essential oil is 82.63% and the essential oil of emprit ginger is 90.24%. Commercial mayonnaise has the lowest taste, because commercial mayonnaise is more dominant in sour taste due to the presence of vinegar in mayonnaise. According to Evanuarini *et al* (2016) stated that the spices found in mayonnaise namely sugar, salt, vinegar and mustard will help increased to mayonnaise.

Overall Acceptability

Based on the table II the result was significantly different (P> 0.05) to the acceptability of mayonnaise. The indicator that influences product acceptance by panelists. Overall acceptance is judged by several indicators such as texture, color, smell and taste. The lowest acceptability is in mayonnaise with the use of emprit ginger with an average value of 4.09 (accepted) while the highest overall acceptance is in mayonnaise with the use of red ginger with a mean value of 4.42 (accepted). Mayonnaise with the addition of fresh red ginger extract has the highest overall acceptance value in terms of texture, odor, color and taste. This is because red

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ginger extract lacks the most brown color, but improves the texture, taste of mayonnaise and ginger which is still acceptable and the aroma is not too pungent. Panelists consider that the use of ginger in food can reduce the fishy odor and get health benefits, including as a remedy for red ginger and emprit ginger. Kaban *et al.* (2016) stated that the type of ginger that is most often used as a medicine is red ginger. In addition, commercial mayonnaise has the strongest scent of mayonnaise, starting to smell rancid, pale white color but the texture is thick and very soft.

The Effect of Different Addition Level of Ginger Extract on Emulsion Stability and Mayonnaise Total Acidity

The effect extract ginger 0,5% (a), 1% (b) and 1,5% (c) from each ginger varieties level added on emulsion stability and mayonnaise total acidity shown at Table III.

TABLE III. Emulsion stability and mayonnaise total acidity of ginger extract added with different levels

Treatment	Emulsion Stability (%)	Total Acidity (%)
Mayonnaise without Treatment ($P0^-$)	92,76 ± 1,23	0,947 ± 0,035
Mayonnaise Commercial ($P0^+$)	98,50 ± 0,65	0,833 ± 0,032
Mayonnaise + GGE 0,5%	$94,15^b$ ± 1,81	$0,888^a$ ± 0,006
Mayonnaise + GGE 1%	$93,15^b$ ± 1,47	$0,872^a$ ± 0,018
Mayonnaise + GGE 1,5%	$81,68^a$ ± 1,35	$0,868^a$ ± 0,022
Mayonnaise + EGE 0,5%	$93,92^b$ ± 1,78	$0,850^a$ ± 0,006
Mayonnaise + EGE 1%	$91,97^b$ ± 1,39	$0,846^a$ ± 0,012
Mayonnaise + EGE 1,5%	$85,08^a$ ± 1,15	$0,832^a$ ± 0,010
Mayonnaise + RGE 0,5%	$95,45^a$ ± 1,71	$0,860^b$ ± 0,013
Mayonnaise + RGE 1%	$94,31^a$ ± 1,21	$0,838^a$ ± 0,006
Mayonnaise + RGE 1,5%	$92,53^a$ ± 1,76	$0,833^a$ ± 0,011

Letters that are superscripted in the same rows show a significant effect (P<0.01).

Emulsion Stability

The value of mayonnaise emulsion stability with different treatment level nested in ginger variety was improved signifficantly (P<0,01). The average value of mayonnaise emulsion stability with increasing the level of ginger extract that nested in elephant ginger variety has value of 94,15%-81,76%. The average value of mayonnaise emulsion stability with increasing the level of ginger extract that nested in emprit ginger variety has result value of 93,92%-85,07%. While the value of mayonnaise emulsion stability with increasing in the level of ginger extract that nested in ginger variety has value of 95,94%-92,53%. The variety of emulsion stability average value is caused by atsiri oil compound contains in ginger. The more level in mayonnaise increased, it won't be thicker. Influenced by atsiri oil compound, mayonnaise with increasing different level is influenced by moisture content and carbohydrates content in those ginger extract. The more level increased from each ginger variety, will be influencing in emulsion stability. Based on Hernani and Winarti (2014) that atsiri oil compound contains ginger around 1-3%. Soekarto (2013) argumented that oil in water emulsion is influence by increasing in compound and oil concentrate.

