Dietary fibre content of Australian foods 3. Fruits and fruit products

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The dietary fibre content of a range of fresh and processed fruits ranged from 5.7% for dates to 0.3% for watermelon. Dried fruits had higher fibre contents than fresh fruits, and peeling apples and pears removed 9% and 34% of the fibre content respectively. The proportions of lignin, cellulose and non-cellulosic polysaccharides in the dietary fibre of most fruits were similar to those in vegetables.

The apparent per head consumption of fruit and fruit products has increased by 7% in the five year period to 1986 and has been steadily increasing since 1958-59 (Australian Bureau of Statistics 1987). Citrus and citrus juices accounted for 39.4% of the total apparent consumption. Dried fruit (2.7%) and other processed fruit (7.5%) were consumed in much smaller quantities. However, the contribution of any type of fruit to overall dietary fibre intake will not necessarily be reflected by total apparent consumption data. Dietary fibre content will be affected by processing methods such as peeling, juice extraction and drying as well as differences due to variations in cultivars and horticultural practice. In this paper we present data on the dietary fibre content of a range of fresh and processed fruits.

Materials and methods

Food samples

Samples were purchased on a single occasion either from Geelong supermarkets or from a wholesale fruit supplier who was often able to provide details concerning the variety, growing locality and seasonal availability. Canned and dried fruit were purchased from a local supermarket. Single purchases of each food item were made and the edible portion only was analysed for dietary fibre. Stones of the stone fruit were discarded; the core was removed from apples and pears. Some fruit were divided into halves and analysed with and without skin. Canned fruits in sucrose syrup were either drained for 15 min in a domestic sieve to separate the fruit pieces before freeze drying or the whole can contents were freeze dried. Generally 1 kg of each fruit was peeled or otherwise prepared and sub-sampled by quartering and coning. The sub-sample (approximately 300 g) was freeze-dried to constant weight, comminuted and stored as previously described (Jones & 1985).

Analytical procedures were as described in our previous paper on dietary fibre in vegetables (Jones & 1990).

Results and discussion

The dietary fibre content of fresh fruit (Table 1) was generally within the range 0.5 to 3.5%. As expected, those with substantially more dietary fibre were dried fruits and fruits containing seeds in the edible portion. Exceptions were avocado (7.5%) and fresh pears (3.3% peeled and 5.0% unpeeled) whose higher values can be largely attributed to a lower water content than other fruits. Bananas also have a relatively low water content but our sample had only 1.3% fibre content.

Removing the peel reduces the fibre content in apples by 6-11% and in pears by 34%. Canned pears have only one half the fibre content of peeled Packham pears possibly owing to differences in variety or stage of maturity. The variety used for canning is usually Bartlett. Fresh pineapple on the other hand had 14% less fibre than canned pineapple.

The composition of fruit fibre was typically: lignin 5-10%, cellulose 20-40% and total non-cellulosic polysaccharides (TNCP) 50-70%. The proportion of lignin was higher in boysenberries and raspberries, presumably because of the seeds, and was also high in figs, dates, prunes, raisins and sultanas. However, dried fruits are subject to both enzymic and nonenzymic browning and the end products of these reactions have been reported to analyse as lignin (Southgate 1984). Thus high proportions of lignin in the dietary fibre of such foods must be interpreted with caution. The amounts of insoluble (INCP) and soluble (SNCP) non-cellulosic polysaccarides were also variable. SNCP was obtained by difference: TNCP−INCP. The

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Table 1. Dietary fibre content of fruit (g/100 g dried food except last column which is g/100 g food as eaten).

