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THE EFFECT OF MORINGA LEAVES CONCENTRATION ON THE CHEMICAL PROPERTIES OF MANGO JAM

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ABSTRACT

Mango fruit has perishable food properties, so a technological touch is needed in the form of a preserved product in the form of jam. Jam is an Intermediate Moisture foods (IMF) product that has health benefits if added with ingredients that have active compounds. The purpose of adding compounds or other substances in making jam products is to improve nutritional status and increase compounds that are beneficial for body health in food for health. Moringa is a plant that has the potential to make jam. Moringa has many compounds including vitamins, minerals, glycosides, Fe, flavonoids, phenols, and antioxidants. This research aims to analyze the chemical characteristics of mango jam products which include pH, total acid, vitamin C and antioxidants. The research design used a Completely Randomized Design. The variables used were a pectin concentration of 1% for all treatments and and fresh Moringa leaf concentrations of 8%, 6%, 4% and 2%. The chemical test data obtained were analyzed using variance analysis (ANOVA) with an α test level of 5% and continued with the Duncan test. The data was analyzed using SPSS for Windows version 25. The research results showed the use of Moringa leaves and pectin influences on the quality of mango jam. Moringa leaves can increase the antioxidant status (IC50) of mango jam. The concentration of moringa leaves (8%) could provide optimal IC50 values. These results could be continued for further research on optimizing the use of fresh Moringa leaves to produce jam products to get product standards.

Keywords: *Chemicals properties; Mango jam; Moringa.*

ABSTRAK

Buah mangga mempunyai sifat pangan yang mudah rusak, sehingga diperlukan sentuhan teknologi berupa produk pengawet berupa selai. Selai merupakan produk makanan semi basah (IMF) yang mempunyai manfaat bagi kesehatan jika ditambah dengan bahan lain yang mempunyai senyawa aktif. Tujuan penambahan senyawa atau bahan lain dalam pembuatan produk selai adalah untuk meningkatkan status gizi dan meningkatkan senyawa dalam makanan yang memiliki manfaat bagi kesehatan tubuh. Kelor merupakan tanaman yang berpotensi untuk dijadikan produk selai. Kelor memiliki banyak senyawa antara lain vitamin, mineral, glikosida, Fe (zat besi), flavonoid, fenol, dan antioksidan. Penelitian ini bertujuan untuk menganalisis

karakteristik kimia produk selai mangga yang meliputi pH, total asam, vitamin C dan antioksidan. Rancangan penelitian menggunakan Rancangan Acak Lengkap. Variabel yang digunakan adalah konsentrasi pektin 1% untuk semua treatmen dan konentrasi daun kelor segar sebanyak 8%, 5%, 4% dan 2%. Data uji kimia yang diperoleh dianalisis menggunakan analisis ragam (ANOVA) dengan taraf uji 5% dan dilanjutkan dengan uji Duncan. Data dianalisis menggunakan software SPSS untuk Windows versi 25. Hasil penelitian menunjukkan penggunaan daun kelor dan pektin berpengaruh terhadap kualitas selai mangga. Daun kelor dapat meningkatkan status antioksidan (nilai IC50) selai mangga. Konsentrasi daun kelor (8%) mampu memberikan nilai IC50 optimal. Hasil ini dapat dilanjutkan untuk penelitian lebih lanjut mengenai optimalisasi pemanfaatan daun kelor segar untuk menghasilkan produk selai guna mendapatkan standar produk.

Kata Kunci: Kelor; Selai mangga; Sifat kimia.

INTRODUCTION

Currently the use of fruit is limited to consumption only fresh. If the harvest is abundant, it is only sold at a cheap price because if it is not sold quickly it would easily spoil (Maryani *et al*., 2023). The mango fruit contains nutritional compounds such as 6% protein, 11% fat and 77% carbohydrates as well as 2% crude fiber and 2% ash (Sogi *et al*., 2013). The fruit skin of mango is around 11–18%, the flash is around 60–75% and seeds are 14–22% (Mandey & Mamuaja, 2016). Mango fruit can be used for longer-lasting products, i.e. as a jam (Syafriani *et al*., 2022) which is a semi wet product or an IMF product (Gutema & Tadesse, 2015).