Mayonnaise with increasing different level nested in ginger variety has different significant comparation from commercial mayonnaise, due to commercial mayonnaise has higher emulsion stability. The commercial mayonnaise stability emulsion influenced by ingredient contains in mayonnaise. Starch form or gum or polisaccaride that increasing in mayonnaise will be support mayonnaise emulsion stability.

Total Acidity

Total acidity can be determined by acidity and alkalimetri titration method. Acidity and alkalimetri are indicators that shown colors changing in titrat liquid. Total acidity value of mayonnaise with different level of treatment nested in ginger variety gave a significant influence effect (P<0,05). Total acidity value of mayonnaise with increasing ginger extract level that nested in elephant ginger variety has result value 0,868%-0,888%. The average of total acidity with increasing level in ginger extract nested in emprit ginger variety has result value of 0,850%-0,832%, while the average of total acidity with increasing level in ginger extract nested in red ginger variety has result value 0,860%-0,833%.

This is caused by increasing different level from each ginger variety. The more ginger level increased, total acidity will be decreased. The more addition level increased, will also increase total water addition. Based on Usman et al. (2018), shown that the more addition acid formed, will decreasing pH value. Furthermore decrease pH value is one of indication that there's an organic acid accumulation.

The Effect of Different Level Addition Ginger Extract on Sensory Evaluation of Full-Fat Mayonnaise

The level addition effect on ginger extract, such as 0,5%; 1% and 1,5% ginger varieties of elephant ginger extract (GGE), emprit ginger extract (EGE) and red ginger extract (REG) respectively on texture, odor, color, taste and overall acceptability of mayonnaise shown at Table IV.

Texture

Texture value of mayonnaise with treatment different level nested to varieties of ginger did not give significant effect (P>0,05). Mayonnaise with different level treatment nested to varieties of ginger has physical effect on the texture of the mayonnaise. The more levels are added, the thicker mayonnaise will be. This is influenced by the extract of ginger which contained essential oil or atsiri oil. Based on Mun et al. (2009), shown that fat as supporting component of food will affect the texture of the product.

Odor

Odor value of mayonnaise with treatment different level nested to varieties of ginger did not give a significant effect (P>0,05). Mayonnaise with different level treatment nested to varieties of ginger can affect the odor of mayonnaise. the more levels are added, the odor of ginger can be stronger. Based on Zancan et al. (2010) it shown that the volatile of essential oil can affect the odor, especially ginger. Based on Koswara (2006) it shown that ginger aroma comes from primary components in atsiri oil such as zingiberen and zingiberon. However, based on Yashin et al. (2017) argumented that ingredients added like herb and spices can increase the sensory evaluation, flavor and can be act as food preservative.

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TABLE IV. Sensory evaluation of mayonnaise with different level addition variety of ginger extract

Treatment	Sensory Evaluation				
	Texture	Odor	Color	Taste	Overall Acceptability
Mayonnaise without treatment ($P0^-$)	4,20 ± 0,20	3,87 ± 0,30	3,67 ± 0,30	3,33 ± 0,42	4,33 ± 0,23
Mayonnaise Commercial ($P0^+$)	4,33 ± 0,31	4,07 ± 0,30	2,53 ± 0,90	2,33 ± 0,31	4,27 ± 0,41
Mayonnaise + GGE 0,5%	4,20 ± 0,40	4,07 ± 0,61	3,67 ± 0,12	4,00 ± 0,53	4,07 ± 0,23
Mayonnaise + GGE 1%	4,20 ± 0,20	4,07 ± 0,42	3,53 ± 0,31	4,07 ± 0,42	4,27 ± 0,42
Mayonnaise + GGE 1,5%	4,47 ± 0,12	4,20 ± 0,20	3,47 ± 0,12	4,13 ± 0,46	4,60 ± 0,35
Mayonnaise + EGE 0,5%	3,87 ± 0,46	3,93 ± 0,12	3,60 ± 0,20	3,73 ± 0,31	3,87 ± 0,61
Mayonnaise + EGE 1%	3,96 ± 0,23	4,00 ± 0,20	3,53 ± 0,23	3,80 ± 0,60	3,93 ± 0,31
Mayonnaise + EGE 1,5%	4,33 ± 0,31	4,20 ± 0,20	3,33 ± 0,12	4,13 ± 0,12	4,47 ± 0,12
Mayonnaise + RGE 0,5%	4,27 ± 0,23	4,07 ± 0,42	3,53 ± 0,31	4,07 ± 0,12	4,20 ± 0,20
Mayonnaise + RGE 1%	4,33 ± 0,12	4,13 ± 0,31	3,33 ± 0,23	4,13 ± 0,31	4,40 ± 0,20
Mayonnaise + RGE 1,5%	4,47 ± 0,23	4,40 ± 0,20	3,27 ± 0,12	4,13 ± 0,23	4,67 ± 0,12

