

PAPER • OPEN ACCESS

Effect of ratio of andaliman (*Zanthoxylum acanthopodium*) with garlic and aging time on the quality of sambal tuk tuk

To cite this article: M Sonangda et al 2019 *IOP Conf. Ser.: Earth Environ. Sci.* **260** 012084

View the [article online](#) for updates and enhancements.

Effect of ratio of andaliman (*Zanthoxylum acanthopodium*) with garlic and aging time on the quality of sambal tuk tuk

M Sonangda, H Sinaga* and L N Limbong

Department of Food and Science Technology, Universitas Sumatera Utara, Medan, North Sumatera, Indonesia

E-mail: *hotnida.sinaga@uq.net.au

Abstract. The purpose of this research was to find the effect of ratio of andaliman with garlic and aging time on the quality of *sambal tuk tuk* stored at room temperature. This research was using completely randomized design with two factors, i.e.: ratio of andaliman with garlic (A): (100%: 0%; 75%: 25%; 50%: 50%; 25%: 75%; 0%:100%) and aging time (L): (0, 4 and 8 day). Parameters analysed were moisture content, total number of microbe, vitamin C content, pH, total soluble solids, colour values (Chromatometer), hedonic organoleptic score of colour, flavour, taste and texture. The results showed that the ratio of andaliman with garlic has highly significant effect on moisture content, total number of microbe, colour score (Chromatometer), score hedonic of organoleptic colour, flavour, texture and texture score. The ratio of andaliman with garlic of (25%:75%) the best quality of sambal tuk tuk based from score of organoleptic and total number of microbe stored for up to 8 days at room temperature.

1. Introduction

Sambal is a dish that can't be separated from Indonesian people and generally use spicy chilli as its main ingredient. Spicy flavour in sambal could enhance one's appetite. Batak tribe originating from North Sumatera Indonesia is also very fond of processed chilli in the form of sambal. Batak tribe is famous for its foods, especially for the spicy and bitter taste from andaliman [1]. Sambal tuk tuk is a condiment served to complement food, this Batak's specialty sambal is also suitable to serve with all food. This sambal get its name "tuk tuk" from the sound of pounding the ingredients traditionally. The ingredients which are onion, hot pepper, candlenut and another additional ingredients, are mixed according to each North Sumatra regions preference, anchovies or dried salted fish are also added to enhance the sambal tuk tuk's taste.

Andaliman (*Zanthoxylum acanthopodium*) is a unique herb because the bitterness gives a different sensation compared with other herbs making it a special ingredient and commodity. The bitter taste is derived from the antioxidants compounds contained in andaliman and one of the potent antibacterial. The resulting bitterness andaliman may stimulate the production of saliva caused by the terpenoid compounds and the Sausshool compounds contained in andaliman [2].

Garlic is one of the herbs that has been proven to inhibit the growth of microorganisms. Garlic has a very distinctive taste generated by the sulphur components present in volatile garlic oil. The type of compound that determines the typical smell of garlic is allicin [3].



Shelf life is one of the most important factor on estimating food making, which affects food expiration date [4]. This research aims to determine the effect of andaliman percentage ratio with garlic towards sambal tuk tuk quality during storage at room temperature.

2. Materials and methods

2.1 Materials

The research used fresh green andaliman, garlic, red chilli pepper, red cayenne, kecombrang flower, candlenut, shallot, sugar, salt, oil and water obtained from Setiabudi Market Medan.

2.2 Making sambal tuk tuk

Fresh andaliman of green dominant colour cleaned with water and drained to dry, weighed according to percentage factor A. Garlic cleansed with water and drained to dry, weighed according percentage factor A. Ingredients sambal of tuk tuk in the portion of 23% red chilli pepper, 12% red cayenne pepper, 10% kecombrang flower, 10% candlenut, 10% shallot, 5% sugar, 5% salt. Red chilli pepper, red cayenne pepper, kecombrang are steamed flower 3 minutes and drained. Candlenut are roasted for 3 minutes. Refined all ingredients using a seed blender for 3 minutes with the addition of 15% comparison andaliman with garlic (100%; 0%, 75%; 25%, 50%; 50%; 25%; 75%; 0%; 100%). Sambal stir fried for 3 minutes with 10% cooking oil. Add in sterile glass / jar glass and stored at room temperature.

