The content of coenzyme Q10 in selected Thai foods: meat products, vegetables, fruits, seeds, legumes, and spices

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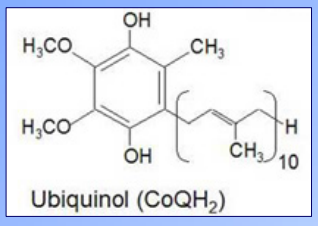
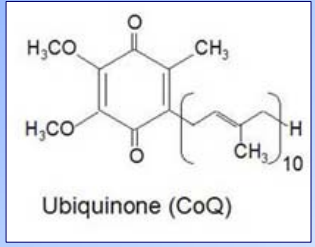
Introduction

Coenzyme Q10 (CoQ10)



Ubiquinol ($CoQH_2$)



Ubiquinone (CoQ)

- Fat soluble benzoquinone homologues
- Vitamin-like substance
- Obtained from biosynthesis and diet
- Antioxidant activity

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8th International Food Data Conference

October 1-3, 2009

Bangkok, Thailand

Beneficial aspects of CoQ10

- Mobile electrons carrier
- Inhibition of lipid peroxidation initiation in plasma membranes
- Inhibition of low density lipoprotein (LDL) oxidation
- Cardiovascular disease treatment
- Decreasing the risk of cancer
- Recycling α-tocopheroxyl radical to regenerate α-tocopherol

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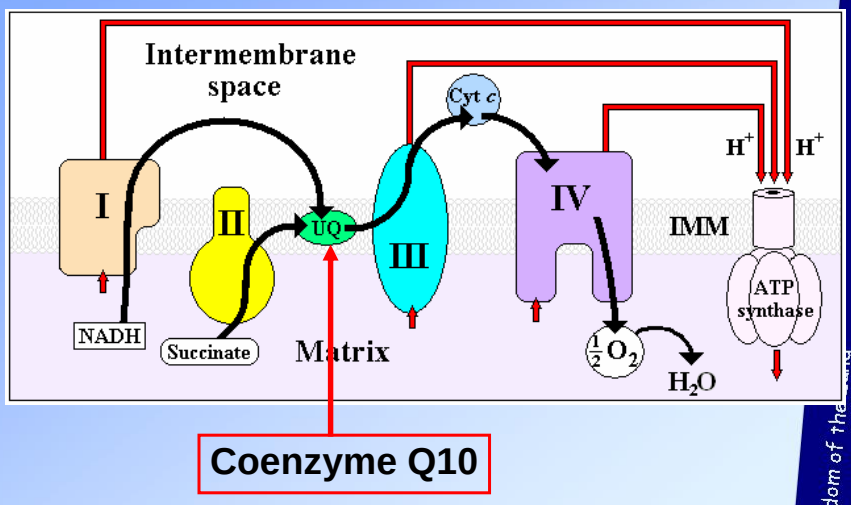
Electron Transport Chain



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Previous research on dietary CoQ_{10} content in Thai foods

- Thirty-four kinds of foods (animal sources and vegetable oils) in Thailand, raw and boiled samples, were analyzed for CoQ_{10} and CoQ_9 contents (Aikkarach Kettawan, 2003)
- Twelve kinds of foods (selected animal products and vegetable oils) in Thailand, raw and conventional cooked samples, were analyzed for CoQ_{10} contents (Sompop Jarathsuthitham, 2004)

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Objectives

- **To determine the content of CoQ_{10} in selected Thai foods**
- **To evaluate the effect of conventional cooking on CoQ_{10} content in some selected Thai foods**

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Materials and Methods

Samples collection

Samples preparation

Chemical analysis

Determination of Moisture content
(AOAC; 920.151, 2001)

Determination of CoQ_{10} content
(Okamoto,1998; and Kettawan, 2007)

HPLC with Electrochemical detector

Quality control samples (animal and plant sources)

Statistical analysis: student *t*-test (SPSS version 13.0)

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Samples collection

- 7 meat products
- 9 vegetables
- 6 fruits
- 7 legumes
- 6 seeds
- 3 cereals
- 12 spices

51 items

Obtained from five representative markets in Bangkok (n=5)

Prepared by combining samples from three grocery stores (200 g X 3) in each market.