Letters that are superscripted in the same rows show a significant effect (P<0.01).

Color

Color value of mayonnaise with treatment different level nested to varieties of ginger did not give a significant effect (P>0,05). Mayonnaise with different level treatment nested to ginger variety can affect color of mayonnaise. The more levels that are added, the color would feel darker Mayonnaise with red ginger will be darker. This statement argumented with Amin et al. (2010) it shown that the panelist likes the darkness color of mayonnaise diverse with mayonnaise added by the different level of emprit ginger extract and elephant ginger extract. The color will be yellow pale. The different color ginger extract can affected by varieties of ginger. Based on Chaiyasit et al. (2007) it shown that the food product color added with natural active antioxidant will be increase mayonnaise color.

Taste

Taste value of mayonnaise with treatment different level nested to varieties of ginger did not gave a significant effect (P>0,05). Mayonnaise with different level addition nested on ginger varieties give real physical effect on the taste of mayonnaise. The more level extract are added to mayonnaise, the more taste of ginger will be. Based on Muntafiah et al. (2017) it shown that ginger taste can be affected by atsiri oil type gingerol. Gingerol component from each ginger was differented. The more levels are added, the more component of gingerol will be. Typical taste of mayonnaise was acid and that taste comes from vinegar which added as continuous phase. Base on Estiasih and Ahmadi (2014) argumented that vinegar was organic acid such as acetic acid, lactic acid, fumarate acid, succinate acid and phosphate acid.

Overall Acceptability

Overall acceptability value of mayonnaise with different level treatment nested to varieties of ginger did give a highly significant effect (P<0,01). Mayonnaise with different level addition nested to varieties of ginger can be affected to overall acceptability of mayonnaise. The more levels are added to mayonnaise, the more acceptance by panelists. Overall acceptability are assessed based on texture, odor, color and taste on mayonnaise. The more level are added up until 1,5%, the overall will be accepted by panelists.

The Effect of Ginger Variety and Level to Droplet Emulsion on the Full Fat Mayonnaise

TABLE V. Emulsion of droplet among variety and level on the full fat mayonnaise

Treatment		Emulsion of droplet (µm)
Control	Mayonnaise without treatment	2,24 - 13,98
	Commercial Mayonnaise	1,87 - 17,28
Treatment with variety of ginger	Mayonnaise with elephant ginger 0,5%	3,01 - 34,93
	Mayonnaise with elephant ginger 1%	2,92 - 23,75
	Mayonnaise with elephant ginger 1,5%	2,94 - 24,64
	Mayonnaise with emprit ginger 0,5%	3,58 - 19,34
	Mayonnaise with emprit ginger 1%	3,06 - 14,17
	Mayonnaise with emprit ginger 1,5%	2,33 - 10,85
	Mayonnaise with red ginger 0,5%	1,98 - 21,92
	Mayonnaise with red ginger 1%	2,68 - 14,19
	Mayonnaise with red ginger 1,5%	1,98 - 6,78

Emulsion of droplets are oil globules that appear microscopically when viewed using a light microscope. Emulsion drops can be seen if there is a liquid phase as the basis. In this study, the emulsion of droplet was seen because there was vinegar as its liquid phase. Mayonnaise with the addition of different levels nested in the type of ginger affects the emulsion droplet in mayonnaise. The more levels are added, the more droplet emulsions will be, smaller and uniform in size. According to Taherian et al. (2008) argues that if more fat or oil is added to the product, the globula oil will look turbid.