The utilizing of fruit as a jam is an alternative that can be used to extend the shelf life and preserve it when the harvest season arrives. Jam has a long shelf life and can increase added value in agricultural products (Maya & Irfin, 2023). All fruit can be made into jam products (Dorlan & Evy, 2017). In making jam there are no provisions on the type of fruit used, because in making jam there are process stages to produce standard jam products. Among the fruits that are often used as jam is mango, because the fruit has an attractive color, is strong yellow, sweet taste and has good vitamins and minerals (Deeksha & Sunita, 2018).

Jam is a food containing medium water or as a semi-moist food. Jam is made by boiling crushed fruit flesh by adding sugar, pectin, acid and other ingredients such as preservatives, dyes or flavoring to reaches sufficiently thick with a consistent texture (Basu *et al*., 2011). Jam is also high-calorie (Bekele *et al*., 2020). Jam products have good characteristics with attractive organoleptic effects for consumers (Martins *et al*., 2021). Besides, it also has a clear, bright color, chewy like jelly but not too hard. Apart from that, jam also has a distinctive fruit flavor (Chalchisa *et al*., 2022).

In the making of jam, an additional binding agent is needed in the form of pectin.

Pectin is needed in jam as a medium for gel formation (Nurani, 2020). Apart from pectin, sugar plays a prominent role in gel formation. The addition of sugar will affect the water pectin balance, thereby eliminating the appearance of pectin. The ideal amount of pectin for gel formation in jam is around 0.75-1.5%, the specified sugar content is no more than 70% and the pectin concentration is not more than 1.5% because it can produce a bad gel (Sutwal *et al*., 2019). The potential of fruit jam products will increase their nutritional characteristics if the product is added with leaves which have potential health benefits (Dorlan & Evy, 2017). The moringa leaves has a lot of potential for nutritional status and health (Stohs & Hartman, 2015). Moringa plant also contained many phytochemical compounds and nutritional compounds that are important for the human body (Gopalakrishnan *et al*., 2016). Moringa leaves contain phenolic compounds, flavonoids, phenolic acids and glycosides (Vongsak *et al*., 2014). Apart from that, alkaloids, tannins, saponins and isothiocyanates and glucosinolates were also found (Giuberti *et al*., 2021).

The Moringa plant also has compounds that play a role in health benefits, including being used as an anti-diabetic, anti-bacterial, anti-cancer, and as an anti-inflammatory (Kashyap *et al*., 2022), due to their biological activities moringa leaves can be used in making various foods and fortifying the powder, such as in making bread, cakes, pasta or soup (Oyeyinka & Samson, 2018). According to this, it is necessary to apply the use of fruit in food products with the addition of natural ingredients in order to obtain higher quality products for human health. The addition of Moringa leaves, which have a lot of potential for the compounds they contain, is thought to be able to be used to improve the health and product quality of jam. So it's not just mangoes that can be used as jam, but natural ingredients such as Moringa leaves have health potential.

MATERIALS AND METHODS

Materials and Tools

The materials used in the research were ripe and fresh podang mango (*Mangnifera Indica* L.), fresh Moringa leaves, white sugar, water. The chemicals used are NaoH 0.1 N, Pectin ($Na_5P_3O_{10}$), ethanol 96%, PP indicator, 1% starch indicator, I2 standard 0.01 N, DPPH 200 µM. Meanwhile, the tools used are a pH meter (Hanna pHep), burette and stand, Erlenmeyer (Pyrex), measuring cup, 100 mL measuring flask, stop watch, digital scale, spatula, funnel, vortex, spectrophotometer.

Experimental Design

The experimental design used in this study is a completely randomized design (CRD). The first factor used was a pectin concentration of 1% (for all treatments) while the second factor was a moringa (fresh

leaves) concentration of 8%, 6%, 4% and 2%. All the treatments were analyzed such as pH, total acid, total vitamin C and antioxidant activity, with each analysis carried out 3 times. The data obtained were analyzed using SPSS software version 25 for Windows to obtain ANOVA with a confidence level of 95% which was then carried out further tests using the DMRT test or Duncan Test to see differences in the treatments used.

