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Garlic Antioxidant (*Allium sativum L.*) to Prevent Meat Rancidity

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Abstract

A study conducted to determine antioxidants ability of garlic applied in beef fat. Garlic's antioxidants determination has the result in water immersion about 53,66%. The study used a completely randomized statistically design with 5x5 factorial. The first factor was the level of crushed garlic (0, 3, 6, 9 and 12% in w/w) then the second factor for storage time (3, 6, 9 and 12 days) at refrigeration temperature (3-5°C). Thiobarbituric acid value (TBA) and beef fat level percentage were evaluated. The results show that there was an interaction ($P < 0.05$) between the value of TBA and beef fat level percentage. Garlic crushed could reduce the level percentage of beef fat and slowdown the increasing TBA values during storage at refrigerator temperature.

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Keywords: beef, garlic, antioxidant, lipid, TBA values

INTRODUCTION

Meat is one of nutritious food comes from cattle aside of milk and egg which contain protein, lipid, ash and carbohydrate. [4] was explained that meat containing 66.10 -69.30% of water, 18.40-21.20% of protein, 8.30-12.30% of lipid and 0.90-1.20% of total ash. Therefore, [19] supported these statement by the study that the average percentage of meat lipid on the range 14.40%.

Meat is categorized as a perishable food due to fat rancidity. Fat rancidity caused by the reaction between

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fatty acid chain and oxygen exposure [21]. Undesirable rancidity flavor produced by the decomposition of lipid forming peroxide and aldehyde compound [10]. [18] were explaining the determination method of fat rancidity through TBA (thiobarbituric acid) value. The rancidity of fat contained malonaldehyde which determined by destillation is then to be reacted with thiobarbituric acid. [16] reported that the TBA value of fresh beef ranged from 0.61 to 0.69 mg / kg, whereas [8] reported that freezing meat could decreasing the TBA value. The frozen beef's TBA values ranged from 0.27 to 0.41 mg / kg.

One of the methods for meat processing is garlic beef marination. Garlic beef marination is could prevent beef fat rancidity and decreasing fatty acid oxidation. [11] reported that garlic pork marination for the concentration 3 and 6% could reduce fatty acid oxidation during storage at 4° C for 7 days. The reaction occurs between allinase and allin from garlic is happened when garlic got physical treatment such as injury, crushed and cut then forming allicin (diallyl thiosuphinate) or 2-propenyl-2-propenethiol sulphinate) for less than 10 seconds [2]. [12] were explaining that allicin is unstable and quickly degraded into various sulfide compounds, which further contributes to flavor. According to [5] organosulfur compounds (alliin, diallylsulfide, allylsulfide and propylsulfide) have the capability as fat antioxidants. Garlic also contains antioxidant compounds such as tocopherol [7], selenium [6], butylated hydroxytoluene (BHT), butylated hydroxyanisole (BHA) and tert-butylhydroquinone (TBHQ) [5].

The expected output and contribution of this study is to provide information regarding the natural preservatives antioxidant from garlic. The outcome of the study to obtained the data regarding the value of garlic antioxidant to prevent meat rancidity as a natural preservative.

MATERIALS AND METHODS

Completely randomized design in 5x5 factorial with three replications was used for this study. The first factor is concentration level of crushed garlic for beef marination (started from 0, 3, 6, 9 and 12% of the weight of beef). The second factor is the storage time (0, 3, 6, 9 and 12 days) at refrigeration temperature storage (3-5°C with the relative humidity 55-65%). Variable examined was fat contain with the procedure analysis according to [13] and the procedure for examined the TBA values according to [18]. The data obtained were then analyzed using variance analysis. When there is any significancy then continued with Duncan's multiple range test [17]. Oxidation activity of garlis were examined using Gorinstein method [7].

RESULTS AND DISCUSSIONS

The results shows that there was an interaction ($P < 0.05$) between the level of garlic crushed and period of time storage at refrigeration temperatures on fat content and TBA values of beef. The data are presented in Table 1 and Table 2. Results of this study indicate that the higher level concentration of the garlic crushed have positive influence for lowering the levels of fatty acid oxidation, thus it could lowering the TBA value of beef. On the other hand the period of storage time at refrigeration temperature had gave the negative effect, because it increases the rate of fatty acid oxidation, thereby increasing the value of TBA on beef. While the fat content decreased due to the level of garlic crushed and the period of storage time at refrigeration temperatures.

