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Subethnic variation in the diets of Moslem, Sikh and Hindu pregnant women at Sorrento Maternity Hospital, Birmingham

BY P. A. WHARTON, P. M. EATON* AND B. A. WHARTON†

Sorrento Maternity Hospital, Birmingham B13 9HE

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1. The previous paper (Eaton *et al.* 1984) described the nutrient intake of pregnant Asian women attending Sorrento Maternity Hospital, Birmingham using the weighed and recall methods. The present paper describes the subethnic variation in nutrient intake by comparing the results from Pakistanis, Sikhs, Hindus and Bangladeshis and also describes food eaten by the pregnant women.

2. Generally, Sikhs had the highest intake of most nutrients (mean energy 7·5 MJ (1800 kcal)/d) and the greatest variety of foods; they ate chapatti and paratha but few ate meat. Hindus had a very similar diet but more ate meat, chicken and rice. Pakistanis had an energy intake about 10% below that of the Sikhs and Hindus; meat was eaten, and intake of fruit, and therefore vitamin C, was quite large. Bangladeshis were the smallest women; they had the lowest intake of energy (mean energy 6·5 MJ (1555 kcal)/d) and most nutrients, except for protein, so that 15% of energy was provided by protein. Fish, rice and a low-fat intake were other features of their diet.

3. From a nutritional standpoint, peoples coming from the Asian subcontinent should be divided into subethnic groups; the collective term 'Asian' is insufficient.

4. It is not clear whether these differences have any effect on the life and health of the individuals. Comparison of groups does not suggest an obvious relationship between dietary intake and fetal growth; however, there is other evidence to implicate the possible role of deficiencies of protein, energy, zinc and pyridoxine.

5. The results provide some support for the community nutritional policies of (a) offering vitamin D supplements to all pregnant Asian women and (b) fortifying bread with calcium, thiamin and nicotinic acid. There is probably no need to offer vitamin A and C supplements but they are harmless. Indications for iron supplementation are no different from those for white English women.

The nutrient intake of Asian women during the second and third trimesters of pregnancy has been described in the previous paper (Eaton *et al.* 1984). The present paper describes the subethnic differences in the nutrient intake, and the different kinds of food eaten by the expectant Sikh and Hindu mothers originating from India (although some came to Britain via East Africa) and the expectant Moslem mothers from Pakistan and Bangladesh.

METHODS

Determinations of the dietary intakes using the weighed and recall methods were made exactly as described in the previous paper, that is at five-weekly intervals from 18 weeks of pregnancy.

The number of women in each subethnic group at each 5-week interval was sometimes small, however. Therefore, for each subethnic group, the results for 18, 23, 28 and 33 weeks have been combined and presented together. This seemed valid since the total energy intake showed little change between 18 and 33 weeks (Durnin *et al.* 1983; Eaton *et al.* 1984). Values at 38 weeks of pregnancy have not been included in the combined presentation; some women had delivered before 38 weeks and in others who had not delivered there was a marked fall in intake.

The largest number of women was assessed at 23 weeks and details of these are given as a representative group. Table 1 shows the social and anthropometric details of the women

* Present address: Dudley Road Hospital, Birmingham.
† For reprints.

Table 1. *Details of Asian women from the four subethnic groups, studied at 23 weeks of pregnancy, and their babies at birth (recall method)*

Subethnic group...	Pakistani moslem	Sikh	Hindu	Bangladeshi moslem
No. of women...	37	15	11	5
Description:				
Mean age at booking (years (SD))	23 (3·8)	23 (4·4)	24 (5·1)	23 (5·8)
No. of primiparae (%)	16 (43)	8 (53)	6 (55)	1 (20)
Anthropometry (mean (SD)):				
Height (m)	1·573 (0·063)	1·545 (0·068)	1·571 (0·051)	1·48 (0·066)
Wt (kg)	59·2 (11·0)	54·7 (9·0)	55·9 (5·5)	49·8 (4·8)
Triceps skinfold thickness (mm)	17·9 (4·7)	17·1 (5·5)	16·4 (3·6)	13·2 (3·5)
Social circumstances (no. (%)):				
Social class IV or below	24 (65)	5 (33)	6 (55)	2 (40)
> 1·5 persons per room	8 (22)	5 (33)	—	1 (20)
No English or single words only	27 (73)	9 (60)	2 (19)	5 (100)
< 2 years in Britain	20 (54)	6 (40)	4 (36)	2 (40)
No education or primary school only	19 (51)	4 (27)	1 (9)	1 (20)
Baby:				
Mean wt (kg (SD))	3·17 (0·49)	3·14 (0·36)	2·78 (0·63)	3·19 (0·37)
< 2·5 kg (no. (%))	4 (11)	—	2 (18)	—

