

# The Measurement of Folacin Content in Korean Foods

## —Part 3. Folate Distribution in Various Foods—

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= 국문요약 =

### 한국 상용 식품의 엽산 분석에 관한 연구

—제 3 보—

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한국인의 식생활을 이루고 있는 주요식품 226종에 포함된 엽산치를 *Lactobacillus casei* 미생물을 사용하여 분석하였다. 제 1 보 및 2 보에서 측정된 채소류와 과일류 식품은 이 보고에서 제외되었다. 엽산치함량은 유리형 및 결합형으로 각종 식품 100 g 중에 포함된 ug 으로 표시하였다.

각종 식품 및 각 식품군에 포함된 엽산치 함량은 크게 차이가 있는 것으로 나타났다. 또한 각종 식품에 포함된 엽산 형태에 따른 화학적 조성도 크게 차이가 있는 것으로 나타났다.

식단 작성시 결합형의 엽산치 함량이 사용될 것이며, 저장가공 및 조리시의 파괴율을 고려해야 하겠다.

가장 풍부한 엽산의 급원은 효모로 2,800.8 ug 결합형으로 식품 100 g 중에 함유됨을 보였다. 밀린 대두, 시금치, 냉이, 소 및 돼지 같은 100 ug 이상 함유됨을 보였다. 그 외의 말린 두류 및 종실류, 썩, 썩갓, 미나리, 부추, 아스파라가스, 계란 노른자, 소 콩팥은 50 ug 이상 함유됨을 보였다. 파, 상치, 무우, 고추, 발효된 콩 식품, 밀, 고구마, 느타리 버섯은 40 ug 정도 함유됨을 보였다. 그의 대부분분의 정제된 곡류, 전분류, 당류, 과일류, 육류, 어패류, 유류는 비교적 적게 함유됨을 보였다. 유지류, 음료 및 주류 조미료는 거의 함유량이 없음을 보였다. 저장가공 및 조리된 식품에서의 엽산치 함량은 전반적으로 크게 손실된 것으로 나타났다.

## INTRODUCTION

The deficiency of dietary folate in man is directly responsible for the defective synthesis of nucleic and megaloblastic anemia. The role of folic acid in human nutrition has been discussed and suggestions for further research, particularly for the Korean population, previously outlined<sup>1)</sup>. In view of the above and to achieve some basis for a standard, evaluation by a microbiological method of folate assay, leading to the presentation of folate content of some vegetables and

fruits, has been carried out<sup>2,3)</sup>.

In continuation, determination of folate content of additional Korean food items has been carried out in order to determine a dietary adequacy and plan of food requirement of dietary folates.

## MATERIALS AND METHODS

### Food Samples

Food samples available on the Korean market were obtained from ordinary commercial sources

mainly in the area of Seoul. In most cases, the foods were bought at several different stores and/or several brands of a food item were obtained. Some items of vegetables and fruits covered by the previous work in Part I<sup>2)</sup> and II<sup>3)</sup> were excluded from this study. The representative food samples were prepared in terms of ug per 100 g edible portion. The sequence of sampling and analysis are reported for a total of three to four samples for each food representing duplicate assay.

## ASSAY PROCEDURE

Using *Lactobacillus casei*(ATCC 7469) as test organism, the assay method was adopted as described previously<sup>2)</sup>.

## RESULTS AND DISCUSSION

The folate distribution in 226 food items available on the Korean market as determined by a modified microbiological assay with *Lactobacillus casei* is presented in Table I. The mean free and total folate activity(ug per 100 g) in the different food groups ranged as follows:

	F.F.A.*	T.F.A.*
Cereal and Grain Products	2.3-27.0	3.6- 41.2
Starch and Starchy Roots	2.6-22.4	9.8- 39.5
Sugar, Syrups and Sweets	1.8- 9.6	3.6- 18.8
Fruits	1.3- 9.4	1.6- 15.3
Vegetables	3.8-48.6	7.9-104.8
Fungi and Mushroom	7.1-13.1	14.8- 44.6
Legumes, Nuts and Seeds	4.2-47.3	9.9-180.7
Meat and Meat Products (excluding liver and kidney)	0.9-13.5	3.8- 22.3
Meat liver and Kidney	48.9-98.0	66.8-143.2
Eggs	3.4-56.4	15.0- 98.7
Fish, Shellfish(excluding soused ones)	0.6-10.3	4.0- 29.6
Sea Weeds	2.0-22.6	4.9- 35.4
Milk and Milk Products	0.5- 5.6	1.2- 13.0
Oils and Fats	0.9- 6.1	1.8- 12.0