Garlic crushed tends to lower beef fat content and slower increasing TBA values during storage at

refrigeration temperature. Meat have initial fat content range from 1.282 up to 1.308% and the initial TBA values range from 0.310 up to 0.311 mg/kg. Decreasing beef fat is caused by allicin compound which worked on reducing cholesterol and triglyceride fatty acid [15], [9]. Decreasing fat content during storage at refrigerator temperature is due to fatty acid oxidation forming malonaldehyde which calculated as the value of TBA [18]. According to [1] aldehydes are rancid flavor compounds, which have more lipid oxidation product. On the other words, the higher value of TBA indicates the longer chain on aldehyde compound. Garlic contains organosulfur compounds (alliin, diallylsulfide, allylsulfide and propylsulfide) which have capability as lipid antioxidants [5]. Subsequently reported that garlic contains antioxidant compounds such as BHT, BHA and TBHQ, which could inhibit the formation of malonaldehyde as calculated as th value of TBA. Raw garlic have capability to inhibit fatty acid oxidation on camel fat at 4°C temperature storage, due to selenium and organo-sulfur compounds [6]. Increasing fatty acid oxidation in meat at 4°C storage temperature started occurred on 48 hours (2 days) after the storage period [14]. Determination of garlic antioxidant compounds using [7] show that garlic have the antioxidant activity for 53.66% compared with the standard 6-hydroxy-2,5,7,8-tetramethylchroman-2-carboxylic acid (Trolox). Therefore garlic have the capability to reduce up 53.66% of free radical compounds.

Table 1. Beef Fat Content with Garlic Beef Marination Treatment at Refrigeration Temperature Storage Period

Garlic Crushed Level of Concentration (%)	Period of Time Storage (Day)				
	0	3	6	9	12
0	1.514 ^d	1.293 ^c	0.962 ^b	0.957 ^b	0.651 ^a
3	1.279 ^c	1.308 ^c	0.980 ^b	0.979 ^b	0.652 ^a
6	1.294 ^c	1.274 ^c	1.274 ^c	1.290 ^c	0.651 ^a
9	1.118 ^b	1.073 ^b	1.112 ^b	0.968 ^b	0.965 ^b
12	0.962 ^b	0.649 ^a	0.648 ^a	0.644 ^a	0.643 ^a

Note: Different superscript lowercase letters on rows/columns indicates significantly different (P < 0.05).

Table 2. the Value of TBA from Beef Marination in Garlic Crushed during Storage period at Refrigerator Temperatures

Garlic Crushed Level of Concentration (%)	Period of Time Storage (Day)				
	0	3	6	9	12
0	0.307 ^{ab}	0.461 ^{de}	0.763 ^{hij}	0.924 ^k	1.024 ^l
3	0.306 ^{ab}	0.455 ^{de}	0.550 ^{fg}	0.919 ^k	0.924 ^k
6	0.306 ^{ab}	0.408 ^{cde}	0.477 ^{ef}	0.805 ^{ij}	0.818 ^j
9	0.307 ^{ab}	0.383 ^{bcd}	0.432 ^{cde}	0.734 ^{hi}	0.738 ^{hij}
12	0.232 ^a	0.386 ^{bcd}	0.358 ^{bc}	0.612 ^g	0.718 ^h

Note: Different superscript lowercase letters on rows/columns indicates significantly different (P < 0.05).

Beef fat content was decreasing during storage caused by the reaction of auto-oxidation of fatty acid with oxygen exposure forming malonaldehyde compounds [18]. Malonaldehyde is a rancid taste aldehyde compound as a decomposition product of unsaturated fatty acids in beef meat [16]. According [22] was explained that free radical compounds produced by auto-oxidation reaction between unsaturated fatty acids and oxygen exposure forming unstable peroxide which then forming the smells rancid short carbon chain (aldehydes and ketones). Therefore the longer period of storage of beef marinated garlic crushed would be able to increase malonaldehyde compound (calculated as the value of TBA) but reducing the beef fat content. Malonaldehyde during storage can be inhibited / reduced by garlic crushed, due to antioxidant compoundsom garlic.

Results of the study shows that there was an interaction between the level of garlic crushed and the storage period at refrigeration temperatures on fat content and TBA value. The higher level concentration of garlic crushed and the longer storage period would remain decreasing beef fat content. Otherwise, the higher level concentration of garlic crushed would remain decreasing the value of TBA but the longer storage was vice versa. The higher levels of garlic crushed have able to reduce the value of TBA and vice versa. The longer the storage period resulting in increasing fatty acid oxidation and the value of TBA in beef meat.

CONCLUSION

Moisture of garlic has antioxidative activity value about 53.66%. It has mean that free radical compounds capable to reducing up to 53.66%. Garlic crushed has the ability to inhibit fat rancidity during storage at refrigeration temperature. Garlic crushed can decreasing the beef fat content during storage at refrigeration temperatures.

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