at 23 weeks from the four subethnic groups studied. Generally, the Sikhs, Hindus and Bangladeshis were better educated and from higher social groups than the Pakistanis. The Bangladeshi women were shorter and were lighter than the other women.

Feast and fast days have been included in the observations since these occurred quite frequently, and it was thought that to exclude them would present an atypical picture of intake. Further details on geographical origin of the women are given in the *Sorrento Asian Food Tables* used in dietary analysis (Wharton *et al.* 1983).

RESULTS

Results from the four subethnic groups are presented in four ways: (1) mean daily intakes of energy and nutrients during pregnancy: combined recall results from 18 to 33 weeks (Table 2); (2) mean daily energy intakes and contribution of energy from the three proximates: combined recall results from 18 to 33 weeks (Fig. 1); (3) intakes of energy and selected nutrients by individual women at 23 weeks: weighed and recall results (Fig. 2); (4) food selection by the mothers: combined weighed and recall results from 18 to 33 weeks (Table 3).

The results are self-explanatory but it is possible to summarize some of the subethnic differences.

Pakistanis

The intakes of nutrients by Pakistani women were mostly above the amounts consumed by the Bangladeshis but below the Sikh and Hindu values. Total energy intake was about 10% below the Sikh and Hindu values and similar to the Bangladeshi values; the

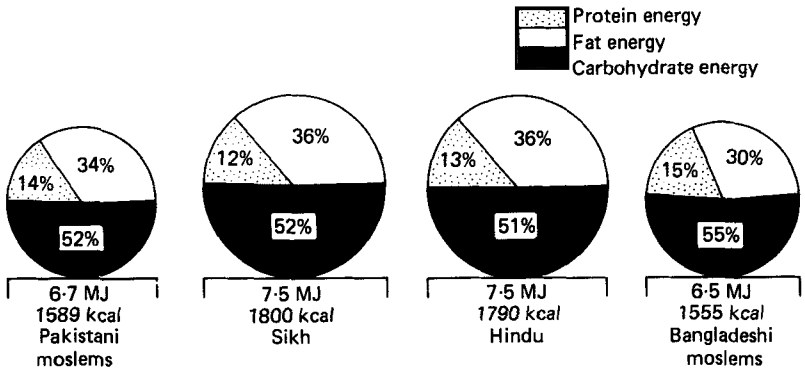

Fig. 1. Mean daily energy intakes and contribution of energy from the three proximates: combined recall results from 18 to 33 weeks of pregnancy.

