Antioxidant Acitivity in Various Processed Products of Inferior Local Tubers (Dioscorea sp. L.)

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Antioxidant Acitivity in Various Processed Products of Inferior Local Tubers (*Dioscorea* sp. L.)

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Abstract
Inferior local tubers such as lesser yam, wild yam and arrowroot contain bioactive compounds such as phenols and diosgenin which act as antioxidants. Antioxidant activities in the processed of local tubers have not been reported. The aim of this research was to identify the antioxidant activity of local tubers (inferior) that has been processed through the process of steaming, frying and milling to be flour. The determination of antioxidant activity was performed using α, α, Diphenyl Picryl Hydrazil (DPPH), which is indicated as a percentage of the apprehension of radical activities by the amount of absorbance at 680 nm. The antioxidant activity of lesser yam steamed, fried and milled were 2.26 %, 0.84 %, and 3.34 % respectively. The antioxidant activity of steamed, fried and milled arrowroot were 1.44 %, 0.65 %, and 1.32 % respectively. Moreover, the antioxidant activity of steamed, fried and milled wild yam were 1.08 %, 0.08 %, and 0.82 % respectively. The antioxidant activity of inferior local tubers have decreased in different types of processing. The highest antioxidant activity was in the milled tubers followed by steamed and fried tuber.

Keywords: antioxidant activity; an inferior local tuber; DPPH method.

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1. Introduction

Oxidative stress is a condition when the free radical compound production or free radical compound is bigger than the amount of antioxidant in the body. Oxidative stress causes the increase of lipid peroxidation. The increase of lipid peroxide concentration in lever can damage liver cell so that peroxide will come out from liver toward blood vessel and can damage organs or other tissues, finally it causes degenerative diseases such as atherosclerosis, coronary heart disease, hypertension and diabetes mellitus, and cancer [1, 2].

Lipid peroxide can be controlled or reduced by antioxidant. If antioxidant in the body (endogenous) decreases because it is used to neutralize free radical, then antioxidant from diet (exogenous) is needed. Antioxidant from the outside can be fruits and vegetables or other food materials which contain antioxidant, known as exogenous

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antioxidant. A lot of researches and studies about antioxidant have been conducted such as antioxidant compound content in seaweed [3–5], tomato's lycopene [6], antioxidant in red fruit [7].

Lesser yam, wild yam, greater yam, arrowroot, and purple yam are Indonesian local inferior tubers which contain high carbohydrate and spread widely in Indonesia, but the usages are still limited. Beside their high carbohydrate, the five tubers contain bioactive compounds such as dioscorin, diosgenin, and phenol that can be antioxidant [8].

Researches and studies about antioxidant still need to be conducted due to the great benefits for health. Many local tubers such as sweet potato, lesser yam, wild yam, and arrowroot contain bioactive compound anthocyanin antioxidant, dioscorin, diosgenin, and phenol [9, 10]. As one of the way to optimize the usage of Indonesian nature material as well as to increase society's health level, then a research needs to be conducted to explore bioactive compound that has physiological characteristics that benefit for health.

The result of research by Yuniastuti et al. [11] showed that cultivation of local tubers in Gunungpati had antioxidant content which was high enough. But, the measured antioxidants were from unprocessed tubers. Therefore, this research was conducted to find out and examine the number or amount of antioxidants from fried, steamed tubers or flour tubers. The problems which will be examined in this research are identifying antioxidant compound in local tubers especially those which are cultivated in Gunungpati, Semarang, that are processed including their flours.

2. Material and method

Materials used in this research were lesser yam, arrowroot, and intoxicating yam. While materials used for extracting the antioxidant were ethanol, 0.1 mM DPPH solution, 10 % Folin-Ciocalteu reagent, 10 % sodium carbonate, and aquadest. Types of equipment used in this research were cabinet dryer, sieve 40 mesh, blender, baker glass, magnetic stirrer, strain paper whatman number 2, funnel, frying and steaming tools, aluminium foil, analytic scale, measuring glass, Erlenmeyer, evaporator, petri cup, dark bottle, refrigerator, reaction tubes, vortex, propipette, measuring pipet, measuring glass, centrifuge incubator, and spectrophotometer.

2.1. Sample preparation

This research process began with the making of products from lesser yam, arrowroot, and intoxicating yam - variation of processing to be fried, steamed, and made into flours. First, lesser yam, arrowroot, and intoxicating yam flours were peeled, then peeled tubers were washed before they were sliced in 12 mm, next sliced tubers were smeared on salt evenly. This smearing process was done for about 24 h. Next, sliced tubers were washed until clean, then they were submerged in a plastic container consisting of water for about 72 h. After that, they were dried in an automatic drying cabinet with 55 °C for 12 h until they became chips of dried tubers. Dried chips were grinded by a blender until smooth. Finally, tubers powders were sieved by a sieve 80 mesh and the tubers flours could be obtained.