Based on observations that have been made the size of the emulsion droplet around 1.98 - 34.93 µm. The more uniform droplet size, the same shape and the more droplet effect on the viscosity and stability of the mayonnaise emulsion. According to Gaonkar et al. (2010) states that the average value of the size of the mayonnaise droplet is 2-10 µm. This is influenced by the large oil content and affects the thick texture and increased mayonnaise volume. According to Prasetya and Evanuarini (2019) stated that the smaller the size of the droplet, the shape of the oil droplet in the vinegar droplet will be more regular. Smaller droplet sizes will take longer to separate when compared to larger droplets. But according to Taherian et al. (2008) argues that there is a possibility that if more oil is added then the cause of oil separation to the water phase will be even greater.

IV. Conclusion

The addition of ginger extract on mayonnaise full fat give significant result at the level 1.5% on quality of mayonnaise.

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REFERENCES

[1] Amin, M.H.M., A.E. Elbelgaty., M. Mustafa and H.K. Ali. 2014. Development of Low Fat Mayonnaise Containing Different Types and Levels of Hydrocolloid Gum. *Journal of Agroalimentary Process and Technologies*. 20(1): 54-63.

[2] Andari, S. 2013. Perbandingan Penetapan Kadar Ketoprofin Tablet Secara Alkalimetri sengan Spektrofotometri-UV. *Jurnal Eduhealth*. 3 (2): 114-119.

[3] AOAC (Association of Official Agricultural Chemist). 2005. *Official Methods of Analysis*. 18th ed. AOAC International. USA.

[4] Chaiyasit, W., R.J. Elias., D.J. McClements and A.D. Aeric. 2007. Role of Physical Structures in Bulk Oils on Lipid Oxidation. *Critical Reviews in Food Science and Nutrition*. 47: 299-317. http://dx.doi.org/10.1080/10408390600754248

[5] Chatterjee, D and B. Paramita. 2015. Use of Eugenol-lean Clove Extract as a Flavoring agent and Natural Antioxidant in Mayonnaise: Product Characterization and Storage Study. *J Food Sci Technol*. 52(8): 4945-4954.

[6] Estiasih, T dan Kgs. Ahmadi. 2014. *Teknologi Pengolahan Pangan*. Jakarta: Bumi Aksara.

[7] Evanuarini, H., Nurliyani., Indratiningsih dan H. Pudji. 2016. Stability Emulsion and Sensory Characteristic Low Fat Mayonnaise Using Kefir as Emulsifier Replacer. *Jurnal Ilmu dan Teknologi Hasil Ternak*. 11 (2): 33-39.

[8] Gaonkar, G., R. Koka., K. Chen and Bruce. 2010. Emulsifying Functionality of Enzyme-Modified Milk Proteins in O/W and Mayonnaise-like Emulsions. *African Journal of Food Science*. 4(1): 016-025.

[9] Handrianto, P. 2016. Uji Antibakteri Ekstrak Jahe Merah *Zingiber officinale* var Rubrum terhadap *Staphylococcus aureus* dan *Escherichia coli*. *Journal of Research and Technologies*. 2(1): 1-4.

[10] Harjanti, R.S. 2008. Pemungutan Kurkumin dari Kunyit (Curcuma domestiva val) dan Pemakaiannya sebagai Indikator Analisis Volumetri. *Jurnal Rekayasa Proses*. 2(2): 49-54.

[11] Hernani dan E. Hayani. 2001. Identification of Chemical Components on Red Ginger (*Zingiber officinale* var. Rubrum) by GC-MS. Proc. *International Seminar on Natural Products Chemistry and Utilization of Natural Resources*. UIUnesco, Jakarta : 501 – 505.

[12] Kaban, A.N., Daniel and C. Shaleh. 2016. Phytochemical, Toxicity and Activity Antioxidant Fraction N- Hexane and Ethyl Acetate Extract of Red Ginger (*Zingiber officinale* var. amarum.). *Jurnal Kimia Mulawarman*. 14 (1): 24-28.

[13] Khan, B.A., N. Akhtar., H.M.S. Khan., K. Waseem., T. Mahmood., A. Rasul., M. Iqbal and Haroon. 2011. Basic of Pharmaceutical Emulsions: A Review. *African Journal of Pharmacy and Pharmacology*. 5(25): 2715-2725. http://dx.doi.org/10.5897/AJPP11.698 .