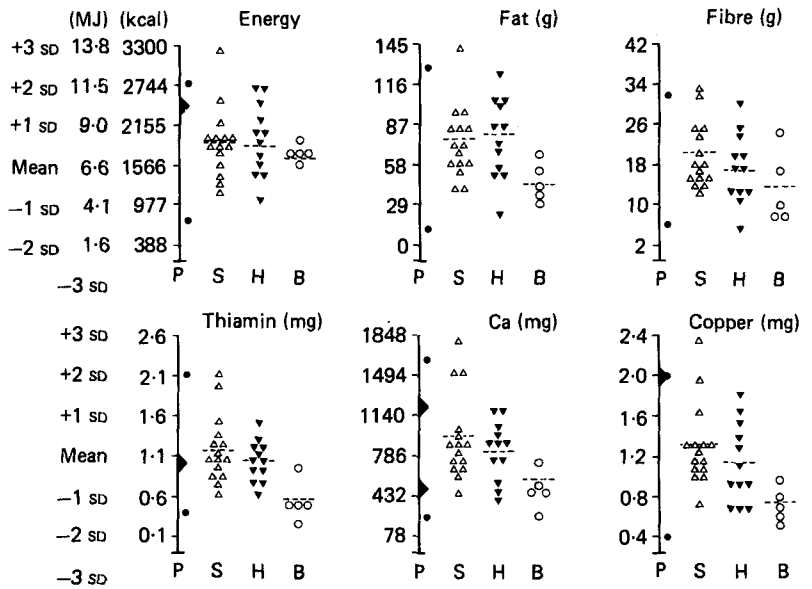

Fig. 2. Daily intakes of energy and selected nutrients by individual women at 23 weeks of pregnancy: weighed and recall methods. Values are means and 3 SD of the intake of thirty-seven Pakistani (P) women at 23 weeks. (●), Range of intake; (▶), UK recommended daily amounts (RDA; Department of Health and Social Security, 1979). For calcium the RDA for the 2nd and 3rd trimesters are shown. S, Sikhs; H, Hindus; B, Bangladeshis.

contribution of energy from the three proximates was similar in the Pakistanis, Sikhs and Hindus. Whilst the intakes of certain vitamins were below the Sikh values the intakes of most vitamins and certain minerals were above the Bangladeshi values.

The Pakistani women ate an 'English' style breakfast, and preferred butter as their table fat. Cornflakes were the favourite breakfast cereal but porridge oats, Rice Krispies and Weetabix were commonly eaten. Chapatti and paratha were the staples; meat and sometimes eggs were often eaten at a main meal. Fruit was popular so that intakes of vitamin C above 60 mg daily were common.

Table 2. *Mean daily intakes of energy and nutrients during pregnancy by subethnic*

Subethnic group...	Pakistani moslems (P) (*n* 90)			Sikhs (S) (*n* 36)		
	Mean	Range	Statistically significantly different from mean in other groups	Mean	Range	Statistically significantly different from mean in other groups
Energy (MJ)	6·7	2·1–18·1	—	7·1	3·9–16·2	—
Energy (kcal)	1589	488–4316	—	1800	940–3872	—
Protein (g)	56	16–210	—	53	24–106	—
Fat (g)	59	14–219	—	60	35–186	—
Carbohydrate (g)	221	64–522	—	253	103–397	—
Dietary fibre (g)	17	3–43	S	21	8–46	P, H, B
Sodium (g)	1·7	0·5–5	—	2·1	529–4604	—
Potassium (g)	1·9	0·4–6·1	—	2·3	697–6144	—
Calcium (mg)	791	228–2015	B	912	405–2244	B
Magnesium (mg)	232	50–610	B	256	95–379	B
Iron (mg)	11	3–32	—	12	5–28	—
Copper (mg)	1·1	0·3–2	B	1·2	0·5–2·9	—
Zinc (mg)	7·3	2·2–28·7	—	6·4	2·9–14·9	—
Sulphur (mg)	369	17–1682	B	333	96–775	H, B
Retinol (μg)	320	0–1089	S	455	181–1850	P, B
Carotene (μg)	1042	43–8121	B	1789	166–8369	B
Vitamin D (μg)	0·9	0–4·6	B	0·98	0·2–3·4	—
Thiamin (g)	1·07	0·2–2·8	H, B	1·21	0·5–2·2	H, B
Riboflavin (g)	1·15	0·2–3·3	S	1·39	0·5–2·8	B
Nicotinic acid (mg)	9·5	3–37	B	10	3·4–20·9	B
Tryptophan (60 mg)	12	3–46	S	11	6–21	—
Vitamin C (mg)	48	2–178	B	45	6–283	B
Vitamin E (mg)	2·2	0·2–7·6	S	2·77	0·4–7·6	P
Vitamin B_6 (mg)	1·02	0·2–2·7	B	1	0·4–1·9	—
Vitamin B_{12} (μg)	2·2	0·0–16·5	B	2·07	0·1–6·0	—
Folic acid (μg):						
Free	70·0	10–193	B	63	28–168	—
Total	116·0	26–336	B	130·7	57–389	B

There were no intergroup differences for phosphorus, chloride, pantothenate or biotin.

RDA, recommended daily amounts; RE, retinol equivalents (1 retinol equivalent = 1 μg retinol or 6 μg carotene or 12 μg other biologically-active carotenoids); NE, nicotinic acid equivalents (1 nicotinic acid equivalent = 1 mg available nicotinic acid or 60 mg tryptophan); αTE, α-D-tocopherol equivalent (1 mg α-D-tocopherol = 1 αTE).

