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To cite this article: S Melia *et al* 2019 *IOP Conf. Ser.: Earth Environ. Sci.* **287** 012028

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The characteristics of the pericarp of *garcinia mangostana* (mangosteen) extract as natural antioxidants in *rendang*

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Abstract. The purpose of this study is to determine the role of pericarp of *Garcinia mangostana* (commonly known as *Mangosteen*) extract as natural antioxidants in *rendang*. The materials used in this study were obtained from *Mangosteen* of Pariaman, West Sumatera, Indonesia. Xanthones were extracted from the pericarp of *Garcinia mangostana* by using ethanol. The *rendang* were made with additional *Mangosteen* extract: 0%, 0.25%, 0.5%, 0.75% and 1%. The data obtained were processed statistically. If treatment showed significant results ($P < 0.05$), it then further tested by using Duncan's Multiple Range Test (DMRT) with SPSS method. Results indicated that pericarp of *Mangosteen* produces the antioxidants. Xanthones content of *Mangosteen* extract was 37.5 mg/100ml. Another component were found: total phenolic content 90 mg gallic acid equivalents (GAE/g dry weight) mg GAE/g, tannins 3.02% and anthocyanins 1.85%. The organoleptic test showed that addition of the extract in *rendang* was not significant ($P > 0.05$) and addition of *mangosteen* extract could extend the storage life of *rendang*.

Keywords – pericarp, *garcinia mangostana* extract, antioxidants, *rendang*.

1. Introduction

The fruit of *Garcinia mangostana* L Rind, also known as the 'queen of tropical fruits', has been used for hundreds of years around the world, mostly in Southeast Asia as medicine. Over the past decades, it was shown that *G. mangostana* (commonly called *Mangosteen*) contains of xanthones, a class of polyphenolic compounds [1].

Various kinds of xanthones in *Mangosteen* had been proven to have strong antioxidant activity including alpha mangostin [2], [3]. Besides containing antioxidant activities, *Mangosteen* has anti-inflammatory, anti-allergy, antibacterial, antiviral and antifungal activities [4], [5]. According to [6], antioxidant activity of *G. mangostana* rind can be extracted with 50% ethanol, which concentration is IC₅₀ wa 5.94 µg/ml.

Rendang is one of the famous traditional food from Indonesia which has unique characteristic in ingredients and its processing. It is made of beef and coconut milk as the main ingredients; it is the reason of *Rendang* contains high percentage of fat. Those ingredients tend to flaw during the storing which lead to the alteration in favor; the taste will be rancid due to fats oxidized. The breakage process on fat will recall the free radical which is dangerous if the contamination is consumed in large amount. Free radical tends to cause severe illness, but it can be avoided by adding antioxidant to the food. Lipid oxidation due to radical reactions is one of the major problem. The antioxidant systems have evolved for protection, and are generally a prerequisite for the survival of aerobic organisms.

The antioxidants are defined as any substance that present in low concentrations compare to those of an oxidisable substance which significantly delay or prevent oxidation of the substrate. The



antioxidants present in all plants and all parts of the plant. A natural antioxidant which can be used as a treatment is xanthones from the pericarp of Mangosteen.

1.1. The purpose of the research

The research purpose is to determine the characteristics of pericarp of *Garcinia mangostana* (*Mangosteen*) extract as natural antioxidants in rendang.

2. Materials and methods

2.1. Material of the research

The material used in this research was beef which was sold in *abattoir*, *Garcinia mangostana* (*Mangosteen*) from Pariaman Distric. The chemical compound used to analyze the proximate was taken from the Laboratory of the Husbandry Production Technology Department, Faculty of Husbandry, Andalas University. They included etil asetat, ethanol, folin-ciocalteu (Sigma chemical Co., St., Lois, Mo., U.S.A.), DPPH/ 2,2-diphenyl-1-picrylhydrazil or 1,1-diphenyl-2-picrylhydrazitl (Merck), NaOH 0,1 N, and gallic acid. The instrumentations used during the research were spectrophotometer UV-Vis 1800, shimadzdu/UFLC, filter paper Whatman, *water bath* and rotary evaporator

2.2. Mangoteen extract [7]

Mangosteen extraction by maceration using 96 % ethanol solvent. The macerates evaporated with a rotary evaporator.

2.3. Rendang processing [8]

Preparing the formulation of ingredients: 1 kg beef, 3 mature coconuts, 150 gr red chili, 65 gr of red onion, 35 gr of garlic, 20 gr of galangal, 20 gr of ginger, 5 gr of turmeric, 4 pieces bay leaf, 2 pieces turmeric leaf, lemongrass and salt. Beef was cut into 2 x 4 x 5 cm dimension and put into the boiled mixture of coconut milk and the spices. The cooking process took around 3 hours. Then, catechin was added after the meat curry became oily; and the treatment was done randomly. It needs to be heated until the curry becomes brownish. The rendang sample is ready to be observed based on its observation variable.

