Dietary Fibre Contents of Some Traditional Japanese Foods

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Japanese foods and cuisines of many kinds are now available in shops and restaurants in metropolitan Australia. The increased interest in Japanese food is both cultural and nutritional. Japanese people have a low fat intake (OECD 1985). If a dietary fibre intake of 30-40 g/day is considered desirable (Bonfield 1986) Japanese intakes are reasonable (Rutishauser 1985). These dietary characteristics might contribute to a lower incidence of cardiovascular disease and certain cancers, and to the longest life expectancy in the world, now found amongst Japanese (United Nations 1987). Dietary fibre is considered important in the aetiology of a number of non-infectious diseases and has been reported to have physiological effects (Pilch 1987) which could result in hypocholesterolemia (Jenkins *et al.* 1979a), prevention of atherosclerosis (Morris 1977) and improvement of diabetes (Jenkins et al. 1979b, Anderson and Chen 1979). Soluble dietary fibres are likely to be important in their own right, exerting physiological effects which are different from those of soluble fibres (Chen and Anderson 1986, Meittinen 1987). Soluble fibres constitute a considerable fraction of the total dietary fibre in mixed diets (Asp and Johansson 1981). The dietary fibre content of Japanese foods, particularly with regard to soluble and insoluble fractions, is not well documented.

Detailed information about dietary fibre fractions can be obtained by the methods of Southgate (1969) and Englyst *et al.* (1982). These methods, however, are complicated, time-consuming and expensive, particularly for large numbers of food samples. Malik *et al.* (1985) have used a rapid, simple, reproducible and accurate enzymatic-gravimetric method to measure insoluble, soluble and total dietary fibre using a procedure developed by Asp *et al.* (1983). The enzymatic-gravimetric method for determining total dietary fibre has been accepted as an official first approach method by the Association of Official Analytical Chemists (Prosky *et al.* 1985). In the present study we have measured, by the method of Asp *et al.* (1983), the insoluble, soluble and total dietary fibre in some traditional Japanese foods which could be purchased in Melbourne.

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A total of nine traditional Japanese foods, packed in the dried state, were purchased at shops in Melbourne, Australia. These included four noodles, four seaweeds and one mushroom, as listed in Table 1. Each food was milled to pass through a 0.3 mm mesh sieve and kept in a dessicator. Ramen, which contained more than 5% fat was ground in a porcelain mortar and defatted with petroleum ether prior to milling. Duplicate samples of dried powdered foods (0.2 - 1 g of each) were used for the determination of insoluble and soluble dietary fibre using the method of Asp *et al.* (1983), as modified slightly by Malik *et al.* (1985). Samples were treated with Termamyl (Novo, Copenhagen), pepsin (porcine, Merck, Darmstadt) and pancreatin (porcine, Sigma, St. Louis) to remove the starch and protein, and then filtered. Residues were weighed for insoluble dietary fibre. The filtrates, precipitated with ethanol, were again filtered, dried and weighed for soluble dietary fibre. Weighings were repeated after incineration to allow for non-combustible components. The intra-assay coefficient of variation (C.V.) was 3.16% and inter-assay C.V. was 3.30% for total dietary fibre with reference to a standard soft white wheat bran (AACC certified food grade, St. Paul, Min.).

The results of the analyses of soluble, insoluble and total dietary fibre are shown in Table 1. Japanese traditional noodles such as Kishimen, Udon and Ramen, made of wheat flour, and Soba, made of buckwheat flour, showed higher contents of soluble dietary fibre than of insoluble dietary fibre, but low total dietary fibre. This reflects the use of refined flours for these processed foods. A staple food of polished rice in Japan also contains low total dietary fibre (Mori 1982, Malik *et al.* 1985)

On the other hand, the four seaweeds analyzed had high values for total dietary fibre, ranging from 40-55% on the basis of dry matter and 37-52% in the food as eaten. The three values for total dietary fibre in Konbu, Wakame and Hiziki were 1.3-3.1 times higher than those reported by Mori (1982) who measured total dietary fibre basically by the method of Southgate (1969). These differences seem to be due to the fact that the Southgate method does not characterise adequately the soluble polymeric portion of dietary fibre (Furda 1977). The brown algae are known to contain considerable amounts of alginic acid. For example, Hiziki has 15-21%, Wakame 25% and Konbu 17-22% on a dry matter basis (Sager *et al.* 1946, Sakurai 1968). The present total dietary fibre values suggest that

Table 1
Insoluble, soluble and total dietary fibre contents of some Japanese noodles, seaweeds and a mushroom

FOOD Japanese / English name (Botanical name)		Moisture %	Dietary Fibre Content Insoluble	Soluble	Total (Percent of dried food; ± S.D.)	Total dietary fibre in food as eaten (g/100g)
NOODLES						
Kishimen	Wheat noodle	5.51	1.18 ± 0.02	3.27 ± 0.55	4.45 ± 0.55	4.2
Udon	Wheat noodle	4.93	0.95 ± 0.06	1.78 ± 0.08	2.73 ± 0.06	2.6
Ramen	Wheat noodle (fried)	4.00	1.52 ± 0.04	1.59 ± 0.04	3.11 ± 0.09	3.0
Soba	Buckwheat noodle	4.42	2.67 ± 0.11	4.02 ± 0.02	6.68 ± 0.13	6.4
SEAWEEDS						
Nori	Asakusa laver *(Porphyra tenera)*	6.79	24.3 ± 3.68	28.3 ± 0.57	52.6 ± 3.39	49.0
Hiziki	Black sea grass *(Hizikia fusiforme)*	4.92	19.8 ± 0.57	34.8 ± 0.48	54.6 ± 0.57	51.9
Wakame	Wakame seaweed *(Undaria pinnatifida)*	7.68	15.5 ± 0.71	38.2 ± 2.05	53.7 ± 1.35	49.6
Konbu	Kombu *(Laminaria japonica)*	7.98	7.51 ± 0.69	32.2 ± 6.12	39.7 ± 6.90	36.5
MUSHROOMS						
Shiitake	Shiitake fungus *(Lentinus edodes)*	8.01	42.2 ± 2.26	4.55 ± 3.00	46.8 ± 2.60	43.1
REFERENCE STANDARD						
Wheat bran[1]			47.3 ± 1.55	3.05 ± 0.72	50.8 ± 1.61	

[1] *Soft white wheat bran, AACC certified food grade, St. Paul, Minn. USA.*

these seaweeds may contain other kinds of dietary fibre other than those formed from alginic acid.

Of great interest are the high values of soluble dietary fibre for the seaweeds, which ranged from 28-38% on a dry matter basis; the soluble dietary fibre values being as much as 54-81% of total dietary fibre. Soluble fibres have their own physiological effects, but few studies with seaweed fibres have yet been reported.

Shiitake fungus has a high value for total dietary fibre, 46.8% on a dry matter basis and 43.1% in the food as eaten, the greater part of this (90%) being insoluble dietary fibre. This is consistent with the value reported recently in Japan by the Ministry of Health and Welfare (1988).

The Japanese people are estimated to consume approximately 20 g of dietary fibre per capita per day (Ministry of Health and Welfare 1988); with fibre from seaweeds, edible fungi and other vegetables other than green and yellow ones making up more than 25% of the total. We conclude that the Japanese may be the only people in the world who have traditionally eaten seaweeds, which must contribute considerably to their dietary fibre intake and that this must provide a relatively high intake of soluble dietary fibre. Since little is known of the physiological roles for soluble dietary fibre, this field is deserving of further investigation.

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