† RDA for food energy and nutrients for groups of people in the UK for women aged 18–54 years (assumed pre-pregnancy weight 55 kg) plus extra for pregnancy (Department of Health and Social Security, 1979).

Sikhs

Generally these women had the highest intake of most nutrients particularly when compared with the Bangladeshi values. A greater variety of foods was in common use. Breakfast was 'English' with butter the preferred table fat and Cornflakes the cereal of choice. Chapatti and paratha were the staples but less than 10% ate meat at either of the main meals. Dietary fibre intake was significantly higher than in other groups.

Hindus

Quantitative intakes and the pattern of food consumption were very similar to the Sikh values except that more meat, chicken and fish were consumed and more ate rice. They

groups of Asian women: combined recall results from 18 to 33 weeks gestation

Hindu (H) (*n* 29)			Bangladeshi moslems (B) (*n* 10)			
Mean	Range	Statistically significantly different from mean in other groups	Mean	Range	Statistically significantly different from mean in other groups	RDA*
7·5	4·5–12·5	—	6·6	2·6–8·2	—	—
1790	1080–2981	—	1555	627–1955	—	2400†
60	29–117	—	59	16–118	—	60†
72	35–152	—	52	23–82	—	—
240	126–322	—	227	95–325	—	—
16	5–30	S	12	4–25	S	—
1·8	0·6–3·7	—	1·7	0·7–3·0	—	1·1§
2·1	1·3–3·6	—	1·4	0·4–2·8	—	1·87§
812	358–1309	B	496	191–754	P, S, H	500†‖
220	143–347	B	143	41–245	P, S, H	450‡
10	6–17	—	9	4–15	—	13†
1·1	0·6–1·8	—	0·7	0·3–1·2	P, S, H	2§
7·2	3·1–20·8	—	6·7	2·2–11·9	—	20‡
468	181–1036	S	597	211–1091	P, S	—
368	107–760	—	280	124–486	S	750†^{RE}
1877	103–8808	B	249	113–425	P, S, H	—
1·3	0·1–4·9	—	1·51	0·7–3·6	P	10†
0·97	0·57–1·64	P, S, B	0·51	0·2–0·9	P, S, H	1†
1·28	0·52–1·78	B	0·91	0·3–1·6	S, H	1·6†
10	4·7–22·5	B	6·17	1·4–10·2	P, S, H	18†^{NE}
12	6·0–26	—	12	4–23	—	—
49	4–174	B	16	2–52	P, S, H	60†
2·4	0·7–3·8	—	2·4	1·3–3·6	—	10‡$^{\alpha TE}$
1	0·7–1·8	—	0·7	0·4–1·1	P	2·6‡
2·17	0·1–7·1	—	3·55	0·9–7·79	P	4‡
60	28–108	—	48	22–65	P	—
114·3	71–226	—	86·9	38·2–125·1	P, S	500†¶

‡ RDA in the USA for women aged 23–50 years plus extra for pregnancy ((US) National Research Council, 1980).

§ USA minimum value quoted for 'estimated safe and adequate daily dietary intake' for non-pregnant adults ((US) National Research Council, 1980).

‖ RDA for 2nd trimester, increases to 1200 in 3rd trimester.

¶ See Eaton *et al.* (1984) regarding accuracy of folate in food tables.

showed great variety in their choice of table fat (42% used margarine, 25% butter, 17% oil; vegetable ghee and lard were occasionally used). Cornflakes were the favoured breakfast cereal.

Bangladeshis

These women had the lowest intake of most nutrients, particularly of various minerals and vitamins. An exception was the higher protein intake so that the proportion of energy provided by protein was higher than in the other groups (15% *v.* Sikhs 12%; see Fig. 1). Breakfast was 'English' like the other groups; over half used butter, one-third chose margarine as table fat, although none ate breakfast cereals. Apart from breakfast, however,

Table 3. *Food selection by the subethnic groups of pregnant Asian women: combined weighed and recall results from 18 to 33 weeks of pregnancy*

(Foods most commonly eaten (by 10% or more of the group) at each meal by the four groups. These are based on the weighed records at 18, 23, 28 and 33 weeks of pregnancy for Pakistanis. In the other three groups, to increase numbers the results are based on the weighed records plus the recall records at 23 weeks of women not having a weighed record at that time)