Fruit	Moisture	INCP*				TNCP†				Cellulose	Lignin	Resistant Starch	Dietary fibre excluding resistant starch	Dietary fibre in food as eaten excluding resistant starch
		Hexoses	Pentoses	Uronic acids	Total INCP	Hexoses	Pentoses	Uronic acids	Total NCP					
Apple (*Golden Del*, peeled)	85	1.11	1.32	0.28	2.71	1.58	2.04	3.27	6.89 (68§)	2.68 (27§)	0.53 (5§)	.0	10.1	1.5
Apple (*Golden Del.*, peeled)	84	0.71	1.27	0.29	2.27	1.36	2.20	3.24	6.80 (65)	2.45 (24)	1.16 (11)	0	10.4	1.7
Apple (*Granny Smith*, peeled)	86	0.48	1.11	0.29	1.88	0.97	1.74	2.83	5.54 (53)	4.23 (41)	0.66 (6)	0	10.4	1.5
Apple (*Granny Smith*, peeled)	85	0.46	1.16	0.22	1.84	0.91	1.70	3.27	5.88 (55)	3.87 (37)	0.81 (8)	0	10.6	1.6
Apricot (SPC, canned, fruit only)	80	0.64	0.80	0.08	1.52	1.92	2.42	2.71	7.05 (64)	3.59 (32)	0.40 (4)	0	11.0	2.2
Apricot (*Moorpark*, unpeeled, excluding stone)	85	0.45	0.67	0.13	1.25	1.20	2.26	4.93	8.39 (67)	3.34 (279	0.72 (6)	0	12.5	1.9
Avocado	68 (21% fat as eaten)	5.81	1.45	0.15	7.41	3.75	10.2	10.5	24.4 (87)	1.28 (5)	2.33 (8)	0	28.0	7.5
Banana	72	0.06	0.05	0.12	0.23	0.87	0.32	1.97	3.16 (67)	1.15 (25)	0.38 (8)	0	4.69	1.3
Boysenberry (John West, canned, fruit only)	73	0.30	1.93	0.43	2.66	1.03	3.08	1.54	5.65 (44)	5.24 (40)	2.02 (16)	0	12.9	3.5
Cantalope	92	0.99	0.31	0.07	1.37	0.82	0.62	2.55	3.99 (57)	2.74 (40)	0.23 (3)	0	6.96	0.56
Cherry (flesh only)	90	0.24	0.38	0.05	0.67	0.71	1.24	2.23	4.18 (72)	1.00 (17)	0.62 (11)	0	5.80	0.58
Date	11	0.42	1.55	0.27	2.24	0.79	1.70	1.53	4.02 (63)	1.37 (21)	1.03 (16)	0	6.42	5.7
Grape (seedless)	85	0.11	0.25	0.03	0.39	0.39	0.55	1.62	2.56 (58)	1.36 (31)	0.47 (11)	0	4.39	0.66
Melon (Honeydew)	91	0.39	0.53	0.01	0.93	0.75	0.85	1.57	3.17 (50)	2.68 (42)	0.51 (8)	tr (12)	6.36	0.57
Nectarine	90	1.62	0.87	0.02	2.51	2.48	3.14	5.40	11.02 (77)	1.59 (11)	1.75 (12)	0.12	14.4	1.4
Orange (*Valencia*)	86	0.52	0.52	0.25	1.29	1.44	1.75	4.34	7.53 (68)	2.55 (23)	0.97 (9)	0	11.05	1.5
Passionfruit	73	0.55	2.67	0.69	3.91	1.13	2.59	1.70	5.42 (38)	5.07 (35)	3.93 (27)	0	14.4	3.9
Paw Paw	89	0.38	0.39	0.06	0.83	1.37	0.71	5.18	7.26 (68)	2.55 (24)	0.83 (8)	1.0	10.6	1.2
Peach (unpeeled)	85	0.52	0.95	0.10	1.57	1.89	3.16	5.04	10.1 (739	3.38 (25)	0.31 (2)	0	13.8	2.1
Peach (Ardmona, Canned, fruit only)	86	0.83	1.07	0.11	2.01	2.11	3.73	2.08	7.92 (62)	4.53 (36)	0.24 (2)	0	12.7	1.8
Pear (Ardmona, canned, fruit only)	83	0.72	2.29	0.23	3.31	1.87	5.63	2.55	10.1 (63)	4.61 (29)	1.31 (8)	0	16.0	2.7
Pear (Ardmona, canned, fruit and syrup)	84	0.53	2.18	0.15	2.86	1.21	3.76	1.97	6.94 (66)	2.84 (27)	0.74 (7)	0	10.5	1.7
Pear (*Packham*, peeled)	78	0.26	2.26	0.22	2.74	1.31	5.34	3.32	9.97 (66)	4.19 (28)	0.99 (6)	0	15.2	3.3
Pear (*Packham*, unpeeled)	73	1.96	4.82	0.34	7.12	1.46	6.74	3.41	11.6 (629	5.11 (27)	1.95 (11)	0	18.7	5.0
Pineapple (fresh)	87	0.62	2.49	0.12	3.23	1.14	3.29	0.72	5.15 (54)	3.74 (40)	0.57 (6)	0	9.46	1.2
Pineapple (Golden Circle, canned, fruit only)	83	1.20	2.25	0.08	3.53	2.20	2.25	0.49	4.94 (59)	3.13 (37)	0.33 (4)	0	8.40	1.4
Plum (*Narrabeen*)	86	0.59	0.48	0.08	1.15	1.87	0.91	3.62	6.40 (70)	2.31 (26)	0.38 (4)	0	9.09	1.3
Prune	35	0.70	0.90	0.18	1.78	1.82	0.90	0.94	3.66 (49)	1.38 (19)	2.36 (32)	0.11	7.40	4.8
Raisin (Sunbeam)	9	0.08	0.38	0.06	0.52	0.29	0.53	1.39	2.21 (56)	1.08 (27)	0.67 (17)	0	3.96	3.6
Strawberry (fresh)	90	0.35	0.76	0.21	1.32	1.16	1.24	4.55	6.95 (66)	2.85 (27)	0.81 (7)	0	10.6	1.1
Sultana (Sunbeam)	7	0.16	0.5	0.02	0.68	0.44	0.19	0.83	1.46 (51)	0.68 (24)	0.70 (25)	0	2.84	2.6
Watermelon	90	0.05	0.35	0.12	0.52	0.92	0.20	0.37	1.80 (60)	0.75 (25)	0.46 (15)	0	3.01	0.3
AACC Wheat Bran (n=23)	8	3.05	26.1	0.37	29.9	4.79	26.5	0.75	31.8 (75)	7.70 (17)	3.32 (8)	0.69	42.6	39.2
Tasmania Pear Standard (n=9)	9	1.31	4.15	0.44	5.90	1.42	6.17	2.97	10.6 (64)	3.88 (23)	2.12 (13)	tr	16.6	—