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Samples preparation

Representative samples (n=5)

↓

Washed with DI water

↓

Collected edible portion

↓

Divided into 2 portions

Homogenized by home-use electric blender	Cooked by conventional methods
↓	↓
Kept in polyethylene bottle at -20° C	Homogenized by home-use electric blender
	↓
	Kept in polyethylene bottle at -20° C

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Results

Table 1. The content of CoQ_{10} (µg/g) in meat products

Samples	Raw		Cooked	
	Range	Mean ± SD *	Range	Mean ± SD *
1. Steamed pork sausage	0.5 - 3.7	1.3 ± 1.4	0.5 - 1.5	0.9 ± 0.4
2. Dried sausage	n.d. - 1.9	0.7 ± 0.8	n.d. - 2.2	0.7 ± 0.9
3. Pork sausage	0.7 - 3.9	1.7 ± 1.3	0.6 - 2.5	1.4 ± 0.8
4. Chicken sausage	0.4 - 2.7	1.7 ± 1.0	0.4 - 2.3	1.5 ± 0.8
5. Fermented pork sausage	0.9 – 2.0	1.5 ± 0.4	-	-
6. Shredded pork	17.4 -28.9	21.8 ± 4.6	-	-
7. Porkball	0.5 - 5.9	2.3 ± 2.2	0.4 - 2.2	1.4 ± 0.9

* n = 5; n.d. : not detectable; - : not determined

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Table 2. The content of CoQ_{10} (µg/g) in vegetables

Samples	Raw		Cooked	
	Range	Mean ± SD *	Range	Mean ± SD *
8.Chinese kale	1.4 - 4.5	2.8 ± 1.4	3.6 - 8.6	5.6 ± 1.9
9.Swamp cabbage	0.7 - 2.9	1.7 ± 0.9	1.7 - 6.0	3.6 ± 1.6
10.Swamp morning glory	1.1 - 2.8	1.7 ± 0.9	2.3 - 4.9	3.4 ± 1.1
11.Cabbage	0.8 - 1.3	1.1 ± 0.2	1.8 - 2.3	2.0 ± 0.2
12.Chinese cabbage	1.7 - 4.1	3.4 ±1. 0	2.3 - 4.3	3.2 ± 0.8
13.Broccoli	0.8 - 3.2	1.9 ± 1.0	3.6 - 5.6	4.8 ± 0.8
14.Raw papaya	0.4 - 0.9	0.6 ± 0.2	-	-
15.Chinese white cabbage	1.2 - 2.1	1.6 ± 0.4	0.5 - 2.1	1.2 ± 0.6
16.Sweet leaf bush	2.4 - 5.9	3.8 ± 1.3	2.9 - 5.1	4.2 ± 0.8

* n = 5; - : not determined

Table 3. The content of CoQ_{10} (µg/g) in fruits

Samples (Scientific name)	Range	Mean ± SD *
17.Mangosteen *(Garcinia mangostana)*	n.d.	n.d.
18.Mango *(Mangifera indica)*	0.1 - 3.5	1.9 ± 1.5
19.Ripe papaya *(Carica papaya, Linn.)*	2.1 - 5.9	3.9 ± 1.7
20.Pineapple *(Ananas comosus, Merr.)*	0.1 - 4.4	2.3 ± 2.0
21.Guava *(Psidium guajava)*	0.2 - 2.4	1.3 ± 0.8
22.Durian *(Durio Zibethinus)*	2.5 - 3.0	2.8 ± 0.3

* n = 5; n.d. : not detectable

Table 4. The content of CoQ10 (µg/g) in legumes

Samples (Scientific name)	Raw		Cooked	
	Range	Mean ± SD *	Range	Mean ± SD *
23.Peanut *(Arachis hypogaea L.)*	3.2 - 4.3	3.7 ± 0.5	3.6 - 4.4	4.0 ± 0.4
24.Soybean *(Glycine max(L.) Merrill)*	4.5 - 6.7	5.6 ± 1.0	4.8 - 5.8	5.2 ± 0.4
25.Mungbean sprout *(Phaseolus aureus Roxb.)*	0.1 - 1.2	0.7 ± 0.5	-	-
26.Mungbean *(Phaseolus aureus Roxb.)*	10.4 - 13.9	12.1 ± 1.3	2.3 - 3.1	2.8 ± 0.3
27.Red kidney bean *(Phaseolus vulgaris)*	9.9 - 16.4	12.3 ± 2.5	2.2 - 6.3	4.0 ± 1.9
28.Cowpea *(Vigna unguiculata)*	7.3 - 18.9	13.3 ± 4.6	2.0 - 5.2	3.9 ± 1.6
29.Fava bean *(Vicia faba)*	0.5 - 7.2	5.3 ± 2.8	-	-

* n = 5; - : not determined

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Table 5. The content of CoQ10 (µg/g) in seeds