Beverages	0 - 1.8	0.5- 3.3
Beer, Wine and Liquor	0 - 1.0	1.3- 2.6
Seasonings	0 - 4.3	0.1- 6.9
Seasonings, fermented soybean products	5.8-29.6	14.5- 72.8
Yeast, dried, brewer's	160.3	2800.8

\*F.F.A.=Free Folic Acid (without conjugase treatment)

\*T.F.A.=Total Folic Acid (with conjugase treatment)

In assaying food items, there was a large variation in folate activity between the different food groups as well as between each individual food.

Within the cereal and grain products, folate activity was found primarily in the outer layers of the grain. Wheat and its products had considerably higher folate levels. The higher value in yeast leavened doughnuts probably resulted from the contribution of the vitamin by yeast, which not only contains folate but also produces folate during fermentation. Keagy et al<sup>4)</sup> showed the same results in their report measuring folate in bread dough before and after fermentation. The mean values for barley, foxtail and sorghum, 14.3 ug total per 100 g fall between those for wheat 40.5 and rice 27.5 total per 100 g. Most cooked products, such as boiled rice and rice cake, showed that foods were lower in folate activity.

The lowest value among the starch and starchy roots was acorn MOKK 9.8 and the most was sweet potatoes 39.5 ug total 100 ug total 100 g particularly.

Most sugar, syrups and sweets contained less than 7 ug total per 100 g. Orange jam with 18.8 ug total per 100 g was the best source in this group. Most fresh and processed fruits contained less than 10 ug total folate per 100 g. Fresh orange, banana and strawberry, with 26.6, 20.2 and 19.7 ug total per 100 g<sup>3)</sup>, respectively, proved considerably higher folate activity. Values of processed fruits were lower, in general, than those for the fresh fruits.

All legumes had high folate activity. Kidney

Table I. Folic acid content of various foods

Item No.	Food & Description	water(%)	Lactobacillus Casei	
			Free folate	Total folate
			ug/100 g	ug/100 g
CEREAL AND GRAIN PRODUCTS				
1.	Barley, milled	13.8	8.2	16.5
2.	Powder	11.1	4.3	9.5
3.	Biscuit	10.4	3.3	11.7
4.	Bread	27.3	12.3	31.0
5.	Buckwheat, boiled	11.4	4.1	29.3
6.	Corn, whole grain	12.8	14.6	20.5
7.	Doughnut, cake type	24.6	3.0	7.4
8.	yeast leavened	23.9	4.4	18.7
9.	Foxtail	13.1	7.5	17.2
10.	Noodle, instant, RAMYON	2.8	2.3	8.8
11.	Rice, highly milled	12.3	14.8	28.6
12.	boiled	66.0	2.3	4.9
13.	Rice glutinous, milled	14.4	14.2	26.4
14.	Ricecake, white, without sugar	45.9	3.1	6.3
15.	white with sugar, plain	43.4	2.9	6.7
16.	with black soybean	51.3	3.3	9.9
17.	with small red bean	46.1	2.8	9.7
18.	glutinous	45.0	2.3	7.6
19.	Sorghum	12.3	9.4	13.9
20.	Sorghum cake, round shape	45.3	2.3	3.6
21.	Wheat, whole grain	12.1	27.0	41.2
22.	flour	14.3	17.5	39.8
STARCH AND STARCHY ROOTS				
23.	Acorn, MOOK	89.7	2.6	9.8
24.	Corn starch	15.7	12.0	16.3
25.	Potatoes	81.8	5.7	10.8
26.	starch	18.3	6.8	21.7
27.	Starch noodle, DANG-MYUN	14.0	8.7	12.3
28.	Sweet potatoes	65.0	22.4	39.5
29.	Taro	80.1	4.8	9.9
SUGAR, SYRUPS AND SWEETS				
30.	Candy plain	6.4	3.8	6.9
31.	Chewing gum	2.8	2.1	3.8
32.	Chocolate	1.0	2.9	6.0
33.	Corn syrup	9.6	3.0	4.2
34.	Crude maltose, white	10.3	2.0	3.6
35.	black	12.8	2.3	4.2
36.	Sugar, white	0.9	2.8	4.6

