

Antioxidant Potential of Tomato Extract and Moringa Leaf Extract

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ABSTRACT

Tomatoes have bioactive components which are a source of antioxidants that can prevent damage to the body. In addition, Moringa leaves also contain bioactive compounds such as polyphenols, flavonoids, ascorbic acid, and isothiocyanates that can increase the body's immune response and inhibit the activation of carcinogenesis. The content of bioactive compounds contained in tomatoes is lycopene, beta carotene, phenol, vitamin C, flavonoids. Tomatoes are also rich in antioxidants. While Moringa leaves are rich in bioactive compounds and antioxidants. Bioactive compounds found in Moringa leaves are phenols, flavonoids, chlorophyll, saponins, vitamin C. Tomatoes play a role in health by reducing the risk of oxidative stress, cancer, cardiovascular, diabetes, reducing hypertension, a direct modulator of vascular resistance through its action as a vasodilator. Moringa leaves also have the potential as antihyperglycemic, so they can control blood sugar, antibacterial activity, fight colds and flu, increase and facilitate breast milk production, as well as antimalarials and antioxidants.

Keywords: antioxidant, moringa leaves, bioactive compounds, tomato

Introduction

The potential of tomatoes in the Indonesian agricultural sector is very abundant, productivity reaches 46.11 tons/ha (Awaliyah & Rostwentivaivi, 2021). Although tomato production is very abundant, there are various problems at the farmer level such as aspects of cultivation, land (soil), control of HPT (Pests and Diseases), and marketing (Lukmanto & Nirwansjah, 2015). In addition to these problems, tomatoes (*Lycopersicon esculentum* L.) also include perishable horticultural products and their general use is only for consumption or food processing ingredients (Samad, 2012). Tomatoes also have various bioactive components contained in them that can be used as antioxidants (Nisa & Surbakti, 2016). Another plant that is also abundant in Indonesia, namely the Moringa plant which is easy to find both along the road and in the yard of the house, this plant has various benefits because of the antioxidant content. People think that the taste of Moringa leaves tends to be bitter and unpleasant, and people think that Moringa leaves have mystical elements as a remover of implants and witchcraft so that their utilization is very low (Rasyidah & Ismawati, 2016).

Tomatoes contain bioactive components such as lycopene, polyphenols and vitamin C which are antioxidants that can prevent damage to the body which can be used as antioxidants (Nisa & Surbakti, 2016). In addition to tomatoes which have various bioactive components, Moringa leaves also contain bioactive compounds such as polyphenols, flavonoids, ascorbic acid, and isothiocyanates which can increase the body's immune response and inhibit the activation of carcinogenesis (Narya, 2015). Moringa leaves can be used as natural antioxidants with an IC₅₀ value of 97.8 g/mL (Putra et al., 2017). The nutritional components in fresh Moringa leaves will increase in concentration if consumed after the drying and pollination processes are carried out (Rasyidah & Ismawati, 2016).

Based on the explanation, tomatoes and Moringa leaves are known to contain complex compounds, so they have the potential to be used as dietary supplements (Wijayati et al., 2014). Dietary supplements can be used as a complement to nutritional needs in the form of vitamins, minerals, and amino acids (BPOM, 2004). Various bioactive content of tomatoes and Moringa leaves certainly have benefits for the body and the world of health. Lycopene is a carotenoid that is needed by the body and is one of the most powerful antioxidants. Its ability to control free radicals is 100 times more efficient than vitamin E or 12500 times than glutathione. Apart from being anti-skin aging, lycopene also has benefits for preventing cardiovascular disease, diabetes, osteoporosis, infertility, and cancer, especially prostate cancer (Mu'nisa, 2012). In addition to the benefits of lycopene, there are also many studies that state that flavonoids are promising compounds for treating cancer, antioxidants, bacterial pathogens, inflammation, and cardiovascular dysfunction, so they need to be explored and studied further (Arifin & Ibrahim, 2018). Moringa leaves also contain vitamin E (α -tocopherol) of 11,42 mg/100 g. Therefore, the antioxidant potential of tomato and Moringa leaf extracts needs to be explored further to determine the potential of the compounds contained and their health benefits.

Tomato bioactive compounds

Ripe tomatoes contain complex antioxidant compounds in the form of lycopene, beta-carotene, phenol, and vitamin C (Table 1). Lycopene in ripe tomatoes is 30-100 ppm. The lycopene content in tomatoes is affected by temperature. The higher the temperature, the higher the lycopene content. Lycopene is also influenced by the level of fruit maturity. The riper and the redder of tomatoes are high of the lycopene content. Beta carotene in tomatoes is 449 g/100g. Beta carotene is very unstable in the air because it can be oxidized. In addition, it is unstable to light and heat because it can undergo isomerization into the cis form. Beta carotene has high antioxidant activity, so it can reduce the risk of several diseases such as heart disease, stroke, cardiovascular disease, lung cancer, prostate cancer, and breast cancer (Hanson et al., 2004). The phenolic compounds in tomatoes are mostly contained in the skin. Phenol content in tomatoes is 45.70 g/100g (Wati et al., 2016). Phenols in tomatoes act as antioxidants that can prevent damage to DNA. The content of vitamin C in tomatoes is 41.65 mg/g. Vitamin C is sensitive to heat, so the vitamin C content in tomatoes is affected by temperature (Goddess, 2019). The flavonoid content in tomatoes is 0.21% of the weight of the sample tested (Princess, 2019).