2.3 Data analysis

This research uses a complete factorial randomized design that is comparison with andaliman with garlic (A): (100%;0%, 75%;25%, 50%;50%, 25%;75%, 0%;100%) and storage time (L): (0, 4, 8 days) at room temperature. The number of treatment combinations or Treatment Combination (Tc) was $3 \times 5 = 15$. The treatment was made in 3 replications, with 45 samples.

2.3.1. Moisture content. A sample of 5 g was put into an aluminium cup which had been dried for one hour at 105°C and weighed. The sample is heated at a temperature of 105°C for three hours, then cooled in the desiccator until it is cool then weighed. Heating and cooling are repeated until a constant sample weight is obtained.

$$\text{Moisture content} = \frac{\text{initial sample weight} - \text{final sample weight}}{\text{initial sample weight}} \times 100\% \quad (1)$$

2.3.2. Determination of total number of microbes. Sample was weighed 1 g and put into a sterilized reaction tube. For the preparation of PCA solution (Plate Count Agar) weight 17.5 grams of PCA in 1 liter of aquadest then heated until the medium completely soluble and boiled. Put 10 ml of PCA solution in reaction tube and sterilized for 15 minutes at 121 °C. Next, reaction tube were prepare and had been filled with 9 ml of 0.85% NaCl sterile solution. Put 1 g of sample into the test tube filled with 9 ml of NaCl sterile solution and take 1 ml of solution and put into a reaction tube containing 9 ml of NaCl solution and diluted up to up to 10^{-4} . Take 1 ml of solution and put into a petri dish cup and poured PCA solution that had been prepared and lowered the temperature to 40°C after the solution cold and the solution solidified, turn the cup upside down and wrapped and incubated for 48 hours at 37°C

2.3.3. Determination of pH. Determination of pH using calibrated pH meter with buffer solution at pH 4 and 7. Solid-shaped samples were mashed first with mortar and pestle, then diluted with distilled water. Then the pH meter is ignited and stabilize (15-30 minutes). Electrodes at pH meters were rinsed with aquadest and dried electrodes with tissue paper. After that the electrode is dipped into the sample

solution and the pH gauge is adjusted and wait until a stable reading is obtained. Then the sample pH is recorded.

2.3.4. Determination of total soluble solids. Samples was weighed as much as 2 gram and put into 18 ml of aquadest. Standardized Hand refractometer by using aquadest. Drip a drop of diluted sample on hand refractometer prism. Observed and recorded value scale. The total content of soluble solids is the value expressed in °Brix.

2.3.5. Determination of vitamin C by the method of calorimetry. Vitamin C content was determined by using colorimetric method. The dye solution was made by weighing 100 mg 2,6-dichlorophenol indophenol, then added 50 ml of hot aquadest and 84 mg sodium bicarbonate. The solution was cooled and diluted to 100 ml of aquadest, then filtered and diluted 25 ml of the solution to a volume of 500 ml with aquadest. Standard ascorbic acid solution was prepared by weighing exactly 100 mg of ascorbic acid and dissolving up to a volume of 100 ml with $\text{H}_2\text{C}_2\text{O}_4$ (oxalic acid) 2%, diluted 4 ml of the solution to a volume of 100 ml with $\text{H}_2\text{C}_2\text{O}_4$ 2% (1 ml = 40 µg ascorbic acid). Sample preparation for analysis of ascorbic acid calorimetrically similar to sample preparation for analysis by titration, however $\text{H}_2\text{C}_2\text{O}_4$ used concentrated at 2%. If the sample to be analysed is solid or semi-solid, 50-100 g of sample is mixed with 6% $\text{H}_2\text{C}_2\text{O}_4$. Then diluted to a volume of 100 ml. Standard ascorbic acid is 40 µl, 80 µl, 100 µl, 120 µl and 160 µl is pipetted into a 5 ml test flask. So obtained a concentration of 8 µg / ml, 16 µg / ml, 20 µg / ml, 24 µg / ml and 32 µg / ml. Then diluted with 2% $\text{H}_2\text{C}_2\text{O}_4$ to 5 ml volume. Transferred into the test tube and then added 10 ml of dye solution, homogenized and measured absorbance of the solution in spectrophotometry Vis with a wavelength of 518 nm. For blanks dye solution is used and absorbance is measured with a wavelength of 518 nm. Then an absorbance vs. concentration curve is created. Weighed the sample as much as 5 g, then put it into a 100 ml volumetric flask with the addition of $\text{H}_2\text{C}_2\text{O}_4$ 2% to the test flask and stirred evenly. Taken as much as 5 ml then diluted again with $\text{H}_2\text{C}_2\text{O}_4$ 2% until it reaches a volume of 100 ml on a volumetric flask. Dilution results were taken as much as 5 ml and put into a test tube and then added with a 10 ml dye solution then the absorbance was measured with a wavelength of 518 nm and the absorbance results were recorded. The content of ascorbic acid in the sample can be calculated by the formula:

$$\text{Vitamin C content} = \frac{\text{ascorbic acid concentration} \times \text{total extract volume} \times \text{diluent factor}}{\text{sample volume} \times 1000 \times \text{sample weight}} \times 100 \quad (2)$$

2.3.6. Colour values. Colour was measured using a Minolta Chroma meter (CR 400 type, Japan). The sample was placed on the available container, then pressed the start button and will get the value of L, a and b of the sample with a range of 0 (black) to ± 100 (white). The notation "a" denotes the chromatic colour of a red-green mixture with a value of "+ a" (positive) from 0 to + 100 for red and a "-a" (negative) value from 0 to -80 for green. The notation "b" denotes a blue-yellow mixed chromatic colour with a "+ b" (positive) value of 0 to + 70 for yellow and a "-b" (negative) value from 0 to -80 for blue. While L states the sharpness of colour. The higher the sharpness of the colour, the higher the value of L.

2.3.7. Organoleptic test of colour, aroma, taste and texture. Organoleptic assessment of colour, flavour, taste and texture is done with a hedonic test. Coded samples randomly and tested by 20 panellists. Sensory testing (organoleptic) is determined based on numerical scale. For hedonic scale used is 1 (very dislike), 2 (dislikes), 3 (rather like), 4 (like) and 5 (very like).

3. Results and discussions

3.1. Moisture content (%)

In Figure 1 shows the combination treatment of andaliman with garlic had highly significant effect of moisture content in sambal tuk tuk. The higher percentage of andaliman (A_1) in sambal tuk tuk the smaller the moisture content, the higher percentage of garlic (A_5) in sambal tuk tuk the higher the moisture content. This happens because the water contain in andaliman is smaller than garlic. Fresh andaliman contained 19.32% water [5]. In Figure 1, different letter notations showed significantly different effects at the 5% level (lower case) and are very significant different at 1% level (upper case).

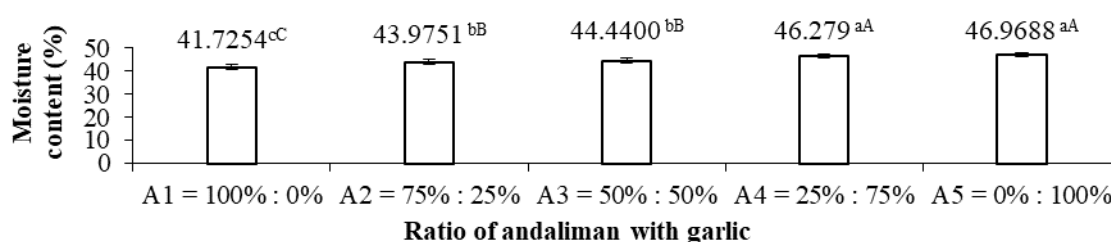


Figure 1. The effect of ratio of andaliman with garlic to moisture content of sambal tuk tuk

3.2 Total microbes

Initially the A_1 treatment (100%: 0%) has the lowest total microbial, 3.5×10^5 log CFU / ml than other treatment. The low number of total microbes due to antimicrobial activity from the addition of andaliman with a high percentage is more effective to inhibiting microbial growth. The higher percentage of andaliman will show higher inhibition. Allisin has the potential to be the strongest antimicrobial agent in garlic [6].

