

Changes in Antioxidant Status between Different Cooking Methods in Eggs Yolk

Abstract

Background: The method of cooking causes important changes in quality and safety of food. The purpose of this study was to survey the relation between nutritional- qualitative factors of eggs in different of cooking methods. **Methods:** The eggs were exposed in different cooking including water cooking, cooking in a microwave and frying. Lipid oxidation, Vitamin E and carotenoid of yolk were measured. **Results:** The changes in lipid peroxidation were not significant. There was significant change in Vitamin E level in water cooking method. The level of vitamin E significantly decreased in this group. The carotenoids content also reduced in microwave method. **Conclusion:** This study showed that significant differences may exist in some nutritional-qualitative factors such as vitamin E and carotenoids levels between common cooking methods of egg. Our findings offer frying as suitable method to maintain their active components.

Keywords: Vitamin E, Carotenoids, Lipid peroxidation, Cooking methods

1. Introduction

Cooking is a process for preparing food with the use of heat. Heating is applied to food to enhance flavour, taste, inactivate pathogenic microorganisms and increase shelf life [1]. The kind of cooking influences on food component. It can lead to undesirable modifications, such as the loss of the nutritional value and lipid oxidation [2]. There are evidences that different method of cooking display different levels of nutritional- qualitative factors in food. The nutritional- qualitative factors in food including antioxidants can reduce degenerative disease. The best known natural antioxidant that have proven important in the food and in human health are Vitamin E and carotenoid[3]. Furthermore, Vitamin E and carotenoid are considered to be critical in protection against oxidative damages. It is suggested that accumulation of natural

antioxidant Vitamin E and carotenoid protect unsaturated fatty acid against peroxidation during cooking.

Among the dietary constituents of food, lipids have critical roles of food safety and quality. The unsaturated fatty acids are sensitive to oxidative damages. The polyunsaturated fatty acids are vulnerable to free radical damages. Their autooxidation is also catalysed by heat [1]. LDL cholesterol are also sensitive to oxidation. Cholesterol oxidation products seem to have important biological effects such as atherogenicity, cytotoxicity and modification of enzyme activity [3].

The yolk from an egg contains about 213 mg cholesterol [4].

There are different methods of cooking to prepare eggs such as water cooking, frying, and cooking in a microwave. The use of microwave has increased because of its advantages which include speed and convenience [5]. The objective of this study was to determine the effects of different method of cooking on some qualification factors include vitamin E and carotenoids plus lipid peroxidation.

2. Material and method:

2.1. Experimental design

We used three method of cooking. To prepare water boiling, the egg is placed in water and boiled at 100°C for 20 min. The yolk was removed for assessing. Then, the microwave was adjusted to 180°C for 5 min used for cooking eggs. In frying method, the yolk separated and placed on a pan without vegetable oils. The temperature reached to 80°C for 2 min.

2.2. Measurement of lipid peroxidation

The formation of thiobarbituric acid in samples was assessed for the measurement of lipid peroxidation according to an original method [6]. Briefly, the supernatant of the sample homogenate was mixed with 20% trichloroacetic acid and the mixture was centrifuged. Then, thiobarbituric acid was added to the supernatant and heated. The absorbance of the supernatant was measured at 532 nm and TBARS concentration was calculated using MDA standard curve.

2.3. Measurement of vitamin E content of muscle

The yolk vitamin E content was measured according to a published method. Samples were exposed to Fe^3 solution, TPTZ and acetate buffer (pH 4). Then, the standard curve was prepared with appropriate vitamin E concentrations. The absorbance of samples was read at 595 nm wavelength[7].

2.4. Measurement of total carotenoids of muscle

Muscle total carotenoids were measured using β -carotene standard curve and spectrophotometry at 470 nm wavelength. The total carotenoid content of the samples was calculated on the basis of the standard curve of β -carotene[8].

2.5. Statistical analysis

The evaluation was made by comparing group. The difference more than 95 % ($p \leq 0.05$) was considered significant. The data values were expressed as mean $\pm$ SD.

3. Results

Level of the nutritional-qualitative factors in different method of cooking was shown in Table (1).

Table 1. Level of nutritional-qualitative parameters of egg yolk

	Level of lipid peroxidation (mg MDA /g)	Vitamin E mg/g	Carotenoids level mg/g
Water cooking	3 $\pm$ 0.47	0.82 $\pm$ 0.05	1.8 $\pm$ 0.1
Frying	3.2 $\pm$ 0.16	2.6 $\pm$ 0.6*	1.96 $\pm$ 0.05
Microwave	3 $\pm$ 0.19	1.6 $\pm$ 0.5	1.56 $\pm$ 0.11

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79 The level of vitamin E was significantly different between water cooking compared to frying (p
80 = 0.04).

81 The P values are not more than 0.05 in lipid peroxidation. Table (1) shows no significant
82 difference in lipid peroxidation level.

83 The changes in level of carotenoids were observed between frying method and microwave
84 cooking ($p=0.05$).

85

86 **4. Discussion**

87 In the current study, the methods of cooking which can affect the nutritional- qualitative factors
88 were surveyed.

89 The egg yolk is susceptible to oxidation because of high level of polyunsaturates fatty acid.
90 Oxidative stress results from excessive levels of reactive oxygen species (ROS) and damages
91 macromolecules such as DNA, lipids, proteins and carbohydrates. ROS attacks polyunsaturated
92 fatty acids and causes lipid peroxidation. MDA is a product of lipid peroxidation that has been
93 used as an indicator in oxidative damages. This component is highly reactive and can cause
94 deterioration of biological molecules such as DNA. MDA is mutagenic and tumorigenic[9].
95 major changes that occur during heating are due to oxidation[1]. The yolk is extremely
96 susceptible to lipid peroxidation because of the accumulation of polyunsaturates fatty acids. The
97 level of lipid peroxidation didn't change in conventional methods of cooking (Table 1). MDA
98 products did not increase in these methods of cooking. Therefore there is no hazard as results of
99 lipid peroxidation in different cooking.

100 The oxidative stability of foods during cooking depends on the level of antioxidant. Presence of
101 antioxidants has an important role on the prevention oxidative changes. This time require a
102 considerable degree antioxidant against peroxidation[10].

103 The antioxidants in foods decrease the formation of heterocyclic amines (HCAs) that form
104 during the frying of protein rich food. HCAs are recognized as animal carcinogens [11]. The
105 vitamin E level didn't alter in frying and microwave heating. The results suggested that changes

of vitamin E level depended to processing time. The exposure time in frying method was 2 min. in previous study, the amount of vitamin E in animal fats destroyed after 8 min of heating[12]. Therefore, the degradation of vitamin E is low in frying method.

Carotenoids have also been documented for health promoting function. These components are known to provide a range of biological effects (provitamin, antioxidant, coloring etc.). The role of carotenoids as a source of pigment and in immune defense system has been established. Because of their oxidation sensitivity, carotenoids must be protected from light, heat, and oxygen. In this study, carotenoids levels were significantly increased in frying cooking and microwave method ($P<0.05$) (Table 1).

In conclusion, the eggs that prepare with frying pan have the potential to be a good source of active components such as carotenoids and vitamin E. These active components are considered to be powerful antioxidants in eggs. In this study, the frying of eggs is recommended among different of cooking method.

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