* INCP = Insoluble non-cellulosic polysaccharides

‡ TNCP = Total non-cellulosic polysaccharides.

§ Numbers in parentheses are % of total dietary fibre.

majority of fruits have substantially more SNCP than INCP components. The highest relative proportions of SNCP are found in nectarine, orange and peach. In unpeeled pear and pineapple there was more INCP than SNCP. Pear, pineapple and prune were also atypical in that they contained more pentosan and uronan polysaccharide polymers in the INCP than in the soluble fraction. Overall, the amounts and composition of NCP in fruit were generally similar to those in vegetables (Jones & 1990) except that the former have a slightly higher uronan content.

Since fruits do not usually contain significant amounts of starch it was not surprising that resistant starch was mostly absent except for small amounts in prune, paw-paw and nectarine.

Table 2. Dietary fibre content of some fruits found by different authors (g/100g edible portion).

Fruit	Present report	Paul & Southgate (1978)	Souci & (1986)	Wills & (1985, 1986 a, b, 1987)
Apple	1.5	2.0	2.3	2.3
Banana	1.3	3.4	2.0	2.8
Orange	1.5	2.0	2.2	2.0
Passionfruit	3.9	15.9	1.45	13.9
Pear (canned)	1.7	1.7	1.1	3.0
Pineapple	1.4	0.9	0.9	2.2
Plum	1.3	2.1	1.7	2.0
Strawberry	1.1	2.2	2.0	1.4

The data were compared with published values for dietary fibre content of foods in the UK (Paul & Southgate 1978), West Germany (Souci & 1986) and Australia (Wills & 1985, 1986a, 1986b, 1987). These authors used different methods of analysis to generate their data although the West German and Australian procedures were similar in principle. Not all fruits were included in each set of data; but where comparisons could be made there was considerable variation (Table 2). For many fruits there was no consistant pattern to the differences in values reported except that our values were usually lower. The reason for this is not clear, but it has been reported elsewhere (Prosky & 1984) that gravimetric procedures of analysis, such as used by the AOAC, which are similar to those used by the West German and Australian authors, generally give higher values for total dietary fibre than does the Englyst & (1982) protocol. The discrepancies in some cases were large, for example passionfruit. This may reflect the difficulty of obtaining a small representative analytical sample from a heterogenous food which could contain quite variable proportions of seed and flesh. Also, our result for avocado (7.5 g) was considerably higher than those reported by others (1.6 g and 3.3 g). The reasons for these differences are probably multifactorial and will include fruit variety, seasonal factors, degree of maturity, and processing and analytical variations.

With the increasing use of standardised analytical methods such as that proposed by the AOAC (Prosky & 1985) it should prove easier in the future to attribute any observed differences to food itself. However, these methods will not provide detailed compositional data such as that presented in the present paper, which may be important as predictors of the effect of fibre on human gut function.

Detailed information concerning the monosaccharide composition of the fibre fractions reported in this and other papers in this series can be obtained directly from Dr GP Jones.

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