Dietary Reference Intakes (DRIs) for pantothenic acid (mg/day)

Sex	Males				Females			
Age	EAR	RDA	AI	UL	EAR	RDA	AI	UL
0-5 months	-	-	4	-	-	-	4	-
6-11	-	-	5	-	-	-	5	-
1-2 years	-	-	4	-	-	-	3	-
3-5	-	-	5	-	-	-	4	-
6-7	-	-	6	-	-	-	5	-
8-9	-	-	6	-	-	-	5	-
10-11	-	-	6	-	-	-	6	-
12-14	-	-	7	-	-	-	6	-
15-17	-	-	7	-	-	-	5	-
18-29	-	-	6	-	-	-	5	-
30-49	-	-	6	-	-	-	5	-
50-69	-	-	6	-	-	-	5[1]	-
≧ 70	-	-	6	-	-	-	5	-
Pregnant women (amount to be added)					-	-	+1	-
Lactating women (amount to be added)					-	-	+4	-

[1] The values were smoothed in relation to those of the preceding and succeeding age groups. EAR, estimated average requirement; RDA, recommended dietary allowance; AI, adequate intake; UL, tolerable upper intake level

Dietary Reference Intakes (DRIs) for vitamin C (mg/day)

Sex	Males				Females			
Age	EAR	RDA	AI	UL	EAR	RDA	AI	UL
0-5 months	-	-	40	-	-	-	40	-
6-11	-	-	40	-	-	-	40	-
1-2 years	35	40	-	-	35	40	-	-
3-5	40	45	-	-	40	45	-	-
6-7	50	60	-	-	50	60	-	-
8-9	55	70	-	-	55	70	-	-
10-11	70	80	-	-	70	80	-	-
12-14	85	100	-	-	85	100	-	-
15-17	85	100	-	-	85	100	-	-
18-29	85	100	-	-	85	100	-	-
30-49	85	100	-	-	85	100	-	-
50-69	85	100	-	-	85	100	-	-
≧ 70	85	100	-	-	85	100	-	-
Pregnant women (amount to be added)					+10	+10	-	-
Lactating women (amount to be added)					+40	+50	-	-

EAR, estimated average requirement; RDA, recommended dietary allowance; AI, adequate intake; UL, tolerable upper intake level

Dietary Reference Intakes (DRIs) for vitamin A (μg RE/day)

Sex	Males				Females			
Age	EAR	RDA[1]	AI[1]	UL[2]	EAR	RDA[1]	AI[1]	UL[2]
0-5 months	-	-	250	600	-	-	250	600
6-11	-	-	350	600	-	-	350	600
1-2 years	200	250	-	600	150	250	-	600
3-5	200	300	-	750	200	300	-	750
6-7	300	400	-	1,000	250	350	-	1,000
8-9	350	450	-	1,250	300	400	-	1,250
10-11	400	550	-	1,550	350	500	-	1,550
12-14	500	700	-	2,220	400	550	-	2,220
15-17	500	700	-	2,550	400	600	-	2,550
18-29	550	750	-	3,000	400	600	-	3,000
30-49	550	750	-	3,000	450	600	-	3,000
50-69	500	700	-	3,000	450	600	-	3,000
≧ 70	450	650	-	3.000	400	550	-	3,000
Pregnant women (amount to be added)					+50	+70	-	-
Lactating women (amount to be added)					+300	+420	-	-

RE=retinol equivalents. EAR, estimated average requirement; RDA, recommended dietary allowance; AI, adequate intake; UL, tolerable upper intake level. 1 μg RE=1 μg retinol=12 μg β-carotene=24 μg α-carotene=24 μg β-cryptoxanthin. [1] Includes provitamins and carotenoids. [2] Does not include provitamins or carotenoids.