2.2. Antioxidant extraction

The amount of 25 g sample was added by ethanol with the comparison 1:5 and stirred by magnetic stirrer for 15 min. After that it was strained by stain paper Whatman number 2 to get filtrate. The filtrate was vaporized by rotary evaporator for 30 min and 40 °C until semi solid extract was obtained, then it was measured. The semi solid extract was then reconstituted in the ethanol at 1 000 mg $\cdot$ L^{-1} concentration

2.3. Antioxidant activity measurement by DPPH method

Antioxidant activity measurement test of sweet potato in DPPH system was carried out using DPPH (a,a, DiphenylPicrylhydrazil) radical scavenging method [12]. The amount of 1 mL of phenol extract sample with variation of concentration 100 rpm, 200 pm, and 500 rpm (1 rpm = 1/60 Hz) added by 4 mL of 0.1 mM DPPH solution and they were made to be vortex. After that absorbency measurement was done every 2 min for 30 min so that decreasing absorbency data was gained. In control treatment, it was done with the same way but only the sample that was changed by ethanol 99.5 % and for comparing sample was changed by BHA 100 mg $\cdot$ L^{-1} and routines 100 mg $\cdot$ L^{-1}. Catching activity percentage (ARA) radical DPPH* was counted by using the Formula (1):

$$\%\text{ARA} = \frac{\text{control absorbency} - \text{sample absorbency}}{\text{control absorbency}} \times 100\% \qquad (1)$$

3. Result and Discussion

The average of antioxidant activity in lesser yam product which was steamed, fried, and made into floured were 2.26 %, 0.84 %, and 3.34 %, while arrow root 1.44 %, 0.65 %, and 1.62 % and wild yam (*Dioscorea hispida* Dennst) 1.08 %, 0.08 %, and 1.82 % (Table 1).

The highest antioxidant activity of lesser yam, arrowroot, and intoxicating yam products was their flour. The result of variance investigation of lesser yam, arrowroot, and

Tubers	Steam (%)	Fried (%)	Floured (%)	p-value
Lesser yam	2.26	0.84	3.34	0.021
Arrow root	1.44	0.65	1.62	
Wild yam	1.08	0.08	1.82	

Table 1: The Antioxidant Activity of tubers.

intoxicating yam products antioxidant activity showed that the kinds of lesser yam, arrowroot, and intoxicating yam products had significant influence ($p \leq 0.05$) toward antioxidant activity of the products. Based on LSD (Least Significance Different) test shows that lesser yam product processed into flour was significantly different from antioxidant activity of arrow root, and intoxicating yam products.

The influence of processing lesser yam, arrowroot, and intoxicating yam products toward antioxidant activity can be seen in Table 1. The highest antioxidant activity of lesser yam product was when it was made into flour, followed by steamed lesser yam and the last was fried lesser yam. Such was the case of arrowroot and intoxicating yam, antioxidant activity of arrowroot and intoxicating yam products made into flour which was the higher than steamed and fried products. The difference in this antioxidant activity was caused by heat and also size of the materials.

Antioxidant activity in fried products, which were lesser yam (0.84 %), arrowroot (0.65 %), and wild yam (0.08 %) were lower than steamed products. This was caused by the heating time in frying process which was shorter than steaming process. The best heating process to prevent antioxidant damage and other flavonoids compounds was processed by using high temperature, but shorter time. This was because antioxidant components were not heatproof.

This research was different from the one conducted by Karen [13] which stated that frying process could increase antioxidant activity on materials as a result of oil absorption inside the materials. Antioxidant could be from carotene compound, or other antioxidants which were used as added materials to oil such as hydroxyl toluene (BHT). Barry [14] stated that BHT had well solution in oil and heatproof.

While according to Pokorny et al. [15] antioxidant activity in lesser yam, arrowroot, and wild yam products through frying process was lower than steamed process. This was because in the frying process, there was antioxidant exchange (in this case was phenolic) between oil and fried food. Antioxidant in frying food will be dissolved in the oil. Fried food stability will be decreased rapidly in storage because it lost its antioxidant compound.

Shobana and Naidu [16], who conducted a research to inactivate antioxidant to herbs and stated that antioxidant activity was getting lower after being heated for 30 min. The heating which was too long might cause the decreasing of compound's skills that were used to catch free radical.

