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Nutrition Content and Antioxidant Activity of Black Garlic

Ni Nyoman Astika Dewi [a], **I Wayan Mustika** [b]

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Correspondence Author [a]

Keywords

Antioxidant activity;
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Sallycysteine;

Abstract

Black garlic is a garlic that has been naturally processed at a certain temperature in a long time. Therefore, the new chemical content and formulations are produced. Black Garlic has stronger antibacterial properties, as well as antioxidants two times higher than regular garlic due to it consists of Sallycysteine. The longer black garlic fermentation of Sallycysteine content increases. The study was intended to identify the nutritional content and antioxidant activity found on black garlic based on fermentation time. The research type used was an analytical observation with complete randomized design included making, observing, and analyzing nutrient content (carbohydrate, protein, and fat) and antioxidant activity on black garlic based on fermentation length. The research sample was black garlic fermented at 70^0C. The experiment was carried out by different treatment of fermentation length was 30 days, 40 days, 60 days, and 90 days. The results showed that nutrient content and antioxidant activity of black garlic during the fermentation process tended to increase. The highest protein content was found on 60 fermented black garlic (7.52% bb). The highest fat content was found in 90 fermented black garlic (5.4% bb). The highest carbohydrate content was found on 90 fermented black garlic (45,476% bb). The black garlic antioxidants activity during fermentation process tends to increase. The highest antioxidant activity was found on 90 fermented black garlic based on GAEAC value (658.9 mg/L), total phenol (140.3 mg GAE/g), and IC value 50% (134.6 ppm). Based on the results of the present study, it is very good for consuming a black garlic.

[a] Department of Nursing, Polytechnic of Health Denpasar, Indonesia
[b] Department of Nursing, Polytechnic of Health Denpasar, Indonesia

Contents

1. Introduction

Black garlic is known from South Korea. Black garlic is used as an herbal body supplement that has greater antioxidant power. Its basic garlic form is added to energy enhancer drinks. In the Taoist legend, black garlic are believed to have benefits for eternal life. Indeed, no one can guarantee that black garlic can provide eternal life. However, it can be ascertained, if the black garlic benefits two times greater than garlic. In Thailand, black magic is renowned for its age enhancement and is uniquely applied in the chocolate made (Anonim, 2013).

Black garlic is garlic that has been processed naturally at a certain temperature for a long time. The new chemical content and formulations are produced. The new pharmacological effect that makes black garlic as one of the most herbal ingredients in need as a supplement to maintain health, stamina, and vitality body. Black garlic is garlic fermented garlic which is widely used as foodstuff. This garlic is made by fermenting garlic at high temperature (but not burnt) for 40 days to 90 days. The process causes the garlic is to change color to black. Then, to ensure the quality, the garlic is cooled and dried for one week. Soft textures and unique flavors make this garlic a great choice to add to the cuisine delicacy. In addition to black garlic cuisine also has properties for our bodies (Abusufyan, 2012).

Black garlic has stronger antibacterial properties, as well as antioxidants two times higher than regular garlic. Due to it consists of S-allyl cysteine (Anonymous, 2013). According to Bae (2014), stated that the longer time of black garlic fermentation the Sallycysteine (SAC) content is increasing. Regarding the presence of the higher antibacterial compounds than garlic is expected to be more effective to overcome prokaryotic pathogenic causes of disease. Whereas, the time length of fermentation for antioxidant activity has not been published. Several black garlic research results have shown the effect on the antibacterial effectiveness on Escheria Coli, the amino acid content of garlic, black garlic extract have an effect on anti-fungi activity, and garlic extract influences immune system. The purpose of the present study is to identify the nutritional content and antioxidant activity of black garlic based on fermentation time.

2. Research Method

The research is an analytical observation with the complete randomized design. The study used black garlic sample with a long treatment of fermentation using temperature 70^0C with different time included 30 days, 40 days, 60 days, and 90 days. Then, in the nutrient analysis (carbohydrate, proteins, polyphenols, and antioxidant activity). The research is conducted at Unit of Laboratory Service of Udayana University, Faculty of Agricultural Technology, Jalan P.B. Sudirman, Denpasar which is held from June to October 2016.