Dietary Reference Intakes (DRIs) for vitamin E (mg/day)[1]

Sex	Males				Females			
Age	EAR	RDA	AI	UL	EAR	RDA	AI	UL
0-5 months	-	-	3	-	-	-	3	-
6-11	-	-	3	-	-	-	3	-
1-2 years	-	-	5	150	-	-	4	150
3-5	-	-	6	200	-	-	6	200
6-7	-	-	7	300	-	-	6	300
8-9	-	-	8	400	-	-	7	300
10-11	-	-	10	500	-	-	7	500
12-14	-	-	10	600	-	-	8	600
15-17	-	-	10	700	-	-	9	600
18-29	-	-	9	800	-	-	8	600
30-49	-	-	8	800[2]	-	-	8	700
50-69	-	-	9	800	-	-	8	700
≧ 70	-	-	7	700	-	-	7	600
Pregnant women (amount to be added)					-	-	+0	-
Lactating women (amount to be added)					-	-	+3	-

EAR, estimated average requirement; RDA, recommended dietary allowance; AI, adequate intake; UL, tolerable upper intake level. [1] Computation was made on α-tocopherol. Vitamins E other thatn α-tocopherol are not included. [2] The value was smoothes in relation to those for the preceding and succeeding age groups.

Dietary Reference Intakes (DRIs) for vitamin D (μg/day)

Sex	Males				Females			
Age	EAR	RDA	AI	UL	EAR	RDA	AI	UL
0-5 months[1]	-	-	2.5(5)	25	-	-	2.5(5)	25
6-11[1]......	-	-	4(5)	25	-	-	4(5)	25
1-2 years	-	-	3	25	-	-	3	25
3-5	-	-	3	25	-	-	3	25
6-7	-	-	3	30	-	-	3	30
8-9	-	-	4	30	-	-	4	30
10-11	-	-	4	40	-	-	4	40
12-14	-	-	4	50	-	-	4	50
15-17	-	-	5	50	-	-	5	50
18-29	-	-	5	50	-	-	5	50
30-49	-	-	5	50	-	-	5	50
50-69	-	-	5	50	-	-	5	50
≧ 70	-	-	5	50	-	-	5	50
Pregnant women (amount to be added)					-	-	+2.5	-
Lactating women (amount to be added)					-	-	+2.5	-

EAR, estimated average requirement; RDA, recommended dietary allowance; AI, adequate intake; UL, tolerable upper intake level. [1]Adequate intakes for an infant who is exposed to appropriate sunlight. The value in parentheses is adequate intakes for those with less sunlight exposure.

Dietary Reference Intakes (DRIs) for vitamin K (μg/day)

Sex	Males				Females			
Age	EAR	RDA	AI	UL	EAR	RDA	AI	UL
0-5 months	-	-	4	-	-	-	4	-
6-11	-	-	7	-	-	-	7	-
1-2 years	-	-	25	-	-	-	25	-
3-5	-	-	30	-	-	-	30	-
6-7	-	-	40	-	-	-	35	-
8-9	-	-	45	-	-	-	45	-
10-11	-	-	55	-	-	-	55	-
12-14	-	-	70	-	-	-	65	-
15-17	-	-	80	-	-	-	60	-
18-29	-	-	75	-	-	-	60	-
30-49	-	-	75	-	-	-	65	-
50-69	-	-	75	-	-	-	65	-
≧ 70	-	-	75	-	-	-	65	-
Pregnant women (amount to be added)					-	-	+0	-
Lactating women (amount to be added)					-	-	+0	-

EAR, estimated average requirement; RDA, recommended dietary allowance; AI, adequate intake; UL, tolerable upper intake level

Dietary Reference Intakes (DRIs) for magnesium (mg/day)

Sex	Males				Females			
Age	EAR	RDA	AI	UL[1]	EAR	RDA	AI	UL[1]
0-5 months	-	-	21	-	-	-	21	-
6-11	-	-	32	-	-	-	32	-
1-2 years	60	70	-	-	55	70	-	-
3-5	85	100	-	-	80	100	-	-
6-7	115	140	-	-	110	130	-	-
8-9	140	170	-	-	140	160	-	-
10-11	180	210	-	-	180	210	-	-
12-14	250	300	-	-	230	270	-	-
15-17	290	350	-	-	250	300	-	-
18-29	290	340	-	-	230	270	-	-
30-49	310	370	-	-	240	280	-	-
50-69	290	350	-	-	240	290	-	-
≧ 70	260	310	-	-	220	270	-	-
Pregnant women (amount to be added)					+30	+40	-	-
Lactating women (amount to be added)					+0	+0	-	-

EAR, estimated average requirement; RDA, recommended dietary allowance; AI, adequate intake; UL, tolerable upper intake level. [1]When the nutrient is obtained from ordinary food, no upper threshold is set. When the nutrient is obtained from a source other than ordinary food, the upper threshold is set at 350 mg/day for adults and 5 mg/kg weight/day for children.