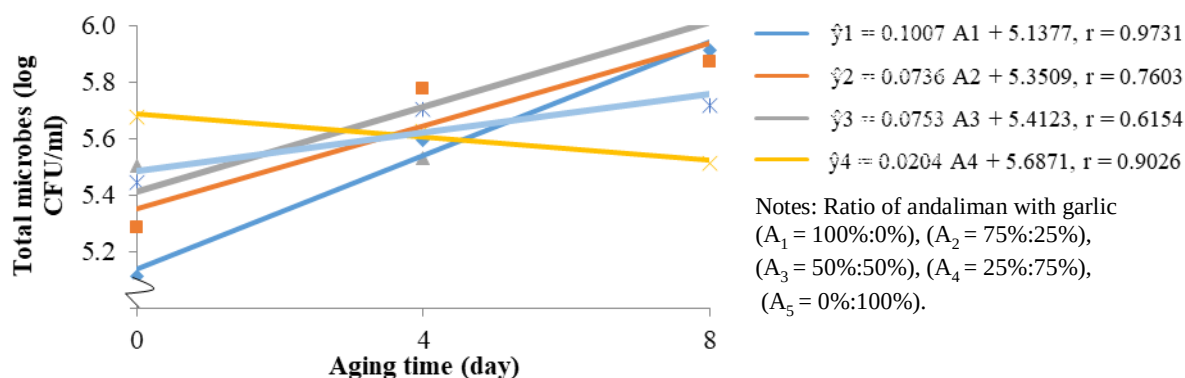


Figure 2. The effect of ratio of andaliman with garlic during aging time of sambal tuk tuk

Figure 2 shows the total microbes of sambal tuk tuk with A_4 treatment (25%: 75%) decrease during storage from zero (0) day was 4.7×10^5 CFU/ml to 3.3×10^5 CFU/ml on days 8th. This is suspected cause by effectiveness of antimicrobial andaliman with suitable garlic in percentage and supported by intrinsic and extrinsic factors of microbial growth so as to show the total decrease of microbe in sambal tuk tuk though not too far. The microbial growth is influenced by two factors: intrinsic and extrinsic in food products. Intrinsic factors such as acidity (pH), water activity (A_w), equilibrium humidity (ERH), nutritional content, biological structure and also antimicrobial [4].

3.3. pH

The decrease in the pH of the sambal tuk tuk caused during storage from zero (0) day 6.08 to 5.66 in day 8th (Figure 3), the pH of sambal tuk tuk decreased steadily during the storage. It cause the longer storage of sambal will cause a decrease of sambal [7].

3.4. Vitamin C

Vitamin C in sambal tuk tuk decreased during the storage, from zero (0) day worth of 100.2571 mg/100 g to 99.5924 mg/100 g in day 8th 9 (Figure 4) Vitamin C or ascorbic acid is a type of acid that is volatile and susceptible to changes due to oxidation affected by temperature and storage time [8].