3. Results and Analysis

The characteristics of research sample can be presented as follows:

Table 1
Characteristics of Research Sample

Treatment	Aroma	Taste	Texture	Color
P1	The typical sting of raw garlic	bitter, typical garlic	Mushy	Brownish white
P2	The typical garlic sting	bitter, typical garlic	Mushy	Light brown

P3	The typical garlic sting	bitter, typical garlic	Mushy	Dark brown
P4	The typical stinging of garlic is overcooked	Savory and slightly sweet	Mushy	Black

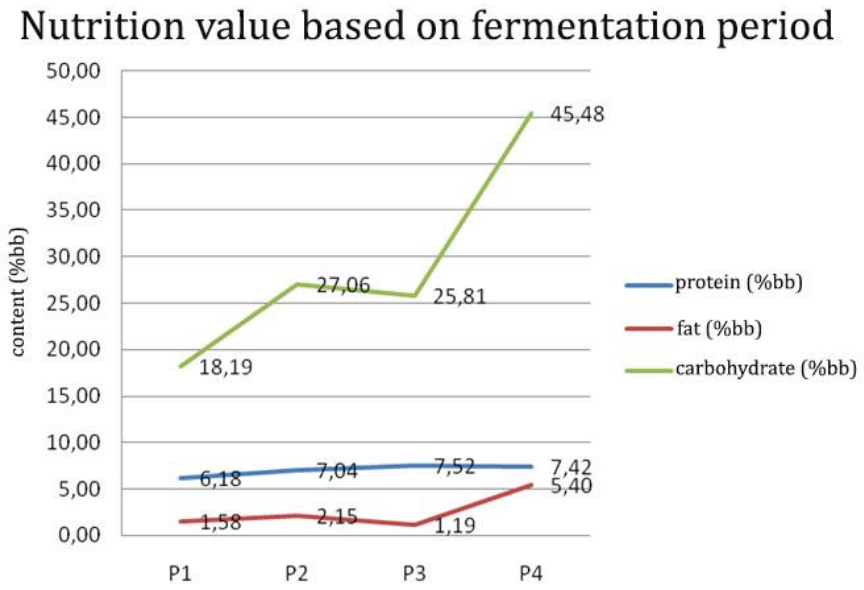
Nutritional Analysis Results

Determination of nutrients levels in the sample is conducted with the protein, fat, and carbohydrate content calculation. The sample extraction is done by maceration using 70% ethanol solvent. 70% ethanol is known to extract optimally. Ethanol is one suitable solvent for isolating polar organic compounds and having a polarity close to methanol. This study is conducted using ethanol solvent because in addition to polarity approaching methanol. Ethanol is also relatively non-toxic. The results of laboratory analysis obtained nutritional value in each treatment as follows:

Table 2
The results of sample values analysis based on fermentation time

Treatment	Water Content (%bb)	Ash Content (%bb)	Protein (%bb)	Fat (%bb)	Carbohydrate (%bb)
P1	62,2508	1,78	6,18	1,58	18,192
P2	62,0847	1,65	7,04	2,15	27,056
P3	63,5417	1,93	7,52	1,19	25,808
P4	38,9771	2,72	7,42	5,4	45,476

Based on the above table, it can be illustrated in different nutrition value based on fermentation period (protein, fat, and carbohydrate contents). The samples unlike in the following graph:



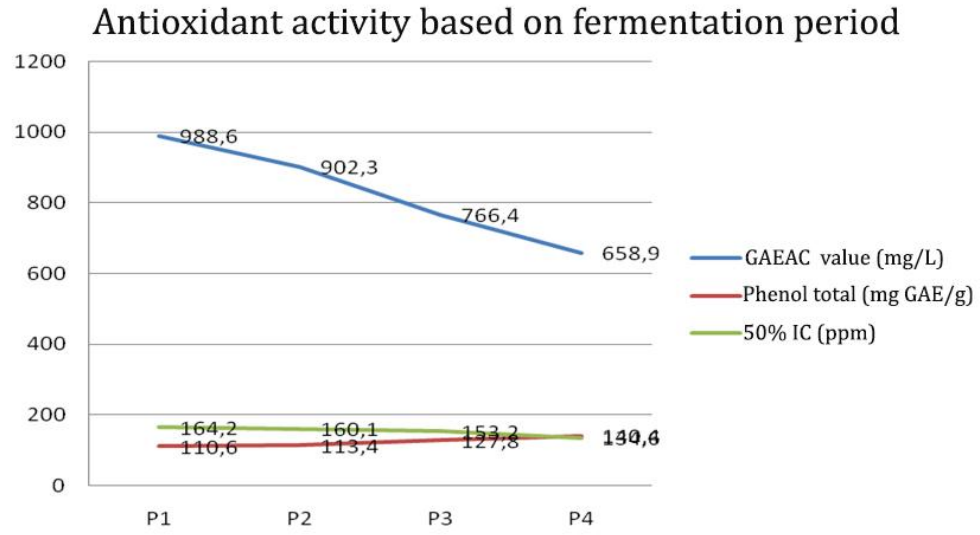
Antioxidant activity

The results of laboratory analysis on antioxidant activity are presented in the following table:

Table 3
The sample analysis results of antioxidant activity on fermentation period

Treatment	GAEAC value (mg/L)	Phenol Total (mg GAE/g)	IC 50% (ppm)
P1	988,6	110,6	164,2
P2	902,3	113,4	160,1
P3	766,4	127,8	153,2
P4	658,9	140,4	134,6

Based on the above table can be seen the antioxidant activity based on fermentation period the sample unlike the following graph:



Analysis

a) Protein contents

Based on the results of laboratory analysis is obtained there is an increase in protein content from raw garlic to black garlic. The highest protein content is found in 60 days fermentation treatment. At the beginning of fermentation, there is an increase in protein contents until the fermentation on the 60th day. Then, there is a decrease in protein contents in fermentation on the 90th day. This is due to the fermentation process can increase the nutrients in the food through biosynthesis of vitamins, essential amino acids and proteins by improving the quality of protein and digestion. In addition, fermentation can also increase the availability of micronutrients and help degrade the antinutritional factor (Achinewhu et al., 1998). The increase in protein content is due to the loss of dry matter during fermentation. In addition, increased protein contents are also caused by increased protein synthesis by fermentation. Subsequently, there is a decrease in protein content in the fourth treatment of fermented garlic, because on the 90th day there is a breakdown of protein into amino acids and short chain peptides. The proteolytic microorganisms grown during the fermentation process can degrade the protein into dipeptide and subsequently become the lost NH3 and NH2 compounds through evaporation. This is in accordance with the research results by Andarti and Wardani (2015), stated that during the process of fermentation miso protein contents decreased.

b) Fat contents

Based on the results of laboratory analysis obtained that fat content tends to increase during fermentation. The highest fat content is in the fourth treatment black garlic (fermentation 90 days). This occurs due to the degradation of organic matter causes the increase of essential fatty acids in the

form of acetic acid, propionic acid, and butyric acid. Banerjee (1978) stated that the fermented essential fatty acids serve as energy suppliers to improve LK synthesis. The fermentation period is also thought to allow sufficient time for microorganisms to perform the biosynthesis of fatty acids derived from the breakdown of easily fermentable carbohydrates. Increasing fat contents are also due to the occurrence of fatty acid hydrolysis for lipase enzyme activity. The hydrolyzed fatty acids are included in the laboratory analysis because in this test the crude fat analysis was performed.

c) Carbohydrates contents

Based on the analysis of laboratory results obtained increased contents of carbohydrates in black garlic during the fermentation process. The highest increase occurred in black garlic with fermentation 90 days (fourth treatment). This happens because, along period of the fermentation process takes place, then the decomposition of carbohydrates into glucose and sucrose. The decomposition of carbohydrate is still belonged in the material due to the fermentation is solid fermentation, and no material is dissolved and wasted in the fermentation process. While the analysis of carbohydrates in this study is a rough carbohydrate analysis, therefore, all the carbohydrates breakdown is included in the analysis results.

d) Water contents

During the fermentation process, there is a decrease in water content. The highest decrease in water content occurred in black garlic fermentation on the 90th day. The increase is due to the microorganisms began to utilize fermentable easy carbohydrates in the substrate as an energy source to grow and develop. The result for simple fermentable carbohydrate reshuffle is simple sugars that converted into energy by byproducts of metabolites, alcohols, acids, CO2, and water. This is in accordance with Suparmo (1989) opinion stated that water is one of the fermentation byproducts that will affect the water content of substrate fermentation products. Cullison and Lowrey (1987) and Rahmadi (2014) stated that the results of the fermentation process are lactic acid, acetic acid, butyric acid, ethanol, fermentation gases (CO2, CH4, CO, NO, and NO2), water and heat.

