

Changes in Antioxidant Status between Different Cooking Methods in Eggs Yolk

Parisa Sadighara¹, Rooholla Ghanbari¹

1. Department of Environmental Health Engineer, Food Safety Division, Faculty of Public Health, Tehran University of Medical Sciences, Tehran, Iran

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 levels of vitamin E in water cooking and frying method were 0.82 ± 0.05 and 2.6 ± 0.6 mg/g respectively. 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 flavor, 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 antioxidants 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].

Eggs have been recognized as valuable sources of high nutritional components. Eggs are a key ingredient in many countries food. There are different methods of cooking to prepare eggs such as water cooking, frying, and cooking in a microwave. The water cooking and frying are traditional method. The use of microwave has been 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 100C 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

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

Total carotenoids of samples 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.

1. Results

Level of the nutritional-qualitative factors in different method of cooking was shown in Table (1). The data values were expressed as mean $\pm$ SD. The evaluation was made by comparing group by analysis of T-Test in SPSS software.

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

	Level of lipid peroxidation	Vitamin E mg/g	Carotenoids level mg/g

	(mg MDA /g)		
Water cooking	3±0.47	0.82 ±0.05	1.8 ± 0.1
Frying	3.2±0.16	2.6 ±0.6*	1.96± 0.05
Microwave	3± 0.19	1.6 ±0.5	1.56± 0.11

The changes in lipid peroxidation were not significant. The level of vitamin E significantly decreased in this water method cooking.

The level of vitamin E was significantly different between water cooking compared to frying ($p = 0.04$). The P values are not more than 0.05 in lipid peroxidation. Table (1) shows no significant difference in lipid peroxidation level. The level of vitamin E was highest in frying ($p < 0.05$).

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

4. Discussion

The egg is usually treated by various processes. These processes could change its composition. In the current study, the methods of cooking which can affect the nutritional- qualitative factors were surveyed.

The egg yolk is susceptible to oxidation because of high level of polyunsaturated fatty acid. Oxidative stress results from excessive levels of reactive oxygen species (ROS) and damages macromolecules such as DNA, lipids, proteins and carbohydrates. ROS attacks polyunsaturated fatty acids and causes lipid peroxidation. MDA is a product of lipid peroxidation that has been used as an indicator in oxidative damages. This component is highly reactive and can cause deterioration of biological molecules such as DNA. MDA is mutagenic and tumorigenic [9]. Major changes that occur during heating are due to oxidation. The polyunsaturated fatty acids are

considered to be susceptible to oxidation during heating [1]. The yolk is extremely susceptible to lipid peroxidation because of the accumulation of polyunsaturated fatty acids. The level of lipid peroxidation didn't change in conventional methods of cooking (Table 1). MDA products did not increase in these methods of cooking. Therefore there is no hazard as results of lipid peroxidation in different cooking.

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

The antioxidants in foods decrease the formation of heterocyclic amines (HCAs) that form during the frying of protein rich food. HCAs are recognized as animal carcinogens [11]. The 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]. This vitamin at high temperature is susceptible to degradation. 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 previous study, the bioaccessibility of egg carotenoids can be affected by different food preparation methods [13].

5. Conclusions

The antioxidants content of fry cooked egg were considered more than other method. The level of vitamin E was highest in this method compared to water cooking and microwave method. The eggs that prepare with frying pan have the potential to be a good source of active components. 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.

References

- 1) Weber J, Bochi VC, Ribeiro CP, Victorio AM, Emanuelli T. Effect of different cooking methods on the oxidation, proximate and fatty acid composition of silver catfish fillets. *Food chemistry*. 2008;106: 140-146.
- 2) Rodriguez-Estrada MT, Penazzi G, Caboni MF, Bertacco G, Lercker G. Effect of different cooking methods on hamburgers. *Meat Science*. 1997; 3: 365-375.
- 3) Iqbal S, Bhanger MI, Anwar F. Antioxidant properties and components of some commercially available varieties of rice bran in Pakistan. *Food Chemistry*. 2005;93:265-272.
- 4) Awad AC, Bennink MR, Smith DM, Composition and Functional Properties of Cholesterol Reduced Egg Yolk . *Poultry Science*. 1997;76:649–653
- 5) Cossignani L, Simonetti MS, Neri A, Damiani P. Changes in olive composition due to microwave heating. *JAOCs*. 1998; 75:931-937
- 6) Sicinska P, Bukowska B, Michalowicz J, Duda W. Damage of cell membrane and ant-oxidative system in human erythrocytes incubated with microcystin-LR in vitro. *Toxicon*. 2006; 47:387-397.
- 7) Devi I, Memon SA, Khuhawar MY. Spectrophotometric analysis of vitamin E using Cu (I)-bathocuproine or/and Fe (II)-2, 4, 6-tris-(2-pyridyl)-s-triazine complexes. *Journal of Chemical Society of Pakistan*. 2004; 26:239-242.
- 8) Thaipong K, Boonprakob U, Zevallos LC, Byrne DH. Hydrophilic and lipophilic antioxidant activities of guava fruits. *The Southeast Asian Journal Tropical Medicine and Public Health*. 2005; 36: 254-257.
- 9) Zhang Y, Chen SY, Hsu T. Immunohistochemical detection of malondialdehyde–DNA adducts in human oral mucosa cells. *Carcinogenesis*. 2001; 23:207–211.
- 10) Surai PF. Tissue specific changes in the activities of antioxidant enzymes during the development of the chicken embryo. *British poultry science*. 1999; 40:397-405.

- 11) El-Abassy RM, Donfack P, Materny A. Assessment of conventional and microwave heating induced degradation of carotenoids in olive oil by VIS raman spectroscopy and classical methods. *Food Research International*. 2010; 43:696-700.
- 12) Anjum F, Anwar F, Jamil A, Iqbal M. Microwave roasting effects on the physico-chemical composition and oxidation stability of sunflower seed oil. *JAOCs*. 2006; 83:777-784.
- 13) Nimalaratne C, Savard P, Gauthier SF, Schieber A, Wu J. Bioaccessibility and digestive stability of carotenoids in cooked eggs studied using a dynamic in vitro gastrointestinal model. *J Agric Food Chem*. 2015; 25;63:2956-62.