Item No.	Food & Description	Water(%)	Lactobacillus Casei	
			Free folate	Total folate
			ug/100 g	ug/100 g
37.	brown	2.0	3.1	4.5
38.	Honey	21.1	2.3	4.2
39.	Molasses	18.3	2.0	3.6
40.	Apple jam	30.3	2.3	4.6
41.	Apricot jam	33.4	2.0	3.9
42.	Grape jam	24.6	2.4	5.3
43.	Orange jam	24.8	9.6	18.8
44.	Peach jam	25.8	1.8	3.6
45.	Strawberry jam	26.9	6.3	10.2
	FRUITS			
46.	Apple, Kuk-kwang	87.0	2.9	4.8
47.	Red type	87.2	3.0	7.6
48.	Apple, Into, green	85.1	2.8	6.5
49.	nectar	87.3	1.9	5.0
50.	juice	97.8	2.3	4.6
51.	Grape, canned	80.3	3.8	8.2
52.	nectar	88.2	3.3	6.8
53.	Jujube, fresh	70.6	2.1	2.5
54.	dries	20.1	2.6	6.0
55.	Korean ginseng, canned	82.1	3.0	6.1
56.	drink, juice	98.0	2.3	4.1
57.	Orange, canned	87.6	8.9	15.3
58.	juice	89.1	5.9	9.4
59.	nectar	88.1	6.9	8.6
60.	juice powder	13.4	9.4	12.1
61.	Peach (white), canned	81.3	1.3	2.8
62.	(yellow), canned	81.5	1.5	3.7
63.	nectar	87.2	2.0	3.1
64.	Persimmon, hard	83.2	1.8	2.6
65.	dried	33.4	5.1	6.8
66.	Pineapple, fresh	87.3	6.6	8.8
67.	canned	80.2	3.3	7.9
68.	necter	86.4	2.3	6.2
69.	Pine, juice powder	13.2	7.0	8.8
70.	Plum, dried	29.8	2.0	3.6
71.	nectar	87.2	0.8	1.6
72.	Strawberry, nectar	86.9	8.8	14.3
73.	juice powder	12.8	6.3	10.6
74.	Tomato juice	94.8	4.9	8.7

Item No.	Food & Description	Water(%)	Lactobacillus Casei	
			Free folate	Total folate
			ug/100 g	ug/100 g
LEGUMES, NUTS AND SEEDS				
75.	Green peas	14.3	23.4	69.8
76.	Mung bean	16.0	20.1	74.5
77.	sprout	95.3	4.3	9.9
78.	Small red beans, red	13.9	14.6	98.9
79.	white	13.5	13.4	79.2
80.	Soy bean, yellow	6.6	83.5	180.7
81.	black	13.0	45.6	96.4
82.	brown	13.1	39.8	92.3
83.	sprout	90.8	4.9	10.6
84.	curd	85.0	6.8	14.6
85.	curd residue	83.5	4.2	15.8
86.	soup powder	6.8	10.0	68.1
87.	Chestnut	60.3	14.8	53.5
88.	Ginkgonut	58.2	14.3	49.8
89.	Peant	3.0	21.8	82.8
90.	Peant butter	1.9	18.9	68.6
91.	Pine nut	5.9	15.3	59.8
92.	Walnut	4.8	43.2	59.9
93.	Perilla seed	17.7	43.2	76.8
94.	Sesame seed	7.7	47.3	88.5
VEGETABLES				
95.	Asparagus	90.3	48.6	53.2
96.	Bamboo shoot	91.3	7.5	11.5
97.	Bracken	13.8	8.7	10.9
98.	Celery	86.9	4.8	10.6
99.	Chard bets	91.2	15.6	17.8
100.	Ginger	83.1	3.8	7.9
101.	Lotus root	88.3	14.6	19.8
102.	Malva	89.8	12.1	21.4
103.	Mugwort	82.3	42.5	68.6
104.	Peppers, hot red	93.2	18.6	42.6
105.	green	90.3	3.9	28.0
106.	Pimiento	92.3	9.6	14.8
107.	Pumpkin	83.0	4.3	23.6
108.	Root of bellflower	26.3	5.4	9.3
109.	Royal fem	20.3	6.6	9.8
110.	Shepherd's purse	83.1	42.9	104.8
111.	Water cress	86.3	38.5	86.5
112.	Wild onion	88.6	16.3	23.4