This experimental research was applying randomized complete block design (RCBD) with 5 treatments and 4 repetitions. Rendang was made with *Mangosteen* extract with levels ranging between 0%, 0.25%, 0.5%, 0.75% and 1%. The data obtained were processed statistically, if treatment showed significant results ($P < 0.05$) then it was further tested by using Duncan's Multiple Range Test (DMRT) with SPSS method.

2.4. Analysis

- Compounds of pericarp of Mangosteen extract
 1. Xanthone [9]
 2. Antosianin[9]
 3. Tannin [9]
 4. Antioxidant activity/ DPPH assay[10]
 5. Total Phenol [11]
- Organoleptic test [12]
- Shelf life

3. Result and Discussion

3.1. Compounds of pericarp of mangosteen extract

Mangosteen fruit (*Garcinia mangostana* L Rind), also called queen of fruit (fruit queen), because its skin is blackish-red, white meat and sweet as well as its superior compounds are xanthones as the substance of natural chemistry, class of polyphenolic secondary metabolites [13].

Mangosteen benefits health because of the xanthones content as antioxidant, anti-inflammatory and antimicrobial. Antioxidant properties are vitamin E and vitamin C xanthone and its derivatives containing compounds: 3 - isomangoestein, Alpha - mangostin, Gama - mangostin, Garcinone A, Garcinone B, C, D and E garcinone, Macrulin and Mangostenol [3]. The compounds of *Mangosteen* extract can be seen in Table 1.

Table 1. The compounds of mangosteen extract.

Compounds	Quantity	Unit
Alfa-mangostin (Xanthonnes)	37.5	mg/100g
Anthocyanin	1.85	mg/100g
Tannin	3.20	%
Antioxidant activity (IC ₅₀)	210.45	µg/ml
Total Phenolic	90	mgGAE/g

The pericarp of *Mangosteen* extract contained alpha - mangostin 0.59 mg/g, anthocyanin 1.13 mg/g, the phenolic content of 8.49 mg/g and the antioxidant capacity of 19.72 mg/g [14]. While the results of the study indicates that the value of alpha - mangostin is quite high at 37.5 mg/g and anthocyanin content of 1.85 %.

The antioxidant activity was measured by using the method of DPPH free radical scavenging (2,2 - diphenyl - 1 - picrylhydrazil). [6] reported that the antioxidant activity (IC₅₀) of extract from peel of mangosteen was 0.023 µg/ml, which was less than the IC₅₀ found in this experiment (210 µg/ml). This implies that different extraction methods could effect on the activity. The antioxidant activity was correlated with phenolic content in extracts [15].

Figure 1, showed the linier regression curves of concentration of mangosteen extract plotted against percent inhibition of DPPH ($y = 0.152x + 17.80$). Furthermore, it was compared to a standard curve of ascorbic acid in order to obtain the value of DPPH with IC₅₀ was 210.45µg / ml.

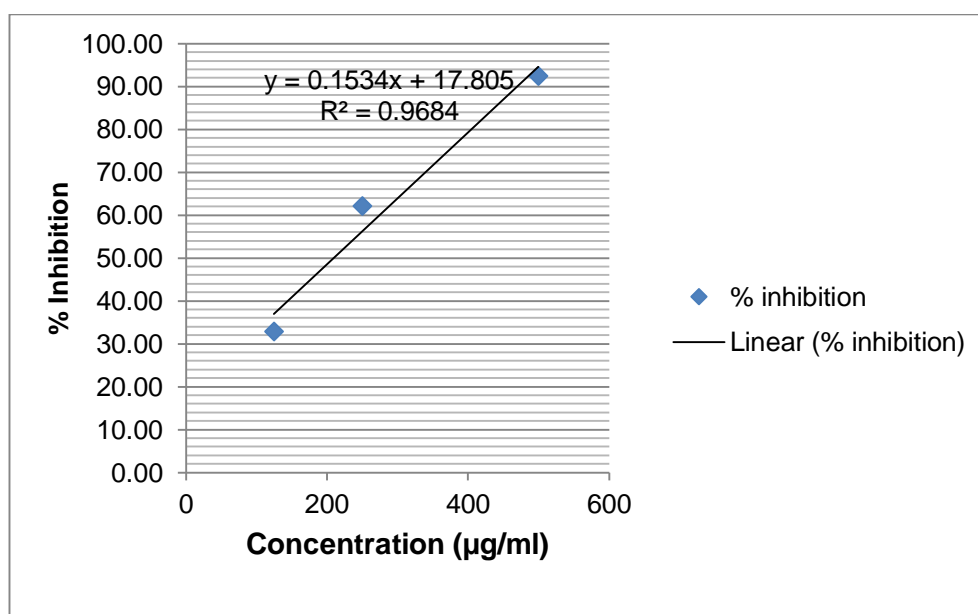


Figure 1. Percent inhibition of DPPH against *Mangosteen* extract

Xanthonnes compounds were extracted by using ethanol. It was consistent with the research [10], the results from the antioxidant activity of Mangosteen extract extracted with ethanol has the greatest activity. In Table 2, it shows the results of phytochemicals in Gambir extract containing flavonoids,

phenolic and saponin. While the Mangosteen extract contained flavonoids, phenolics, saponins, alkaloids and steroids.