RESULT AND DISCUSSION

Jam is a popular food, at least it can be made with the addition of natural ingredients which have potential for human health. One of them can use Moringa plants or leaves to increase compounds that are good for the health of the human body. The research results in the application of making mango jam with the addition of different concentrations of Moringa leaves are as follows.

pH

pH measurements are intended to see the degree of acidity of the jam product. measurement using a pH meter. The results showed that there are differences in pH value in each treatment carried out. The results of the pH analysis can be seen in Figure 1.

From these data, it is clear that there are differences in the level of acidity (pH) for each treatment. The formulation and concentration of Moringa leaves obtained a pH value 4.03 - 4.84. In a previous study, it was stated that the optimum value for jam acidity was 3.1-3.5 (Santosa *et al.*, 2021).

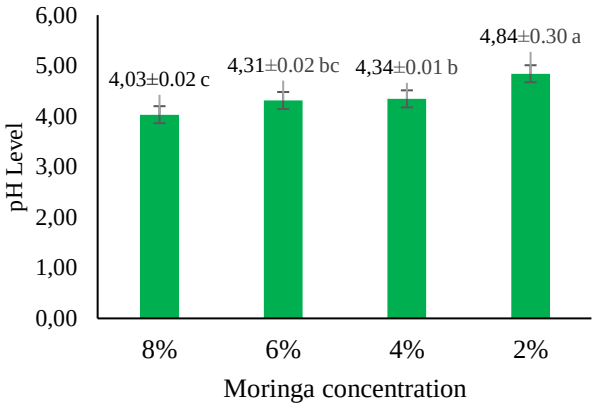

Figure 1. Average of pH

According to the four treatments, the pH in the jam has not aligned with previous research. It occurred due to when the making of mango jam didn't add a certain amount of citric acid which generally has a function as regulator of the acidity of the jam. Thus, this will not have an effect on the pH levels of jam, which generally is sour. The less optimal pH is also caused by the heating given during jam processing. Apart from that, it is also stated that Moringa has a neutral pH between 5.8-6.0 (Irawan & Rahmi, 2023).

Total titrated acid

The total acid content in mango jam has different values for each treatment. The addition of 8% and 6% Moringa leaves had no difference in total acid values. This is very consistent with the addition of 4% and 2% Moringa and does not differ in the total acid value. However, concentrations of 8% and 6% have different values in total acid

compared to concentrations of 4% and 2%. The results of the analysis could be seen Figure 2.

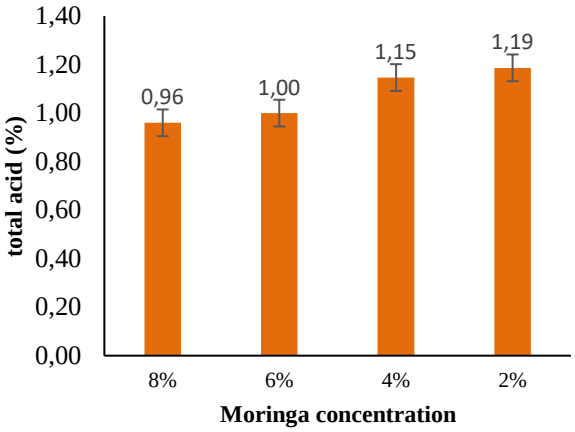

Figure 2. Total acid value

From these data it is clear that the average value of total titrated acid ranges from 0.96% - 1.19%. The acids analyzed in mango jam are all types of acids found in mango jam. These acids are in the form of dissociated acids and acids that cannot be dissociated. The amount of these acids can be determined by the amount of NaOH that reacts with the acids. This increase in total titrated acid is most likely caused by the addition of a certain amount of pectin in making jam.

In a research, it was stated that pectin can bind a number of sugar levels, water and number of dissolved solids (acids), so that the total acid will increase due to the sugar being hydrolyzed into acid compounds (Agustina & Handayani, 2016).

Vitamin C

Fruits generally contain lots of vitamins, such as vitamin C or A. The making of mango jam which is rich in vitamin C. Apart from that, Moringa leaves also contribute to the amount of vitamins in the jam. In other research, it was stated that if fruit is used for food, it could at least increase the total amount of vitamins in the food product (Ratrinia *et al*., 2022).

Determination of vitamin C levels using titration methods. This method is an acid-base titration where a solution with acidic properties is titrated by a base solution (NaOH). The amount of acid in the solution is equal to the amount of base. The following is data on vitamin C levels from research results (Figure 3).

