July 2004

ARSENIC IN SEAWEED

The Food Standards Agency has completed a survey of total and inorganic arsenic in five varieties of imported seaweed. Results from this survey showed that one seaweed variety, hijiki, contains a significant level of inorganic arsenic, which is known to add to the risk of people getting cancer if it is regularly consumed. Arsenic is present in food in various chemical forms, with inorganic forms being the most toxic. Most arsenic in the diet is present in the less harmful organic forms.

The key facts of this survey are:

- The survey was commissioned following a report that the Canadian Food Inspection Agency was advising consumers to avoid the consumption of hijiki seaweed due to its high inorganic arsenic content.

- Concentrations of total and inorganic arsenic were measured in a total of 31 samples covering five varieties of seaweed (arame, hijiki, kombu, nori and wakame) found in a range of outlets in the London area. A list of the samples is provided in Table 1, below. Analysis was carried out by the Central Science Laboratory, Sand Hutton, York.

- Seaweed is generally sold in dried form. Where preparation by soaking was recommended prior to consumption, measurements were carried out on both the initial and prepared forms and on the water collected after soaking.

- Arsenic was detected in all samples. In most cases it was present in organic forms, which are not thought to represent a significant risk to health. Inorganic arsenic, a form that can cause cancer, was only detected in the nine samples of hijiki seaweed analysed. All of the results of the tests are shown in Table 2.

- Consumption of hijiki seaweed would significantly increase daily dietary exposure to

inorganic arsenic. **Consumers are therefore advised not to eat hijiki seaweed.**

A copy of the final report of this survey has been placed in the FSA Library – address details above. If you wish to consult a copy, please contact the library for an appointment giving at least 24 hours notice or, alternatively, copies can be obtained from the Library: a charge will be made to cover photocopying and postage.

Table 1. Seaweed samples purchased

Variety	Country of Origin	Brand	Retailer	Weight (g)
Hijiki	Japan	Hime	Japan Food Centre	113.4
	Japan	Fujikko Calendar	Arigato	12
	Japan	Fujikko Calendar	Oriental City	12
	Japan	Clear Spring	Harvey Nichols	50
	Japan	Clear Spring	Planet Organic	50
	Japan	Daichu	www.mountfuji.co.uk	24
	Japan	Sanchi	B Green Health Foods	60
	Japan	Otomegusa	Atari Ya	35
	Japan	Yamachu Naga	Arigato	30
Arame	Japan	Clear Spring	Sainsbury	50
	Japan	Clear Spring	Planet Organic	50
	Japan	Clear Spring	Harrods Food Hall	50
Wakame	Korea	Wel-Pac	Arigato	56.7
	Korea	Wel-Pac	Arigato	57
	Korea	Wang	Arigato	28
	Unknown	Riken	Harrods Food Hall	20
	Japan	Clear Spring	Sainsbury	50
Kombu	Unknown	Shirakiku	Arigato	57
	Japan	Clear Spring	Harrods Food Hall	50
	Japan	Clear Spring	Harvey Nichols	50
	Korea	Wel-Pac	Japan centre	114
	USA	Hime	Arigato	85
	Japan	Clear Spring	Planet Organic	50
	Japan	Kizami	Japan Centre	16
Nori	China	Nagai's	Japan Centre	28
	Japan	Clear spring	Harvey Nichols	13.5
	Japan	Sanchi	Sainsbury's	25
	China	Yukata	Waitrose	11
	Unknown	Blue Dragon	Tescos	10
	Unknown	Shirako	Mount Fuji (internet)	Not available
	USA	Shirakiku	Arigato	25

Table 2. Concentrations of total and inorganic arsenic in 31 samples of edible seaweed before and after preparation[1]

	Arsenic Concentration					
	As Sold		As Prepared		Soaking Water	
Variety	Total arsenic (mg/kg)	Inorganic arsenic (mg/kg)	Total arsenic (mg/kg wet weight)	Inorganic arsenic (mg/kg wet weight)	Total arsenic (mg/kg)	Inorganic arsenic (mg/kg)
Hijiki	107	73.0	18.5	13.2	14.1	7.8
	112	80.4	7.9	5.1	1.51	0.9
	116	83.0	11.5	7.9	4.63	2.9
	100	68.8	15.5	10.2	3.37	2.1
	94.6	66.7	13.7	8.3	3.53	2.3
	110	80.5	11.4	7.9	6.02	3.6
	112	76.0	30.9	22.7	2.97	0.4
	102	72.3	8.9	5.5	4.65	4.0
	134	96.1	26.3	18.8	8.20	Not Analysed
Hijiki Average	**110**	**77**	**16**	**11**	**5**	**3**
Arame	32.3	<0.3	2.6	<0.3	1.04	<0.01
	30.7	<0.3	2.7	<0.3	1.10	Not Analysed
	27.9	<0.3	3.4	<0.3	Not Analysed	Not Analysed
Arame Average	**30**	**<0.3**	**3**	**<0.3**	**1**	**<0.01**
Wakame	35.0	<0.3	5.2	<0.3	0.23	<0.01
	41.9	<0.3	6.1	<0.3	Not Analysed	Not Analysed
	34.2	<0.3	4.6	<0.3	0.13	<0.01
	29.2	<0.3	2.6	<0.3	0.09	<0.00
	35.8	<0.3	3.4	<0.3	1.34	<0.01
Wakame Average	**35**	**<0.3**	**4**	**<0.3**	**0.4**	**<0.01**
Kombu	50.8	<0.3	2.3	<0.3	0.28	<0.01
	32.2	<0.3	0.9	<0.3	0.08	<0.01
	68.5	<0.3	6.5	<0.3	Not Analysed	Not Analysed
	75.2	<0.3	5.2	<0.3	0.64	<0.01
	74.6	<0.3	5.8	<0.3	0.69	<0.01
	18.9	<0.3	1.4	<0.3	0.07	<0.01
	28.1	<0.3	2.3	<0.3	0.05	<0.01
Kombu Average	**50**	**<0.3**	**3**	**<0.3**	**0.3**	**<0.01**
Nori	22.7	<0.3	Nori seaweed is not soaked in water before eating			
	22.0	<0.3				
	18.2	<0.3				
	26.2	<0.3				
	31.9	<0.3				
	18.2	<0.3				
	28.6	<0.3				
Nori Average	**24**	**<0.3**				

[1] Concentrations below the limits of detection (LOD) are indicated with a '<' sign.
LOD for total arsenic = 0.02 mg/kg (solids) & 0.003 mg/kg (water).
LOD for inorganic arsenic = 0.3 mg/kg (solids) & 0.01 (water)