Subethnic group...	Pakistani moslem		Sikh		Hindu		Bangladeshi moslem	
No. of observations (days)...	142		44		24		29	
Breakfast	Eggs	43	Bread	45	Bread	63	Bread	97
	Bread	28	Table fat	34	Table fat	63	Table fat	90
	Breakfast cereal	19	Breakfast cereal	32	Eggs	42	Eggs	83
	Biscuit/cake	15	Eggs	14	Breakfast cereal	29	Baked beans	10
	Table fat	14	Jam/marmalade	14	Chapatti/paratha	21		
			Chapatti/paratha	11	Biscuit/cake	21		
Snacks	Fruit	46	Tea	77	Tea	58	Tea	17
	Milk	48	Fruit	52	Milk	58	Fruit	14
	Tea	37	Milk	50	Fruit	46	Biscuit/cake	10
	Fizzy drinks and squash	24	Biscuit/cake	41	Biscuit/cake	38		
	Biscuit/cake	14	Bread	39	Fizzy drink and squash	21		
	Bought savoury snacks	11	Fizzy drinks and squash	23				
			Home-made savoury snacks	16	Confectionery and ice-cream	13		
First main meal	Chapatti/paratha	75	Chapatti/paratha	77	Chapatti/paratha	63	Rice	100
	Fruit	35	Cooked vegetables	50	Cooked vegetables	46	Fish	55
	Cooked vegetables	26	Fruit	30	Rice	25	Meat	38
	Meat	16	Dahl	27	Raw vegetables/salad	21	Cooked vegetables	31
	Dahl	15	Raw vegetables/salad	16	Bread sandwich or toast	21	Dahl	17
	Raw vegetables/salad	12	Yoghurt	14	Dahl	17	Chicken	14
	Eggs	11	Bread sandwich or toast	11	Chicken	17		
					Fish	13		
					Chapatti/paratha	83		
Evening meal	Chapatti/paratha	83	Chapatti/paratha	77	Rice	38	Rice	69
	Fruit	39	Cooked vegetables	45	Dahl	38	Fish	55
	Meat	27	Dahl	39	Cooked vegetables	29	Meat	34
	Cooked vegetables	25	Raw vegetables/salad	23	Chicken	21	Cooked vegetables	17
	Raw vegetables/salad	19	Yoghurt	18	Meat	21	Dahl	14
	Dahl	15			Raw vegetables/salad	13	Fruit	14
							Chicken	14

the meal pattern was very different and more limited in variety. Fruit was eaten only occasionally (14% *v.* 46–52% in other groups) and this was probably responsible for the much lower intake of vitamin C. The staple was white rice (not chapatti or paratha) and vegetables were less-commonly eaten. These differences were possibly responsible for the lower intakes of thiamin, nicotinic acid and carotene. This was the only group commonly to eat fish; meat was also popular but milk was not. This combination may account for the higher intakes of protein and vitamin B_{12} but comparatively low intakes of calcium, magnesium and riboflavin.

Their food customs probably also account for the lower intakes of fat. Paratha are made with fat, and fat is commonly added to chapatti. The Bangladeshis ate neither of these staples which were popular with the Pakistanis, Sikhs and Hindus.

DISCUSSION

Subethnic differences

Clearly, from a nutritional standpoint (and probably from others), peoples coming from the Asian subcontinent must be divided into subethnic groups – it is insufficient to use the collective term 'Asian'. There were differences in size (see Table 1) and although the differences in mean energy intake were not large there were substantial differences in the type and range of food selected by women resulting in marked differences in the intakes of certain nutrients.

Nutritional physiology and pathology in pregnancy

Whether these subethnic differences in diet have any effects on the life and health of the individual is not clear. On a group basis it is difficult to point to any effect. All four groups had intakes of energy and nutrients below the recommended dietary amounts (RDA) of various authorities (e.g. Mg, phosphorus, iron, copper, zinc, riboflavin, nicotinic acid, vitamin B_6, folate, vitamin D, vitamin E and biotin) but many RDA are 'safe levels', probably comfortably in excess of many individual's requirements. Despite this many women had normal-sized babies. The Bangladeshis, while eating less of a less-varied diet, had comparatively well-grown babies. On the other hand their diet did contain a greater proportion of protein, and their lower phytate intake would presumably have led to less impairment of trace element absorption (Rheinhold, 1976). The Hindus tended to have small babies yet their dietary intake was generally greater than that of the Pakistanis and Bangladeshis. They ate more chicken, meat and fish than the Sikhs, and phytate intake was below that of the Sikhs and Pakistanis.