Dietary Reference Intakes (DRIs) for calcium (mg/day)

Sex	Males			Females		
Age	AI	DG	UL[2]	AI	DG	UL[2]
0-5 months						
Breastfed infants	200	-	-	200	-	-
Formula-fed infants	300	-	-	300	-	-
6-11 months						
Breastfed infants	250	-	-	250	-	-
Formula-fed infants	400	-	-	400	-	-
1-2 years	450	450[3]	-	400	400	-
3-5	600	550	-	550	550[3]	-
6-7	600	600	-	650	600	-
8-9	700[4]	700	-	800	700	-
10-11	950	800	-	950	800	-
12-14	1,000	900	-	850	750	-
15-17	1,100	850	-	850	650	-
18-29	900	650	2,300	700	600[4]	2,300
30-49	650	600[4]	2,300	600[4]	600[4]	2,300
50-69	700	600	2,300	700	600	2,300
≧ 70	750	600	2,300	650	550	2,300
Pregnant women (amount to be added)[1]				+0	-	-
Lactating women (amount to be added)[1]				+0	-	-

AI, adequate intake; DG, tentative dietary goal for preventing life-style related diseases; UL, tolerable upper intake level. [1] No additional value is defined; but it is desirable to achieve the adequate intake. When a subject suffers from a placental dysfunction such as pregnancy toxemia, active efforts should be made to consume calcium. [2] Because sufficient studies have not been conducted on the upper threshold, it is not set for those under 17 years. However, it by no means recommends excessive intake or assures the safety of such an intake. [3] Because the adequate intake and the median value of the current intake are close, the former is adopted. [4] The value was smoothed in relation to those of the preceding and succeeding age groups.

Dietary Reference Intakes (DRIs) for phosphorus (mg/day)

Sex	Males				Females			
Age	EAR	RDA	AI	UL	EAR	RDA	AI	UL
0-5 months	—	—	130	—	—	—	130	—
6-11	—	—	280	—	—	—	280	—
1-2 years	—	—	650	—	—	—	600	—
3-5	—	—	800	—	—	—	800	—
6-7	—	—	1,000	—	—	—	900	—
8-9	—	—	1,100	—	—	—	1,000	—
10-11	—	—	1,150	—	—	—	1,050	—
12-14	—	—	1,350	—	—	—	1,100	—
15-17	—	—	1,250	—	—	—	1,000	—
18-29	—	—	1,050	3,500	—	—	900	3,500
30-49	—	—	1,050	3,500	—	—	900	3,500
50-69	—	—	1,050	3,500	—	—	900	3,500
≧ 70	—	—	1,000	3,500	—	—	900	3,500
Pregnant women (amount to be added)					—	—	+0	—
Lactating women (amount to be added)					—	—	+0	—

EAR, estimated average requirement; RDA, recommended dietary allowance; AI, adequate intake; UL, tolerable upper intake level

Dietary Reference Intakes (DRIs) for chromium (μg/day): Provisional

Sex	Males				Females			
Age	EAR	RDA	AI	UL	EAR	RDA	AI	UL
0-5 months	-	-	-	-	-	-	-	-
6-11	-	-	-	-	-	-	-	-
1-2 years	-	-	-	-	-	-	-	-
3-5	-	-	-	-	-	-	-	-
6-7	-	-	-	-	-	-	-	-
8-9	-	-	-	-	-	-	-	-
10-11	-	-	-	-	-	-	-	-
12-14	-	-	-	-	-	-	-	-
15-17	-	-	-	-	-	-	-	-
18-29	35	40	-	-	25	30	-	-
30-49	35	40	-	-	25	30	-	-
50-69	30	35	-	-	25	30	-	-
≧ 70	25	30	-	-	20	25	-	-
Pregnant women (amount to be added)					-	-	-	-
Lactating women (amount to be added)					-	-	-	-

EAR, estimated average requirement; RDA, recommended dietary allowance; AI, adequate intake; UL, tolerable upper intake level