Item No.	Food & Description	Water(%)	Lactobacillus Casei	
			Free folate	Total folate
			ug/100 g	ug/100 g
FUNGI AND MUSHROOM				
113.	Clavaria bctrytis	90.3	10.8	21.3
114.	Fragrantmushroom, dried	9.8	12.1	23.4
115.	Fungus, dried	15.1	11.5	44.6
116.	Juda's ear dried	9.0	7.1	14.8
117.	Mushroom, fresh	92.2	13.1	26.3
118.	Pine agaric, fresh	89.1	10.9	22.9
MEAT AND MEAT PRODUCTS				
119.	Beef, lean meat	63.4	4.1	8.8
120.	heart	78.1	13.5	22.3
121.	kidney	76.4	48.9	66.8
122.	liver	70.3	98.0	143.2
123.	Chicken	74.5	4.6	9.5
124.	Dogmeat	76.8	5.3	10.6
125.	Duck's meat, canned	71.3	2.3	5.9
126.	Pheasant	71.2	4.3	8.8
127.	Pork, lean meat	67.5	3.2	8.9
128.	ham	66.1	0.9	3.8
129.	heart	78.6	11.3	14.9
130.	liver	72.3	68.3	110.5
131.	sausage	58.2	2.3	4.2
132.	Rabbit	72.3	4.1	12.3
133.	Turkey	66.0	6.0	9.8
EGG				
134.	Hen's egg, whole, raw	75.1	20.3	28.9
135.	yolk	50.2	56.4	98.7
136.	white	89.7	3.4	15.0
FISH AND SHELLFISH				
137.	Alaskan pollack	82.3	0.6	6.8
138.	dried	35.0	2.1	15.0
139.	soused intestine	81.8	0.2	1.3
140.	soused roe	72.5	0.2	1.2
141.	Anchovy, dried, large	16.9	6.3	8.2
142.	small	8.7	10.3	14.7
143.	Alka-fish	72.9	2.0	5.2
144.	Cod	81.2	5.1	13.4
145.	Croaker	72.3	5.6	10.4
146.	Halibut	73.9	3.3	9.9
147.	Hairtail	75.1	3.1	6.5
148.	Mackerel	77.3	6.8	13.5

Item No.	Food & Description	Water(%)	Lactobacillus Casei	
			Free folate	Total folate
			ug/100 g	ug/100 g
149.	Mackerel pike	70.3	4.6	8.8
150.	Red seaream	78.2	3.8	13.6
151.	Salmon	72.3	8.7	17.6
152.	Sole	74.8	4.8	10.6
153.	Yellow tail runner	83.4	4.8	24.8
154.	dried	53.1	5.8	29.6
155.	Abalony	75.6	4.3	6.6
156.	Ark-shell	78.6	4.2	8.2
157.	Clam, big	85.6	3.3	11.3
158.	small, soused	68.7	0.9	3.4
159.	Cork-shell	77.6	2.1	4.0
160.	Red crab	80.3	2.3	16.5
161.	Oyster	80.1	3.8	6.5
162.	soused with red pepper powder	71.4	1.2	2.8
163.	Shrimp, small	84.2	6.9	13.0
164.	soused	68.4	1.2	3.4
165.	Sping lobster	81.2	4.8	13.4
166.	Cuttle fish	80.8	2.1	4.2
167.	Octopus	83.6	3.8	8.2
168.	Sea cucumber	93.0	4.3	9.2
169.	Fried fish	65.8	2.8	4.7
SEA WEEDS				
170.	Agar-agar	22.3	2.0	4.9
171.	Laver, Korean type	14.3	10.8	13.3
172.	Japanese type	12.8	11.6	20.2
173.	green, dried	4.0	22.6	35.4
174.	Tangle, fresh	91.2	2.8	3.6
175.	dried	15.2	5.6	19.1
176.	DA SHI MA	15.0	12.1	16.6
MILK AND MILK PRODUCTS				
177.	Cows milk, whole, fluid	88.7	4.0	4.9
178.	powder	2.2	4.1	10.3
179.	modified, dried	2.3	5.6	8.6
180.	Goat's milk	88.4	0.7	1.2
181.	Human milk	88.7	3.2	5.3
182.	Cheese	38.4	1.2	13.0
183.	Ice cream, vanilla	70.1	1.8	2.0
184.	Yoghurt	78.3	0.5	10.0
OIL AND FATS				
185.	Butter	16.3	0.9	2.4