Nevertheless, the prevalence of low birth weight in babies born to mothers from the Indian subcontinent is unusually high, and in other studies we have shown that dietary protein–energy supplementation during the third trimester of pregnancy in Asian women who failed to put on fat adequately in the second trimester did lead to enhanced fetal growth (Viegas *et al.* 1982*a*, *b*). We are currently examining the relationship of diet in an individual pregnancy with the outcome of that particular pregnancy. Further work will be necessary to establish the pathophysiological significance of the low (when compared with RDA) intakes of pyridoxine and Zn but it may have implications for fetal growth (Reinken & Dapunt, 1978; Meadows *et al.* 1981).

Implications for nutritional policy in the community

The very low intakes of vitamin D recorded for all groups, together with the known high prevalence of osteomalacia occurring in pregnant Asian women (Watney *et al.* 1971), is further support for the public health policy of advising vitamin D supplements for all

pregnant Asian women. This policy not only affects maternal health but also reduces the prevalence of late hypocalcaemia and risk of convulsions in the babies (Watney *et al.* 1971; Brooke, 1981). The extent to which their vitamin D status is modified by the phytate intake is not clear.

Vitamin tablets provided by the Department of Health and Social Security contain vitamins A and C and iodine. The supplements of vitamin A and C seem unnecessary but harmless. We did not determine I intakes but note that a deficiency occurs in the subHimalayan regions where many of our women came from. In some areas the Indian government is considering carrying out a supplementation programme with I incorporated in oil. The Bangladeshis ate much fish (one of the major sources of I), the Hindus and Sikhs ate fish but less often than the Bangladeshis whilst the Pakistanis rarely did so.

Intake of Fe seemed reasonable so that the indications for supplementation are no different from those for white European women.

The intakes of Ca by some women, particularly the Bangladeshis, were very low. Since they drank little milk but did eat bread the continued fortification of bread with Ca would be useful for this group. In view of our results we suspect that continued fortification of bread with thiamin and nicotinic acid may be useful for some pregnant Asian women.

REFERENCES

Brooke, O. G. (1981). *British Journal of Obstetrics and Gynaecology* **88**, 18–26.

Department of Health and Social Security (1979). *Report of Committee on Medical Aspects of Food Policy* no. 15. London: H.M. Stationery Office.

Durnin, J. V. G. A., McKillop, F. M., Grant, S. & Fitzgerald, G. (1983). *Proceedings of the Nutrition Society* **42**, 162A.

Eaton, P. M., Wharton, P. A. & Wharton, B. A. (1984). *British Journal of Nutrition* **52**, 457–468.

Meadows, N. J., Ruse, W., Smith, M. F., Day, J., Keeling, P. W. W., Scopes, J. W., Thompson, R. P. H. & Bloxham, D. L. (1981). *Lancet* **ii**, 1135–1136.

National Research Council (1980). *Food and Nutrition Board Recommended Dietary Allowances*, 9th ed. Washington DC: National Academy of Sciences.

Phillips, D. R., Wright, A. J. A. & Southgate, D. A. T. (1982). *Lancet* **ii**, 605.

Reinken, L. & Dapunt, O. (1978). *International Journal of Vitamin Nutrition Research* **48**, 341–347.

Rheinhold, J. G. (1976). *Lancet* **ii**, 1132–1133.

Viegas, O. A. C., Scott, P. H., Cole, T. J., Eaton, P., Needham, P. G. & Wharton, B. A. (1982*a*). *British Medical Journal* **285**, 592–595.

Viegas, O. A. C., Scott, P. H., Cole, T. J., Mansfield, H. N., Wharton, P. & Wharton, B. A. (1982*b*). *British Medical Journal* **285**, 589–592.

Watney, P. J. M., Chance, G. W., Scott, P. & Thompson, J. M. (1971). *British Medical Journal* **ii**, 432–436.

Wharton, P. A., Eaton, P. M. & Day, K. C. (1983). *Human Nutrition: Applied Nutrition* **37A**, 378–402.

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