Dietary Reference Intakes (DRIs) for molybdenum (μg /day): Provisional

Sex	Males				Females			
Age	EAR	RDA	AI	UL	EAR	RDA	AI	UL
0-5 months	—	—	—	—	—	—	—	—
6-11	—	—	—	—	—	—	—	—
1-2 years	—	—	—	—	—	—	—	—
3-5	—	—	—	—	—	—	—	—
6-7	—	—	—	—	—	—	—	—
8-9	—	—	—	—	—	—	—	—
10-11	—	—	—	—	—	—	—	—
12-14	—	—	—	—	—	—	—	—
15-17	—	—	—	—	—	—	—	—
18-29	20	25	—	300	15	20	—	240
30-49	20	25	—	320	15	20	—	250
50-69	20	25	—	300	15	20	—	250
≧ 70	20	25	—	270	15	20	—	230
Pregnant women (amount to be added)					—	—	—	—
Lactating women (amount to be added)					—	—	—	—

EAR, estimated average requirement; RDA, recommended dietary allowance; AI, adequate intake; UL, tolerable upper intake level

Dietary Reference Intakes (DRIs) for manganese (mg/day)

Sex	Males				Females			
Age	EAR	RDA	AI	UL	EAR	RDA	AI	UL
0-5 months	-	-	0.001	-	-	-	0.001	-
6-11	-	-	1.2	-	-	-	1.2	-
1-2 years	-	-	1.5	-	-	-	1.5	-
3-5	-	-	1.7	-	-	-	1.7	-
6-7	-	-	2.0	-	-	-	2.0	-
8-9	-	-	2.5	-	-	-	2.5	-
10-11	-	-	3.0	-	-	-	3.0	-
12-14	-	-	4.0	-	-	-	3.5[1]	-
15-17	-	-	4.0[1]	-	-	-	3.5	-
18-29	-	-	4.0	11	-	-	3.5	11
30-49	-	-	4.0	11	-	-	3.5	11
50-69	-	-	4.0	11	-	-	3.5	11
≧ 70	-	-	4.0	11	-	-	3.5	11
Pregnant women (amount to be added)					-	-	+0	-
Lactating woman (amount to be added)					-	-	+0	-

EAR, estimated average requirement; RDA, recommended dietary allowance; AI, adequate intake; UL, tolerable upper intake level. [1] The value was smoothed in relation to those of the preceding and succeeding age groups.

Dietary Reference Intakes (DRIs) for iron (mg/day)[1]

Sex / Age	Males EAR	Males RDA	Males AI	Males UL	Females Not menstruating[2] EAR	Females Not menstruating[2] RDA	Females Menstruating EAR	Females Menstruating RDA	Females AI	Females UL
0-5 months infants										
Breastfed	-	-	0.4	-	-	-	-	-	0.4	-
Formula-fed	-	-	7.7	-	-	-	-	-	7.7	-
6-11 months	4.5	6.0	-	-	4.0	5.5	-	-	-	-
1-2 years	4.0	5.5	-	25	3.5	5.0	-	-	-	20
3-5	3.5	5.0	-	25	3.5	5.0	-	-	-	25
6-7	5.0	6.5	-	30	4.5	6.0	-	-	-	30
8-9	6.5	9.0	-	35	6.0	8.5	-	-	-	35
10-11	7.5	10.0	-	35	6.5	9.0	9.5	13.0	-	35
12-14	8.5	11.5	-	50	6.5	9.0	9.5	13.5	-	45
15-17	9.0	10.5	-	45	6.0	7.5	9.0	11.0	-	40
18-29	6.5[3]	7.5[3]	-	50	5.5[3]	6.5[3]	9.0[3]	10.5[3]	-	40
30-49	6.5	7.5	-	55	5.5	6.5	9.0	10.5	-	40
50-69	6.0	7.5	-	50	5.5	6.5	9.0	10.5	-	45
≧ 70	5.5	6.5	-	45	5.0	6.0	-	-	-	40
Pregnant women (amount to be added)					+11.0	+13.0	-	-	-	-
Lactating women (amount to be added)					+2.0	+2.5	-	-	-	-

EAR, estimated average requirement; RDA, recommended dietary allowance; AI, adequate intake; UL, tolerable upper intake level. [1] The values were set excluding those with menorrhagia (blood loss exceeding 80 mL/period). [2] Applies to pregnant and lactating women. [3] The value was smoothed in relation to those of the preceding and succeeding age groups.