Item No.	Food & Description	Water(%)	Lactobacillus Casei	
			Free folate	Total folate
			ug/100 g	ug/100 g
186.	Lard	0	1.1	1.8
187.	Margarine	15.8	1.3	2.0
188.	Sesame oil	0	6.1	12.0
189.	Shortening	0	1.3	1.9
190.	Soybean oil	0	5.8	11.9
191.	Tallow	0	0.9	2.0
192.	Vegetable oil, all kinds	0	3.9	8.1
MISCELLANEOUS Beverages				
193.	Cider, sweetened	92.2	0.9	1.2
194.	Cola type	91.0	0	0.9
195.	SKI HEI(sweet rice beverage)	78.3	1.8	3.3
196.	barley tea	98.5	0.8	1.1
197.	Black tea	98.9	0	0.9
198.	Boxthorn tea	97.9	0.6	1.0
199.	Chocolate flavor tea	97.6	0.8	1.2
200.	Cinnamon tea	98.8	0	0.5
201.	Citron tea	98.2	0	0.9
202.	Coffee	98.0	1.0	1.8
203.	Corn tea	97.4	1.2	2.3
204.	Ginger tea	98.3	0	0.8
205.	OMIJA tea	98.9	0	0.9
206.	SSANG-WHA tea	98.1	0.6	1.2
BEER, WINE AND LIQUOR				
207.	Beer		1.0	2.3
208.	CHUNG JOO, "Clean wine"		0	1.3
209.	TACK JOO, Korean drink brewed with rice, "milk colored wine"		0.8	2.0
210.	SO JOO, Korean spirit "burning wine"		0.6	2.4
211.	Wine, red		0	2.6
212.	white		0.3	2.2
SEASONINGS AND OTHERS				
213.	Black pepper powder	12.3	0.1	0.4
214.	Curry powder	7.3	0	0.1
215.	M.S.G.	1.2	0.6	1.5
216.	Mayonnaise	16.2	1.3	2.9
217.	Red pepper powder	21.2	0.2	0.6
218.	Toasted sesame powder	7.3	4.3	6.9
219.	Tomato Catsup	70.2	1.3	3.9
220.	Vinegar	96.3	0	0.6
221.	Soy sauce	72.3	5.8	17.6



Item No.	Food & Description	Water(%)	Lactobacillus Casei	
			Free folate	Total folate
			ug/100 g	ug/100 g
222.	Japanese	73.6	5.9	14.5
223.	Fermented soybean paste	54.5	29.1	39.8
224.	Fermented soybean paste with red pepper powder	49.8	29.6	44.5
225.	NATTO, fermented soybean	60.3	20.4	72.8
226.	Yeast, dried, brewer's	7.6	160.3	2800.8

beans 66.9 ug<sup>23</sup> contained the least and yellow soybean 180.7 ug total per 100 g the most. All nuts and seeds contained at least 50 ug total folate per 100 g showing considerably high folate activity levels, also. Within the vegetable group, folate activity varied widely among the raw foods, from a low of 3.1 ug total folate per 100 g in garlic to a high of 150.7 ug in spinach<sup>23</sup>. Generally speaking, leafy green vegetables provided high folate levels. Values for each listed vegetable in the cooked state were not assayed in this study and should be expected to show a considerable amount of folate lost. Among fungi and mushroom, Juda's ear contained the least 14.8 and fungus the most 44.6 ug total per 100 g.

Among the meat and meat products, liver is the best source of folate; Beef liver 143.2 and pork liver 110.5 ug total per 100 g. Muscle meats were not good sources of folates. Beef, dogmeat, pork and poultry had all less than 10 ug total per 100 g. Organ meat, such as kidney, is higher in folate than are muscle meats, though not as high as liver. Most of the folate activity in eggs is in the yolk.

Fish and shellfish showed rather low folate activity in each individual food. Dried yellow tail runner, at 29.6 ug total per 100 g, contained the highest activity among this group. Fish soured were all very poor sources of folate. Sea weeds, such as dried green laver containing 35.4 ug total folate per 100 g, were among the best sources in this group.