Table 2. The phytochemicals in pericarp of *Mangosteen* extracts.

Compounds	<i>Mangosteen</i> extract
Flavonoid	(+)
Phenolice	(+)
Saponin	(+)
Alkaloid	(+)
Steroid	(+)

One of the most well-known groups of antioxidant compounds is the phenolic. Phenolics and polyphenolics can provide relief from certain physical ailments and degenerative disease in human (reduction cardiovascular disiasse and cancer) [16]. Some research has shown that the sources of phenolics (fruits, vegetables, grains) can lead to the increasing quantity of antioxidants in human body [16].

Flavonoids are one of the common and widely distributed group of phenolic compounds in plant, which can be closed as flavons, flavonols and anthocyanidins). Tannins (Phenolic Polymer) has capacity to bind proteins in the transformation of animal hides to leather. Tannins can be subdivided into two classes: hydrolysable and condensed tannins [16].

3.2. Organoleptic test

Based on the results of the research shows that adding the pericarp of Mangosteen extract at several levels presented the organoleptic test of rendang. For more details, the scores of each treatment can be seen in Table 3.

Table 3. the average score of taste and flavor's rendang with the addition of the pericarp of *mangosteen* extract.

Treatment	Taste	Flavor
A	3.75±0.99	3.60±1.25
B	3.50±0.94	3.40±1.19
C	3.50±0.83	3.50±1.10
D	4.10±1.04	3.65±0.72
E	3.75±0.83	3.80±0.97

From Table 3, it can be seen that the average score of taste rendang with the addition of the pericarp of Mangosteen extract ranging from 3.50 to 4.10. In this case, the level of preference for the rendang with the addition of pericarp of Mangosteen extract until 1.00 % level is really like. Results of analysis of variance shows that the treatment effect is not significant ($P > 0.05$) to the value of rendang taste with the addition of Mangosteen extract. The addition of mangosteen extract at rendang is not significant ($P > 0.05$) to the value rendang aroma. It causes the rendang with the mangosteen extract did not produce a distinctive aroma. So it does not affect the rendang's flavor. From Table 3, it shows that the score of rendang's flavor from 3.40 to 3.80.

3.3. Shelf life

Table 4. shows that rendang containing the Mangosteen extract (1%) has a storage life of 12.50 days, longer than the rendang without the addition of Mangosteen extract (6.75 days). It was because the mangosteen extract contains chemical compounds called polyphenols which fuction as antioxidants. In accordance with the results of research conducted that xanthoness Mangosteen extract

contains 37.5 mg / 100ml, antioxidants activity (210.45 µg/ml). Another components were analysed was polyphenol 58.28 mg GAE/g, tannins 3.02% and anthocyanins 1.85%.

Table 4. Shelf-life rendang with addition gambir extract.

Treatment	Self-life (Days)
A	6.75 ± 0.50 ^a
B	12.00 ± 0.00 ^b
C	12.00 ± 0.00 ^b
D	12.25 ± 0.50 ^b
E	12.25 ± 0.57 ^b

The important application of antioxidant was their inclusion in food products as preservatives storage-life and to maintain quality of food. Antioxidant in food depends on many factors, such as: the antioxidant location in food, interactions with other food constituents and condition of environment (pH, ionic strength, hydrophilic and lipophilic balance) [17]. In the previous research, [18] rendang with addition of gambir extract (1%), could extend the storage-life until 18 days.

4. Conclusions

The results indicate that the pericarp of *Mangosteen* provides antioxidants (11.70 % inhibition). Xanthone content of *Mangosteen* extract was 37.5 mg/100ml. Another components analysed were polyphenol 58.28 mg GAE/g, tannins 3.02% and anthocyanins 1.85%. The organoleptic test shows that addition of the extract in rendang was not significant ($P > 0.05$) and addition of *mangosteen* extract could expand the storage life of rendang.

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Acknowledgements

The financial support from Direktorat Jenderal Pendidikan Tinggi Kementerian Pendidikan dan Kebudayaan, Research Grant Implementation Agreement Number: 030/SP2H/PL/DIT.LITABMAS/II/2015, Date February 15, 2015 was greatly appreciated.