Table 1. Tomato bioactive compounds

Bioactive compounds	Amount	Reference
Lycopene	30 -100 ppm	Eveline et al. (2014)
Beta carotene	449 g/100g	Hanson et al. (2004)
Total phenol	45.709 g/100g	Wati et al.(2016)
Vitamin C	41.654 mg/g	Goddess (2019)
Flavonoids	0.21% (w/w)	Princess (2019)

Tomato Antioxidant Content

The antioxidant activity of tomatoes using the DPPH method is 84.28% (250mg/ml), Trolox method 6.84 μ mol/g, IC₅₀ 44.06 ppm, AEAC 1.87 mg/g (Table 2). Antioxidants contained in tomatoes are very large and beneficial for health. Antioxidants are compounds that can counteract or reduce the negative effects of oxidants in the body (Damayanthi et al., 2010). Antioxidants work by donating one electron to compounds that are oxidant so that the activity of these oxidant compounds can be inhibited. The balance of oxidants and antioxidants is very important because it is related to the functioning of the body's immune system. These conditions are primarily to maintain the integrity and functioning of lipid membranes, cell proteins and nucleic acids and to control signal transduction and gene expression in immune cells. according to Wati et al. (2016). The antioxidants contained in ripe tomatoes that are consumed can be a good effort in maintaining and improving the body's defense system.

Table 2. Tomato Antioxidant Content

Method	Antioxidant activity	Reference
DPPH	84.28% (250mg/ml)	Mu'nisa (2012)
Trolox	6.84 μ mol/g	Hanson et al. (2004)
IC ₅₀	44.06 ppm	Wati et al. (2016)
AEAC	1.87 mg/g	Damayanthi et al. (2010)

Moringa Leaf Bioactive Compounds

Moringa leaves contain bioactive compounds, namely total phenols, flavonoids, chlorophyll and saponins (Table 3). The total phenol in Moringa leaves is 170.07 mg/100g. According to Nasicimento et al. (2017), total phenol content is affected by ambient temperature. Moringa leaves will be better if it is at a lower temperature. Flavonoids in Moringa leave as much as 2.7 g/100g. Flavonoids are a group of diphenyl propane or C₆-C₃-C₆ compounds that are not produced by humans. Flavonoids are obtained by consuming fruits and vegetables. The total chlorophyll in Moringa leaves is 12.6 mg/g. According to Ansah et al., (2011), chlorophyll is a green substance found in leaves. The greener the leaves, the higher the chlorophyll content. The amount of saponins in Moringa leaves is 80g/kg. According to Ferreira et al. (2008), saponins are found in plants that are in their infancy. Moringa leaves contain vitamin C as much as 0.87

mg/100g. Vitamin C as a strong antioxidant to ward off free radicals. Vitamin C can cure flu (Sankhyan et al., 2013).

Table 3. Moringa leaf bioactive compounds

Bioactive compounds	Amount	Reference
Total phenol	170.07 mg/100g	Nasicimento et al. (2017)
Flavonoids	2.7 g/100g	Lin et al. (2018)
Chlorophyll	12.6 mg/g	Ansah et al. (2011)
Saponins	80 g/kg	Ferreira et al. (2008)
Vitamin C	0.87 mg/100g	Sankhyan et al. (2013)

Moringa Leaf Antioxidant Content

The antioxidant activity of Moringa leaves using the DPPH method showed 86% (Table 4). According to López et al., (2017) the DPPH method was used to evaluate the antioxidant ability of Moringa leaves to remove free radicals present. The DPPH method is used because it is simple, easy, fast, and sensitive to a small number of samples for antioxidant evaluation. The trolox method showed 5.89 g/ml. Trolox was used as a positive control (Fitriana et al., 2016). The ABTS method showed 11.73 g/ml, the ABTS method was used to measure the antioxidant capacity compared to the trolox method (Fitriana et al., 2016). According to Fitriana et al. (2016), ABTS method has a higher sensitivity than DPPH, ABTS was chosen because it can stabilize free radical compounds by donating proton radicals. The IC₅₀ method shows 57.54 ppm. According to Rizkyanti et al., (2017), IC₅₀ method is used to determine the antioxidant activity of the extract, the smaller the IC₅₀ value, the higher the activity of a material. Active antioxidant strength is indicated by IC₅₀ values of 50-100 ppm, moderate strength is indicated by IC₅₀ values of 101-250 ppm, weak antioxidant strengths are indicated by IC₅₀ values of 250-500 ppm, while inactive antioxidant strengths are those whose values are more than IC₅₀ 500 ppm. The FRAP method showed 0.99 mM Fe²⁺/g antioxidant activity. according to Bing et al. (2019) The FRAP method is used because it is simple and fast to determine antioxidant activity, the method is inexpensive and the tools used are quite simple.