[14] Koswara, S. 2006. *Jahe, Rimpang dengan Sejuta Khasiat*. Jakarta: Pustaka Sinar Harapan.

[15] Liu, X., X.M. Xu, and D. Guob. 2012. Rheological, Texture and Sensory Properties of Low Fat Mayonnaise with Different Fat Mimetics. *LWT – Food Sci and Tech*. 40: 946 – 954.

[16] Mun, S., Y.L. Kim., C.G. Kang., K.H. Park., J.Y. Shim and P.K. Yong. 2009. Development of Reduced Fat Mayonnaise using 4αGTase-modified Rice Starch and Xanthan Gum. *International Journal of Biological Macromolecules*.44:400–407 http://dx.doi.org/10.1016/j.ijbiomac.2009.02.008

[17] Muntafiah, A., D. Yulianti., A.H. Cahyaningtyas dan I.D. Hani. 2017. Pengaruh Ekstrak Jahe Merah (*Zingiber officinale*) dan Madu terhadap Kadar Kolesterol Total Tikus Model Diabetes Melitus. *Scripta Biologica*. 4(1): 1-3. http://dx.doi.org/10.20884/1.SB.2017.4.1.329

[18] Prasetya, D.A and H. Evanuarini. 2019. The Quality of Mayonnaise Using Blimbi Starfruit Juice (*Averrhoa bilimbi* L.) as Acidifier Based on the Emulsion Stability, Droplet of Emulsion and Color. *Jurnal Ilmu dan Teknologi Hasil Ternak*. 14 (1): 20-29.

[19] Safitri, A. R., Evanuarini, H and Thohari, I. 2019. The Potential of Local Ginger as Antioxidant on Full Fat Mayonnaise. *Jurnal Ilmu dan Teknologi Hasil Ternak.* 14 (2): 90-98.

[20] Samuel., U. Pato dan R. Evy. 2015. Variasi Penambahan Ekstrak Jahe Merah (*Zingiber officinale* var Rubrum) terhadap Mutu dan Antioksidan Bubuk Instan Akar Alang-Alang. *Jom Faperta*. 2(2): 1-13.

[21] Setyawan, A.D. 2002. Keragaman Varietas Jahe (zingiber officinale Rosc) berdasarkan Kandungan Kimia Minyak Atsiri. *BioSmart.* 4(2): 48-54.

[22] Silfia dan A. Sri. 2014. Pengaruh Penambahan Gula terhadap Kualitas Vinegar dari Air Kelapa. *Jurnal Dinamika Penelitian Industri*. 25(2): 117-124.

[23] Soekarto, S.T. 2013. *Teknologi Penanganan dan Pengolahan Telur*. Alfabeta. Bandung.

[24] Susrini, 2005. *Index Efektifitas. Suatu Pemikiran tentang Alternatif untuk Memilih Perlakuan Terbaik pada Penelitian Pangan*. Ed.ke-3 Fakultas Peternakan. Universitas Brawijaya. Malang.

[25] Tadros, T.F. 2013. *Emulsion Formation, Stability and Rheology*. First edition: wiley-VHC Verlag GmbH and Co. KGaA. 1-76.

[26] Taherian, A.R., P. Fustier., M. Britten., H.S. Ramaswamy. 2008. Rheology and Stability of Beverage Emulsions in the Presence and Absence of Weighting Agents. A Review. *Food Biophysics*. 3: 279-286.

[27] Usman, N.A., E. Wulandari dan S. Kusmajadi. 2015. Pengaruh Jenis Minyak Nabati terhadap Sifat Fisik dan Akseptabilitas Mayonnaise. *Jurnal Ilmu Ternak*. 15(2): 22-27.

[28] Yashin, A., Y. Yashin., X. Xia and N. Boris. 2017. Antioxidant Activity of Spices and Their Impact on Human Health: A Review. *Antioxidants*. 6(70): 1-18. http://dx.doi.org/10.3390/antiox6030070

[29] Zancan K.C., M.O.M. Marques., A.J. Petenate., M.A. Meireles. 2002. Extraction of ginger (*Zingiber officinale Roscoe*) oleoresin with CO2 and co-solvents: a study of the antioxidant action of the extracts. *J. Supercritical Fluids*. 24: 57–76.