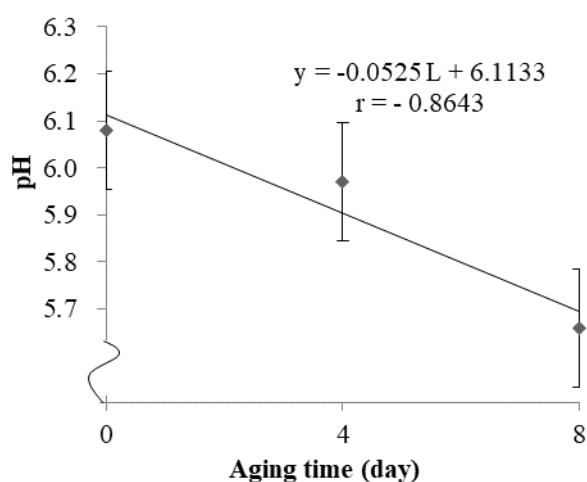


Figure 3. The effect of aging time to pH of sambal tuk tuk

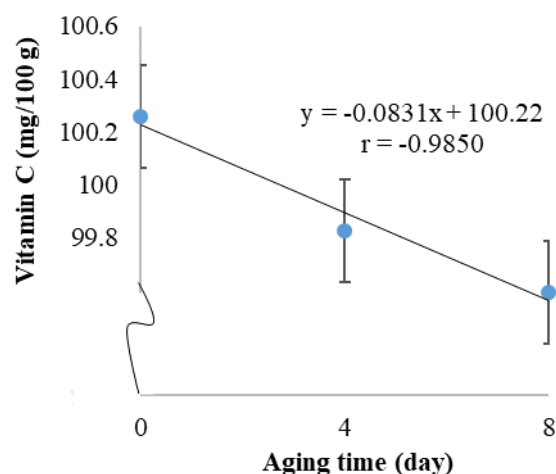


Figure 4. The effect of aging time to vitamin C of sambal tuk tuk

3.5. Total soluble solids

The decrease of total soluble solids during storage from zero (0) day 16.17 ° Brix to 8.70 ° Brix day 8th (Figure 5). It caused by the decrease of sugar content. The Sugar is broken-down of polysaccharides during the storage [9].

3.6. Colour score

The result of color analysis at Figure 6 shows that the ratio of andaliman with garlic had highly significant effect on the quality of sambal tuk tuk. It showed that the additions of more andaliman resulted in the decrease of red colour score. The value of ⁰hue showed that sambal tuk tuk made of 100% of garlic became red (67.5162) and the addition of andaliman caused the colour changed to red-yellow colour (53.5662). The changed in the products colour is determined by the pigment in the fresh materials. Andaliman has dark colour [1], it's faded the red colour of chili, while on the higher ratio of garlic made sambal tuk tuk has a brighter colour. In Figure 6, different letter notations showed significantly different effects at the 5% level (lower case) and are very significant different at 1% level (upper case).

3.7. Organoleptic hedonic of colour

Treatment of A₁ and A₂ has the lowest hedonic of colour value caused by percentage of andaliman is high so the colour of the sambal tuk tuk is darker. Treatment of A₄ and A₅ has a high hedonic of colour value 3.7222 and 3.6222 caused by the white colour of garlic that made the colour of sambal tuk tuk

brighter Figure 7. The panellist prefer the brighter than the dark colour from andaliman [1]. In Figure 7, different letter notations showed significantly different effects at the 5% level (lower case) and are very significant different at 1% level (upper case).

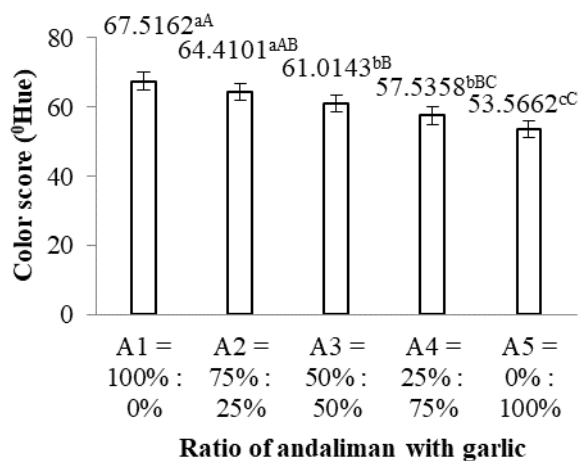


Figure 5. The effect of aging time to total soluble solid of sambal tuk tuk

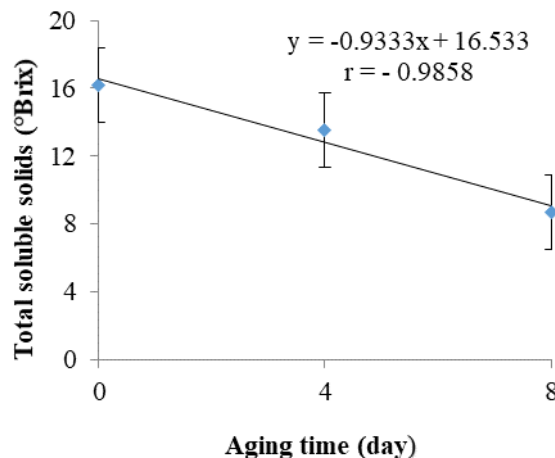


Figure 6. The effect of ratio of andaliman with garlic to colour score of sambal tuk tuk