4. Conclusion

In the process of decreasing antioxidant of lesser yam, arrowroot, and intoxicating yam in those three tubers, the decreasing level of antioxidant activity as a result of different processes showed the same tendency. The most effective method to keep the antioxidant content was to change tubers into flour. The antioxidant activity of local inferior tubers had decreased in different processes. The highest antioxidant activity was achieved by making tubers into flour, then it decreased in tubers that were steamed, and fried.

References

[1] Fang YZ, Yang S, Wu G. Free aadicals, antioxidants, and nutrition, Nutrition 2002;18:872–879.

[2] Furukawa S, Fujita T, Shimabukuro M, Iwaki M, Yamada Y, Nakajima Y, et al. Increased oxidative stress in obesity and its impact on metabolic syndrome. Journal of Clinical Investigation 2004; 114(12):1752–1761.

[3] Olsen EK, Espen H, Johan I, Jeanette HA. Cellular antioxidant effect of four bromophenols from the Red Algae, *Vertebrata lanosa*. Marine Drugs 2013;11:2769–2784.

[4] Namvar F, Rosfarizan M, Javad B, Zafar-Balanejad S, Fahimeh F, Heshu SR. Antioxidant, antiproliferative, and antiangiogenesis effects of polyphenol-rich seaweed (*Sargassum muticum*). BioMed Research International. 2013; 2013:604787. p 9.

[5] Fiedor J, Burda K. Potential role of carotenoids as antioxidants in human health and disease. Nutrients 2014;6:466–488.

[6] Eveline, Tagor MS, Sanny. Studi aktivitas antioksidan pada tomat (*Lycopersicon esculentum*) konvensional dan organik selama penyimpanan. [Study of antioxidant activity of conventional and organic tomato (*Lycopersicon esculentum*) during the storage process] Prosiding SNST ke-5 Tahun 2014. Fakultas Teknik Universitas Wahid Hasyim Semarang; 2014, p 22–28 [in Bahasa Indonesia].

[7] Tjahjani S, Khiong K. 2010. Potensi buah merah sebagai antioksidan dalam mengatasi malaria berghei pada mencit strain Balb/C [Potency of red fruit as an antioxidant in overcoming malaria berghei in Balb/C mice]. Majalah Kedokteran Indonesia 2010;60(12):1–10. [in Bahasa Indonesia].

[8] Shajeela PS, Mohan VR, Jesudas LL, Soris PT. Nutritional and antinutritional evaluation of Wild Yam (*Dioscorea* spp.). Tropical and Subtropical Agroecosystems 2011;14:723–730.

[9] Mar'atirrosyidah R, Teti E. Aktivitas antioksidan senyawa bioaktif umbi lokal inferior [Antioxidant Activity and Bioactive Compound of Inferior Local Tuber]. Jurnal Pangan dan Agroindustri 2015;3(2):594–601. [in Bahasa Indonesia].

[10] Therasin S, Baker AT. Analysis and identification of phenolic compounds in *Dioscorea hispida* Dennst. Asian Journal of Food and Agro-industry 2009;2(4):547–560.

[11] Yuniastuti A, Iswari RS, Wijayanti N. Pengembangan pangan fungsional berbasis umbi-umbian sebagai sumber antioksidan dalam upaya meningkatkan derajat kesehatan masyarakat melalui pendekatan nutrigenomik [Development of functional food with tubers as source of antioxidant in an effort to improve the community health status through nutrigenomic approach]. Laporan Penelitian. Lembaga Penelitian dan Pengabdian Kepada Masyarakat. Universitas Negeri Semarang; 2015. [in Bahasa Indonesia].

[12] Islam MS, Yoshimoto M, Ishigure K, Okuno S, Yamakawa O. Effect of artificial shading and temperature on radical scavenging activity and polyphenolic composition in sweet potato (*Ipomoea batatas* L.) leaves. Journal of the American Society Horticultural Science 2003: 128:182–187.

[13] Ronald LP Xianli Wu, Karen S. Standradized methods for the determination of antioxidant capacity and phenolic in foods and dietary supplements, Journal of Agricultural and Food Chemistry, 2005, 53(10):4290–4302.

[14] Barry H, John MCG. Free radicals in biology and medicine. Oxford University Press. 2007. p. 543

[15] Pokornyn J, Yanishleva N, Gordon M. Antioxidant in food. Woodhead Publishing Ltd. England. 2001. p. 400

[16] Shobana S, Naidu KA. Antioxidant activity of selected Indian spices. Prostaglandins Leukot Essent Fatty Acids 2000:62:107–110.

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