Dietary Reference Intakes (DRIs) for copper (mg/day)

Sex / Age	Males EAR	Males RDA	Males AI	Males UL	Females EAR	Females RDA	Females AI	Females UL
0-5 months	-	-	0.3	-	-	-	0.3	-
6-11	-	-	0.3	-	-	-	0.3	-
1-2 years	0.2	0.3	-	-	0.2	0.3	-	-
3-5	0.3	0.4	-	-	0.3	0.3	-	-
6-7	0.3	0.4	-	-	0.3	0.4	-	-
8-9	0.4	0.5	-	-	0.4	0.5	-	-
10-11	0.5	0.6	-	-	0.5	0.6	-	-
12-14	0.6	0.8	-	-	0.6	0.7	-	-
15-17	0.7	0.9	-	-	0.5	0.7	-	-
18-29	0.6	0.8	-	10	0.5	0.7	-	10
30-49	0.6[1]	0.8[1]	-	10	0.6	0.7	-	10
50-69	0.6	0.8	-	10	0.6	0.7	-	10
≧ 70	0.6	0.8	-	10	0.5	0.7	-	10
Pregnant women (amount to be added)					+0.1	+0.1	-	-
Lactating women (amount to be added)					+0.5	+0.6	-	-

EAR, estimated average requirement; RDA, recommended dietary allowance; AI, adequate intake; UL, tolerable upper intake level. [1] The value was smoothed in relation to those of the preceding and succeeding age groups.

Dietary Reference Intakes (DRIs) for zinc (mg/day)

Sex	Males				Females			
Age	EAR	RDA	AI	UL	EAR	RDA	AI	UL
0-5 months								
Breastfed infants	-	-	2	-	-	-	2	-
Formula-fed infants	-	-	3	-	-	-	3	-
6-11 months	-	-	3	-	-	-	3	-
1-2 years	4	4	-	-	3	4	-	-
3-5	5	6	-	-	5	6	-	-
6-7	5	6	-	-	5	6	-	-
8-9	6	7	-	-	5	6	-	-
10-11	6	8	-	-	6	7	-	-
12-14	7	9	-	-	6	7	-	-
15-17	8	10	-	-	6	7	-	-
18-29	8	9	-	30	6	7	-	30
30-49	8	9	-	30	6	7	-	30
50-69	8	9	-	30	6	7	-	30
≧ 70	7	8	-	30	6	7	-	30
Pregnant women (amount to be added)					-	+3	-	-
Lactating women (amount to be added)					-	+3	-	-

EAR, estimated average requirement; RDA, recommended dietary allowance; AI, adequate intake; UL, tolerable upper intake level

Dietary Reference Intakes (DRIs) for selenium (μg/day)

Sex	Males				Females			
Age	EAR	RDA	AI	UL	EAR	RDA	AI	UL
0-5 months	—	—	16	—	—	—	16	—
6-11	—	—	19	—	—	—	19	—
1-2 years	7	9	—	100	7	8	—	50
3-5	10	10	—	100	10	10	—	100
6-7	10	15	—	150	10	15	—	150
8-9	15	15	—	200	15	15	—	200
10-11	15	20	—	250	15	20	—	250
12-14	20	25	—	350	20	25	—	300
15-17	25	30	—	400	20	25	—	350
18-29	25	30	—	450	20	25	—	350
30-49	30	35	—	450	20	25	—	350
50-69	25	30	—	450	20	25	—	350
≧ 70	25	30	—	400	20	25	—	350
Pregnant women (amount to be added)					+4	+4	—	—
Lactating women (amount to be added)					+16	+20	—	—

EAR, estimated average requirement; RDA, recommended dietary allowance; AI, adequate intake; UL, tolerable upper intake level

Dietary Reference Intakes (DRIs) for iodine (µg/day)

Sex	Males				Females			
Age	EAR	RDA	AI	UL	EAR	RDA	AI	UL
0-5 months	-	-	130	-	-	-	130	-
6-11	-	-	170	-	-	-	170	-
1-2 years	40	60	-	-	40	60	-	-
3-5	50	70	-	-	50	70	-	-
6-7	60	80	-	-	60	80	-	-
8-9	70	100	-	-	70	100	-	-
10-11	80	120	-	-	80	120	-	-
12-14	95[1]	140	-	-	95[1]	140	-	-
15-17	95[1]	140	-	-	95[1]	140[1]	-	-
18-29	95	150	-	3,000	95	150	-	3,000
30-49	95	150	-	3,000	95	150	-	3,000
50-69	95	150	-	3,000	95	150	-	3,000
≧ 70	95	150	-	3,000	95	150	-	3,000
Pregnant women (amount to be added)					+75	+110	-	-
Lactating women (amount to be added)					+130	+190	-	-

EAR, estimated average requirement; RDA, recommended dietary allowance; AI, adequate intake; UL, tolerable upper intake level. [1] The value was smoothed in relation to those of the preceding and succeeding age groups.