Samples (Scientific name)	Raw		Cooked	
	Range	Mean ± SD *	Range	Mean ± SD *
30.White sesame *(Sesamum indicum, L.)*	1.2 - 2.2	1.7 ± 0.4	1.0 - 2.1	1.5 ± 0.5
31.Black sesame *(Sesamum indicum, L.)*	0.5 - 2.1	1.1 ± 0.6	0.3 - 3.2	2.0 ± 1.4
32.Sunflower seed *(Helianthus annuus)*	0.8 - 2.2	1.2 ± 0.6	-	-
33.Pumpkin seed *(Cucurbita moschata, Poir.)*	0.2 - 0.6	0.4 ± 0.2	-	-
34.Cashew nut *(Anacardium occidentale)*	1.1 - 3.2	2.4 ± 0.8	-	-
35.Almond *(Prunut dulcis)*	0.4 - 4.1	2.3 ± 1.4	-	-

* n = 5; - : not determined

In cereals group (Corn, Jasmine rice and unpolished rice), not detectable (n.d.) CoQ10 content

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Table 6. The content of CoQ_{10} (µg/g) in spices

Samples	Range	Mean ± SD *
36.Garlic	0.9 – 4.0	2.6 ± 1.1
37.Bird chili	n.d.	n.d.
38.Galingale	1.0 - 1.9	1.3 ± 0.4
39.Goat pepper	0.2 - 5.5	1.8 ± 2.1
40.Dried pepper	n.d.	n.d.
41.Kaffir lime leaf	1.7 - 6.1	3.4 ± 1.8
42.Kaffir lime peel	2.5 - 5.5	3.9 ± 1.4
43.Lemon grass	0.5 - 0.9	0.7 ± 0.2
44.Shallot	0.7 - 1.4	1.1 ± 0.3
45.Kaempfer	n.d.	n.d.
46.Ginger	1.1 - 2.1	1.6 ± 0.4
47.Turmeric root	1.6 – 3.0	2.3 ± 0.5

* n = 5; n.d. : not detected

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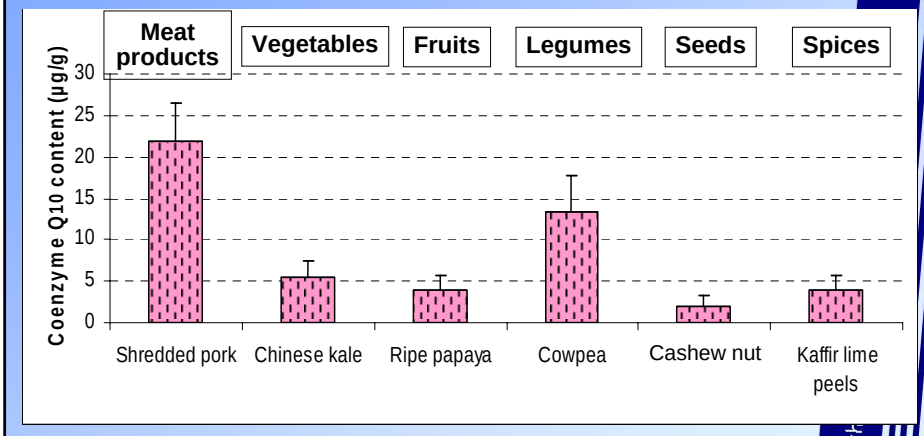
Figure 1. The highest CoQ_{10} content in each group



Mean ± SD (n = 5)

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Table 7. Percentage of CoQ10 retention after cooking

Groups	% retention
Meat products	77.3 - 97.4
Vegetables	72.3 - 317.0
Legumes	55.0 - 197.5
Seeds	79.8 - 150.4

$$\text{True retention (\%)} = \frac{\text{Nutrient content (g/100g) of cooked sample x g of cooked sample}}{\text{Nutrient content (g/100g) of raw sample x g of raw sample}} \times 100$$

(Murphy *et al*. ,1975)

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Table 8. Percent CoQ10 retention after cooking

Samples	% Retention	Samples	% Retention
Steamed pork sausage	97.4 ± 51.1	Broccoli	317.0 ± 215.6
Dried sausage	90.8 ± 56.0	Chinese white cabbage	72.3 ± 28.4
Pork sausage	82.2 ± 17.8	Sweet leaf bush	120.5 ± 23.6
Chicken sausage	96.6 ± 24.6	Peanut	103.3 ± 15.7
Porkball	77.6 ± 27.0	Soybean	197.5 ± 31.2
Chinese kale	216.1 ± 84.3	Mungbean	55.0 ± 8.0
Swamp cabbage	265.2 ± 180.3	Red kidney bean	63.6 ± 37.4
Swamp morning glory	244.3 ± 110.6	Cowpea	77.4 ± 51.1
Cabbage	169.5 ± 14.8	White sesame	79.8 ± 19.2
Chinese cabbage	103.0 ± 23.9	Black sesame	150.4 ± 92.3

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Conclusions

- **Legumes (12.1 to 13.3 µg/g) and shredded pork (21.8 µg/g) showed highest CoQ_{10} content**
- **Household cooking affected CoQ_{10} content in some food items**

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Thank You for Your Attention

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