Table 4. The antioxidant content of Moringa leaves

Method	Antioxidant activity	Reference
DPPH	86%	López et al. (2017)
Trolox	5.89 g/ml	Fitriana et al. (2016)
ABTS	11.73 g/ml	Fitriana et al. (2016)
IC ₅₀	57.54 ppm	Rizkyanti et al. (2017)
FRAP	0.99 mM Fe ²⁺ /g	Bing et al. (2019)

Health Potential of Tomato Extract

The health potential of tomato extract can be seen from various compounds (Table 5). Compounds found in tomato extract that have health potential include lycopene, potassium, and potassium. Lycopene is a carotenoid that is needed by the body and is one of the most powerful antioxidants. Its ability to control free radicals is 100 times more efficient than vitamin E or 12500 times than glutathione. Apart from being anti-skin aging, lycopene also has benefits for preventing cardiovascular disease, diabetes, osteoporosis, infertility, and cancer, especially prostate cancer, as well as being able to act as an antioxidant (Mu'nisa, 2012). according to Ghadage et al. (2019) Lycopene can reduce the risk of oxidative stress, overcome cancer, cardiovascular, and diabetes. In addition, lycopene is also able to reduce hypertension (Ried et al., 2009). The potassium content in tomato extract is proven to be a direct modulator of vascular resistance through its action as a vasodilator so that it can control blood pressure (Ramdani et al., 2020).

Table 5. Health potential of tomato extract

Compound	Health Potential	Reference
Lycopene	Reduce the risk of oxidative stress, cancer, cardiovascular, diabetes	Ghadag et al. (2019)
Lycopene	Decrease hypertension	Ried et al. (2009)
Potassium	Decrease hypertension	Ramadhian et al. (2016)
Potassium	Direct modulator of vascular resistance through its action as a vasodilator	Ramdani et al. (2020)
Lycopene	As an antioxidant	Mu'nisa (2012)

Health Potential of Moringa Leaf Extract

The health potential of Moringa leaf extract is very diverse (Table 6). There are several compounds such as isothiocyanate, flavonoids, vitamin C and phytosterols. These compounds have a variety of potential health benefits. The isothiocyanate compound acts as an antihyperglycemic so that it can control blood sugar and is highly recommended for diabetics (Berawi et al., 2019). In addition to isothiocyanate, it also contains flavonoid compounds. These compounds can act as antimalarials, antioxidants, and have antibacterial activity that can be used in the world of health (Veronica et al., 2020; Chaira et al., 2018). Vitamin C in Moringa leaves also has the potential to fight colds and flu (Berawi et al., 2019). Moringa leaf extract also contains phytosterols. Phytosterols can increase and facilitate the production of breast milk in mothers who are breastfeeding so that milk intake can be sufficient (Johan et al., 2019). Apart from the various health potentials that have been conveyed, Moringa leaf extract also has various components of amino acids, fatty acids, beta carotene, minerals, and vitamin E. 6 Moringa oleifera plants are used to overcome nutritional problems, especially in infants and nursing mothers. The leaves contain essential amino acids (Sulistiyorini et al., 1998).

Table 6. Health potential of Moringa leaf extract

Compound	Health Potential	Reference
Isothiocyanate	As an antihyperglycemic, so it can control blood sugar	Berawi et al. (2019)
Flavonoids	Antibacterial activity	Chaira et al. (2018)
Vitamin C	Can be used to fight colds and flu	Berawi et al. (2019)
Phytosterol	Increase and facilitate the production of breast milk	Johan et al. (2019)
Flavonoids	As antimalarial and antioxidant	Veronica et al. (2020)

Conclusion

Tomatoes and Moringa leaves contain complex bioactive compounds and antioxidant components. The content of bioactive compounds contained in tomatoes includes lycopene, beta carotene, phenols, vitamin C, flavonoids. Tomatoes are also rich in antioxidants. While Moringa leaves are also rich in bioactive compounds and antioxidants. The bioactive compounds found in Moringa leaves such as phenols, flavonoids, chlorophyll, saponins, vitamin C. The antioxidant content of Moringa leaves is

very large. Tomatoes and Moringa leaves have the potential as a source of antioxidant intake for the community.

Recommendation

Tomatoes and Moringa leaves are rich in antioxidants and therefore have the potential to be developed into supplements. Vitamin C in tomatoes has a high content but vitamin C is susceptible to damage due to heat, so it is recommended to use low temperatures in processing it. The content of bioactive compounds and antioxidants in tomatoes is influenced by tomato varieties, so it is recommended to use ripe red tomatoes. Moringa leaves are rich in antioxidants and smell bad. To reduce the unpleasant odor in the leaves, before making the extract, it is recommended that the Moringa leaves be blanched first.

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