3.8. Organoleptic hedonic of flavour

Treatment with the highest andaliman percentage (A₁) has a high organoleptic value of the flavour (preferably) than the other treatments (Figure 8). The increased of andaliman caused the flavour value higher. Aromatic of andaliman is produced from citronellal compounds which give a strong and warm citrus flavour [5]. The treatment of A₅ with the highest of garlic has a lowest value. It causes the flavour the organosulfur compound in garlic [6] is dislike by panellist. In Figure 8, different letter notations showed significantly different effects at the 5% level (lower case) and are very significant different at 1% level (upper case).

3.9. Organoleptic hedonic of texture

The A₅ treatment have a preferred value (Figure 9) because the texture of the sambal tuk tuk with the composition of garlic produce a finer sambal tuk tuk than the treatment with the higher percentage of andaliman. The texture of the sambal tuk tuk is with higher percentage of andaliman has a rough texture. It caused by the highest andaliman content on sambal tuk tuk gift rough texture because the skin of andaliman [10]. In Figure 9, different letter notations showed significantly different effects at the 5% level (lower case) and are very significant different at 1% level (upper case).

3.10. Organoleptic score of texture

The treatment A₅ has the higher value 3.1167 and A₁ 2.5167 (Figure 10). The texture of a sambal tuk tuk is effected by percentage of andaliman and garlic. The softer sambal tuk tuk is preferred by the panellist. Andaliman has a fairly rough texture because of the hard skin of andaliman [10]. In Figure 10, different letter notations showed significantly different effects at the 5% level (lower case) and are very significant different at 1% level (upper case).

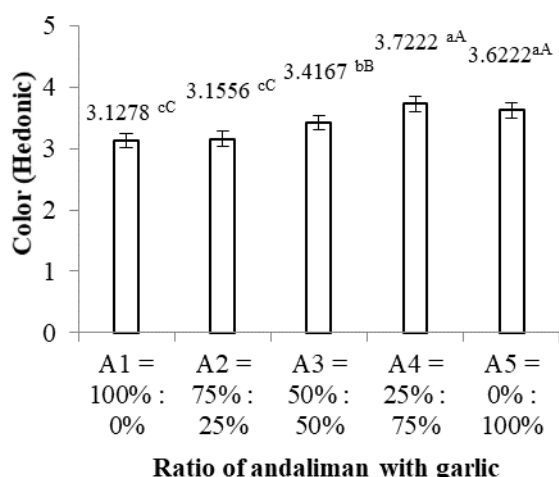


Figure 7. The effect of ratio of andaliman with garlic to colour (hedonic) of sambal tuk tuk

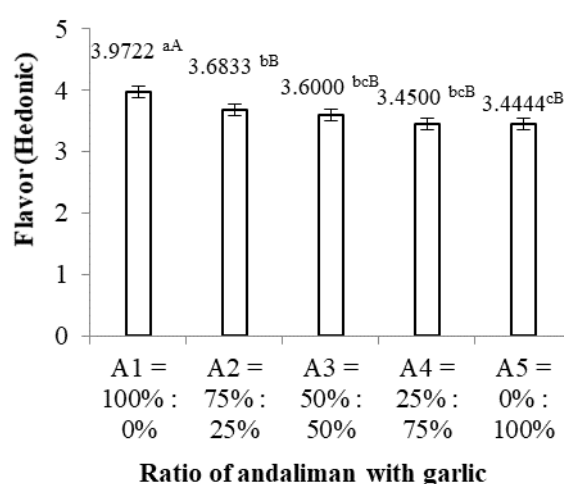


Figure 8. The effect of ratio of andaliman with garlic to flavour (hedonic) of sambal tuk tuk