Milk products had low amounts of folate activity. Whole cow's milk and human milk contained

about 5ug total per 100 g. Both sources of milk contribute in normal diets of infants at an adequate level to prevent deficiency, as pointed out by Sullivan et al<sup>9</sup>. On the other hand, goat's milk contained only 1 ug total per 100 g indicating that a baby being fed it should develop the deficiency syndromes and need folate supplementation.

Oils and fats were very poor sources of folate, although vegetable oil of any kind had considerably higher sources in this group.

Beverages had almost no folate activity. Seasonings fall in the same category as in beverage group, though fermented soybean products had much higher folate activity. Yeast 2800.8 ug total per 100 g contained the highest folate activity among all the foods assayed.

As a whole, data presented here agrees closely with other reported data<sup>6-10</sup>, nevertheless, some food items have quite different values even though a similar assay technique was employed. Thus, it becomes clear that the results are doubtless due to the differences such as the kind of foods, method of storing food, active derivatives of food itself, variation in maturity, differences affected by season, soil produced food as well as actual differences in folate content between food samples.

Data for free and total folate differ little for many food items, indicating that most of the folate is in the free form. However, some food items showed many fold enhancement of total folate activity. Therefore, the predominant chemical form of folate varies, supporting the folate variation pattern in each individual food as shown

in the previous study<sup>2)</sup>.

Tamura and Stokstad<sup>1)</sup> have reported data that is consistent with the folate variations. These folate variations, and other influential factors<sup>2,3)</sup> suggest that in the calculation of dietary folate intake, total, rather than free folate activity levels should be used.

In the aspect of assessing dietary, the special attention for the additional losses should be given during meal preparation and processing. Decreases in folate activity in cooked and processed foods result from both destruction and leaching into the cooking water as reported in the several studies<sup>12-16)</sup>. The extent of such losses also varies in many studies. Data presented here agrees well with reports showing that, almost always, processed or cooked foods were lower in folate activity than the fresh and raw state. It is also found the amount of decrease varies greatly among foods.

Loss of free folate appeared to be greater than of total folate. In a study by Tagauchi et al<sup>15)</sup>, loss of folate measured in nineteen foods was measured and reported 10 to 50 per cent of free folate remained and 20 to 90 per cent of total folate remained after 5 min. boiling. After foods had been boiled for 15 min., only 5 to 10 per cent free folate remained and 20 to 40 per cent total folate remained. Huskisson et al<sup>16)</sup> studied twenty-eight foods for folate retention after they had been cooked and reported that 27 per cent for free folate and 55 per cent for total folate were a mean retention. Therefore, retention of folate activity during cooking and processing of foods should be considered as a major concern in appraising diets and food supplies.

With the limitations discussed above, the reported data serve as a possible guide in providing information of the potential folate intakes to meet a dietary adequacy and plan of requirement.

## SUMMARY

In continuation of the previous studies<sup>2-3)</sup>, the

folate activity levels in 226 Korean food items were determined by a modified microbiological assay with *Lactobacillus casei*. There was a large variation in folate activity between the different food groups as well as between each individual food. There was also a wide variation in the biologic availability of folate in foods and the different forms of the folate with different foods in varying amounts. Data showed that almost always, foods cooked and/or processed were lower in folate activity than fresh or raw food and the amount of the loss varied greatly in each food.

In calculating dietary intake, total rather than free folate activity levels should be used. In addition, loss of folate activity during cooking and processing of foods should be considered as a major concern for appraising diets and food supplies.

Among all assayed food items, including Part I<sup>2)</sup> and II<sup>3)</sup>, yeast 2800.8 ug total per 100g the highest folate level. Soybean, spinach, Shepherd's purse and liver of beef and pork had over 100 ug total per 100 g folate activity. Folate ranging over 50 ug total per 100 g was found in all dried legumes, nuts and seeds assayed, Garland Chrysanthemum, leek, mugwort, water cress, asparagus, egg yolk and beef kidney. Wheat, sweet potatoes, dried fungus, green onion, hotred pepper, lettuce, radish and some fermented soybean products had considerably higher folate content ranging around 40 ug total per 100 g. Substantial amounts of folate were not found in many food groups, and among specific groups, in part in starch, sweets, fruits, meat, fish, milk, and cooked and processed foods. Soused fish, oils and fats, beverages, liquor and seasonings, other than fermented soybean products, had almost no folate.

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