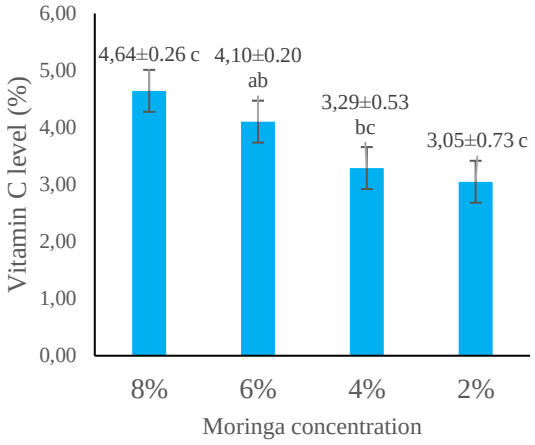

Figure 3. Vitamin C level

From Figure 3, it can be seen that there was an increase in vitamin C levels, along with an increase in the percentage of Moringa leaves used. This increase in vitamin C levels is due to the number of Moringa leaves that are given in each treatment. Moringa leaves contain compounds that play a role in health such as vitamin C, minerals, phenols or flavonoids (Nuapia *et al*., 2020), so that, if the

Moringa leaves are added to the food production process, it would increase the amount of vitamin C in the product, because the vitamin C in Moringa will accumulate with the vitamin C in mangoes, thereby increasing the vitamin C levels in the mango jam.

Antioxidant capacity (IC50)

Antioxidant compounds play a role in warding off free radical compounds which can cause degenerative diseases in humans. The measuring of the capacity or ability of antioxidant compounds using the DPPH method. These results indicate that there are differences in the capacity of antioxidant activity in the jam produced. The results could be seen in Fig 4.

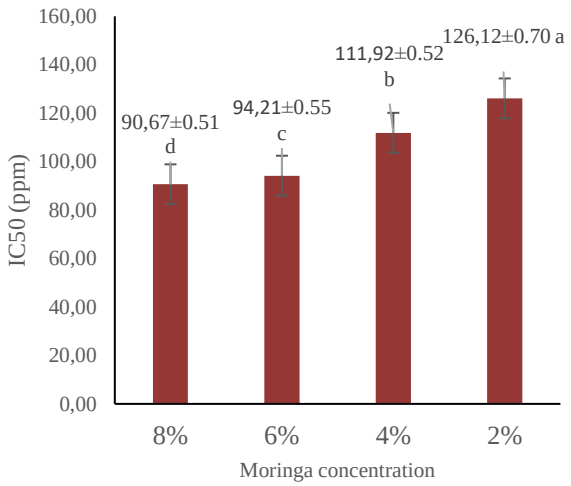

Figure 4. IC50 value

Based on Figure 4, it showed that there are differences in IC50 (inhibition concentration, after it is in the finished product (jam) and analyzed for its antioxidant activity) values for each given concentration of Moringa leaves. The 8% concentration of Moringa leaves shows the lowest IC50 (90.67 ppm), however this antioxidant activity is classified as strong activity. The lower of IC50 (ppm) value will result in stronger antioxidant activity. However, if the IC50 value increases (ppm) this would affect the weakness of the antioxidant. The strength and weakness of the antioxidant also depends on the amount of Moringa.

Moringa leaves contain bioactive compounds that can increase antioxidant status such as phenols, flavonoids, glycosides, vitamins and so on (Prayitno *et al*., 2022). Apart from that, the heat applied during processing also affects the stability of antioxidants (Nuraini & Karyantina, 2019).

CONCLUSIONS AND RECOMMENDATIONS

From the research results, it was concluded that the quality of mango jam was impacted by the addition of pectin and moringa leaves. Mango jam's IC50 value and antioxidant status can be raised by adding moringa leaves. Moringa leaf concentration of 8% is able to provide optimal IC50 values. It is advised to further research on optimizing the use of fresh Moringa leaves to produce jam products that comply with specified product standards. To raise the acid content of the jam, a specific amount of citric acid must be added. For the further research is required to determine the shelf life of jam

products and to analyze data using additional factors that align with the general features of the jam. Apart from that, it is also recommended that a sensory quality analysis be used to determine the level of preference for the jam product using a hedonic test involving panelists.

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