Dietary Reference Intakes (DRIs) for sodium (mg/day, the value in parentheses is equivalent to table salt [g/day])

Sex	Males				Females			
Age	EAR	AI	DG[1]	UL	EAR	AI	DG[1]	UL
0-5 months	—	100 (0.26)	—	—	—	100 (0.26)	—	—
6-11	—	600 (1.5)	—	—	—	600 (1.5)	—	—
1-2 years	—	—	(<4)	—	—	—	(<3)	—
3-5	—	—	(<5)	—	—	—	(<5)	—
6-7	—	—	(<6)	—	—	—	(<6)	—
8-9	—	—	(<7)	—	—	—	(<7)	—
10-11	—	—	(<9)	—	—	—	(<8)	—
12-14	—	—	(<10)	—	—	—	(<8)	—
15-17	—	—	(<10)	—	—	—	(<8)	—
18-29	600 (1.5)	—	(<10)	—	600 (1.5)	—	(<8)	—
30-49	600 (1.5)	—	(<10)	—	600 (1.5)	—	(<8)	—
50-69	600 (1.5)	—	(<10)	—	600 (1.5)	—	(<8)	—
≧ 70	600 (1.5)	—	(<10)	—	600 (1.5)	—	(<8)	—
Pregnant women (amount to be added)					—	—	—	—
Lactating women (amount to be added)					—	—	—	—

EAR, estimated average requirement; AI, adequate intake; DG, tentative dietary goal for preventing life-style related diseases; UL, tolerable upper intake level. [1] When energy intake can be measured, it is set at less than 4.5 g/1,000 kcal for those between 1~69 years (for both genders). Make an exception of males between 12 and 17 years, it is set at less than 4 g/1,000 kcal.

Dietary Reference Intakes (DRIs) for potassium: Adequate Intakes (AIs) (mg/day)[1]

Sex	Males				Females			
Age	EAR	RDA	AI	UL	EAR	RDA	AI	UL
0-5 months	-	-	400	-	-	-	400	-
6-11	-	-	800	-	-	-	800	-
1-2 years	-	-	800[1]	-	-	-	800[1]	-
3-5	-	-	800	-	-	-	800	-
6-7	-	-	1,100	-	-	-	1,000	-
8-9	-	-	1,200	-	-	-	1,200	-
10-11	-	-	1,500	-	-	-	1,400	-
12-14	-	-	1,900	-	-	-	1,700	-
15-17	-	-	2,200	-	-	-	1,600	-
18-29	-	-	2,000	-	-	-	1,600	-
30-49	-	-	2,000	-	-	-	1,600	-
50-69	-	-	2,000	-	-	-	1,600	-
≧ 70	-	-	2,000	-	-	-	1,600	-
Pregnant women (amount to be added)					-	-	+0	-
Lactating women (amount to be added)					-	-	+370	-

EAR, estimated average requirement; RDA, recommended dietary allowance; AI, adequate intake; UL, tolerable upper intake level. [1] The value that is considered appropriate to maintain *in vivo* potassium balance was used as the adequate intake. [2] The value was smoothed in relation to those of the preceding and succeeding age groups.

Dietary Reference Intakes (DRIs) for potassium to prevent hypertension: Tentative Dietary Goal for Preventing Life-style-related Diseases (DGs) (mg/day)

Sex	Males		Females	
Age	Optimum value to prevent lifestyle-related diseases[1]	DG	Optimum value to prevent lifestyle-related diseases[1]	DG
0-5 months	-	-	-	-
6-11	-	-	-	-
1-2 years	-	-	-	-
3-5	-	-	-	-
6-7	-	-	-	-
8-9	-	-	-	-
10-11	-	-	-	-
12-14	-	-	-	-
15-17	-	-	-	-
18-29	3,500	2,800	3,500	2,700
30-49	3,500	2,900	3,500	2,800
50-69	3,500	3,100	3,500	3,100
≧ 70	3,500	3,000	3,500	2,900
Pregnant women (amount to be added)			-	-
Lactating women (amount to be added)			-	-

DG, tentative dietary goal for preventing lifestyle-related diseases. [1] The 6th Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (The JNC 6 Report) states that the intake of 3,500 mg/day is desirable to prevent hypertension. This value is supported for active primary prevention of hypertension.