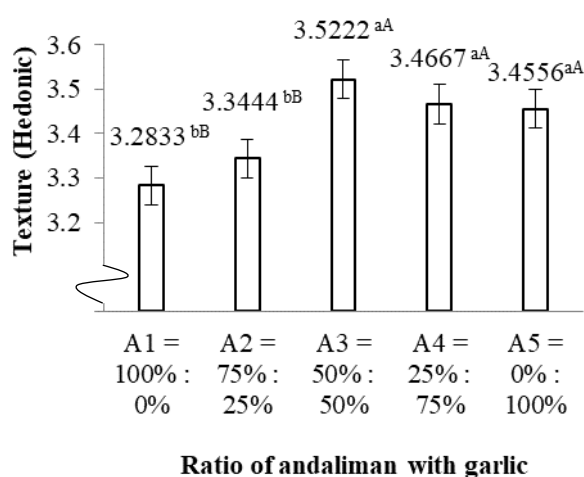


Figure 9. The effect of ratio of andaliman with garlic to texture (hedonic) of sambal tuk tuk

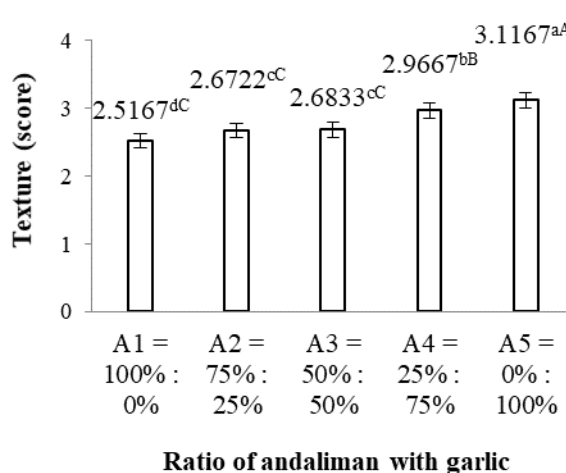


Figure 10. The effect of ratio of andaliman with garlic to texture (score) of sambal tuk tuk

4. Conclusions

The results showed that the ratio of andaliman with garlic had highly significant effect on moisture content, total number of microbe, colour score, organoleptic hedonic of colour, flavour, texture and texture scores. Based on total microbes and organoleptic test, it was found that the best quality of sambal tuk tuk was produced from 25% of andaliman and 25% of garlic (25%: 75%). The products were also stable up to 8 days even when they were stored at room temperature.

References

- [1] Siregar A U, Rusmarilin H and Nurminah M 2017 The formulation of instant arsik powder using andaliman with asam gelugor and ratio of stabilizer *J. Rekayasa Pangan dan Pert* 5 221-28

- [2] Asbur Y and Khairunnisyah K 2018 Utilization andaliman (*Zanthoxylum acanthopodium* DC) for producing plant essential oils *J. Kultivasi* **17** 537-43
- [3] Apriliani A, Sukarsa S and Hidayah H A 2014 Ethnobotany study of plants as traditional food additives by the community in Pekuncen District, Banyumas Regency *J. Scripta Biologica* **1** 76-84
- [4] Herawati H 2008 Determination of shelf life in food products *J. Litbang Pertanian* **27** 124-30
- [5] Agnesty D, Karo-karo T and Suhaidi I 2017 Effect of ratio of sichuan pepper with torch ginger stem and drying temperature on the quality of sichuan pepper condiment powder *J. Rekayasa Pangan dan Pert* **5** 454-61
- [6] Salima J 2015 Antibacterial activity of garlic (*Allium Sativum* L.) *Med. J. Lampung University* **2** 30-8
- [7] Renate D, Pratama F, Yulianti K and Priyanto G 2014 Kinetic Model of Capsaicin Degradation on Red Chilli Paste at Various Storage Temperature *Agritech* **34** 330-36
- [8] Rachmawati R, Defiani M R and Suriani N L 2008 Effect of temperature and length of storage on vitamin C concentration of chilli (*Capsicum frutescens*) *J. Biologi* **8** 36-40
- [9] Sitompul R S E, Sinaga H and Julianti E 2017 The effect of Etlingera elatior (Kecombrang) flower addition on the quality of sambal tombur packaged in glass jar during storage at room *J. Rekayasa Pangan dan Pert* **5** 678-84
- [10] Siregar B L 2013 The germination and dormancy breaking of andaliman (*Zanthoxylum acanthopodium* DC.) seed *J. Agronomi Indonesia* **41** 249-54