e) Ash contents

Ash content in food depends on the type of food that is related to the type of minerals contained in foodstuffs. Ash content is the material left behind when food is burned at a temperature 500 - 800 degrees Celsius. The highest ash content occurred in the fourth treatment black garlic. At the beginning of fermentation, there is a decrease in ash content in the second treatment (fermentation of black garlic on the 40th day). This is due to increase in organic material formed from the fermentation of extracts without nitrogen (BETN). BETN fermentation results are altered to form organic components. The increase in organic matter decreases the percentage of inorganic (ash content) of black garlic fermented. Then, there is an increase in ash content due to the increasing degradable organic material causes increase in ash content proportionally due to the increasing period of the fermentation process.

f) Antioxidant Activity

An antioxidant is defined as compounds that can delay, slow down, and prevent the process of lipid oxidation. In a special sense, the antioxidant is a substance that can delay or prevent the occurrence of free radical oxidation reactions in lipid oxidation (Kochhar and Rossell: 1990, Ardiansyah: 2007). Antioxidant analysis of black garlic with different fermentation time showed results that tended to increase. The highest antioxidant capacity occurred in the fourth treatment (fermentation of black garlic on the 90th day) characterized by a glaring black color indicating high levels of anthocyanin in black garlic. The GAEAC garlic value on the 90th day fermentation showed value is obtained 658.9 mg/L of black garlic materials already had an antioxidant capacity equivalent to the value of the gallic acid activity. The total phenol content in black garlic showed that the increase is in accordance with the period of fermentation time. The highest phenol total value occurred in the 90th day fermentation treatment is 140.3 mg GAE/g indicated that black garlic had a high antioxidant function. 50% IC value on black garlic results showed a significant decrease in value. The lowest value 50% IC occurs in black garlic with 90% fermentation that is 134,6 ppm. This shows the longer fermentation process has been

lower value 50% IC. This means that black garlic with a fermentation 90 days has the highest antioxidant activity because only with 134.6 ppm of material has been able to perform oxidant inhibitory power.

This study is as well as in accordance with the research that has been conducted Kim, et al, (2012), which proves that the fermentation process to produce black garlic has been shown to increase levels of polyphenols, and flavonoids in black garlic. Polyphenol contents increased about 23%, while flavonoid levels would increase 37% in black garlic. Polyphenols and flavonoids act as antioxidants that can prevent the cancer onset and premature aging. The antioxidants presence will get free radicals that can damage the body's cells. Increasing contents of the natural antioxidants (polyphenols and flavonoids) in black garlic, can reduce the risk of cancer, and also premature aging.

4. Conclusion

Black garlic protein content during the fermentation process tends to increase. The highest protein content is found on 60 days fermented black garlic is 7.52% bb. Fat content in black garlic during the fermentation process has increased. The highest fat content found in 90 days fermented black garlic is 5.4% bb. Carbohydrate content during the fermentation process increased. The highest protein content found in 90 days fermented black garlic is 45,476% bb. The antioxidants activity of black garlic during the fermentation process has increased. The highest antioxidant activity is found on 90 days fermented black garlic based on GAEAC value (658.9 mg/L), total phenol (140.3 mg GAE/g), and IC value 50% (134.6 ppm).

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Biography of Author

Ni Nyoman Astika Dewi S.Gz, M.Biomed was born in Gianyar, November 30th, 1977. Her office address is on Jalan Sanitasi No. 1 Denpasar, astikadewininyoman@yahoo.co.id, phone: 081353393144. She teaches Biochemistry and Nutrition In the Life Cycle. She graduated her bachelor degree in Brawijaya University, Malang in nutrition science. She finished her master degree in Udayana University in biochemistry science.

Drs I Wayan Mustika, S.Kep., Ns., M.Kes is a Senior Nursing Lecturer. His functional position is Head Lector/Assistant Professor. He was born in Megati, on August 11th, 1965. His mobile phone +6281239161739, wayankayunan@gmail.com and live at Jalan Sanitasi No. 1 Sidakarya, Denpasar. He teaches some subjects included society health nursing, family care, gerontic treatment, health tourism, health promotion. He completed his Bachelor Degree in IKIP PGRI Bali in 1991, Nursing Education in 2008, as well as the Academy of Nursing in Padjajaran Bandung in 2000 than following in Education Profession of Ners in 2009. He finished his Master Degree in AKK UNAIR Surabaya in 2003.