APJCN 2008: 17, Supplement 2: 391-452 ISSN 0964-7058

2008 Volume 17 Supplement 2

Asia Pacific Journal of Clinical Nutrition

The Second Asian Network Symposium on Nutrition

Nutrition Reference and Dietary Recommendation in Asian Countries
~from nutrition science to policy~

Proceedings of a symposium
held at the National Institute of Health
and Nutrition, Tokyo, Japan
March 3, 2006

Guest Scientific Editor
Van S. Hubbard
Shaw Watanabe

Organized by the National Institute of Health and Nutrition, Japan

Supporting bodies

Ministry of Health, Labour and Welfare, Japan
Japan Dietetic Association, Japan
The World Health Organization, Regional Office for the Western Pacific

APCNS • IUNS

Program Participants

Speakers

Corazon VC. Barba
Director,
Institute of Human Nutrition and Food, College of Human Ecology,
University of the Philippines, Los Baños.
Los Baños, Laguna, Laguna, 4030
Philippines.

Nguyen Cong Khan
Director,
National Institute of Nutrition.
48B Tang Bat Ho Street
Hanoi, Vietnam

Mabel Yap
Director,
Research and Information Management Division,
Health Promotion Board.
3 Second Hospital Avenue
168937 Singapore

Hee Young Paik
Department of Food and Nutrition, College of Human Ecology, Seoul National University.
San 56-1, Shilim-dong, Kwanak-gu
Seoul, Korea

* 2005－2009 Council Member,
International Union of Nutrition Sciences

Satoshi Sasaki
Project Leader of "Scientific Evaluation of Dietary Reference Intakes",
National Institute of Health and Nutrition.
1-23-1 Toyama Shinjuku-ku,
Tokyo, 162-8636, Japan

Prof. Yukari Takemi
Nutrition Ecology, Department of Nutrition Sciences, Kagawa Nutrition University.
3-9-21, Chiyoda, Sakado-shi,
Saitama, 350-0288, Japan

Debaters

Dr. Soichiro Iwao
Director,
WHO Centre for Health Development
I.H.D. Centre Building, 9th Floor.
1-5-1, Wakinohama-Kaigandori
Chuo-ku, Kobe, 651-0073, Japan

Dr. Van S. Hubbard
Director,
NIH Division of Nutrition Research Coordination,
National Institute of Health
2 Democracy Plaza, Room 631
6707 Democracy Boulevard, MSC 5461
Bethesda, MD 20892-5461, U.S.A.

Available online at www.sciencedirect.com

ScienceDirect

ELSEVIER

Nutrition Research 29 (2009) 164 – 172

Nutrition Research

www.nrjournal.com

Education, but not occupation or household income, is positively related to favorable dietary intake patterns in pregnant Japanese women: the Osaka Maternal and Child Health Study

Kentaro Murakami[a,*], Yoshihiro Miyake[b], Satoshi Sasaki[a], Keiko Tanaka[b], Yukihiro Ohya[c], Yoshio Hirota[d]
the Osaka Maternal and Child Health Study Group[1]

[a]*Department of Social and Preventive Epidemiology, School of Public Health, the University of Tokyo, Tokyo 113-0033, Japan*
[b]*Department of Public Health, Faculty of Medicine, Fukuoka University, Fukuoka 814-0180, Japan*
[c]*Division of Allergy, Department of Medical Specialties, National Center for Child Health and Development, Tokyo 157-8535, Japan*
[d]*Department of Public Health, Osaka City University School of Medicine, Osaka 545-8585, Japan*

Received 30 September 2008; revised 12 February 2009; accepted 15 February 2009

Abstract

Although a large body of epidemiologic data accumulated in Western countries show that individuals with a higher socioeconomic position consume higher quality diets, information on such socioeconomic differences in the diets of non-Western populations, including Japanese, is absolutely lacking. This cross-sectional study examined the association of socioeconomic position with dietary intake in a group of pregnant Japanese women. Subjects were 1002 Japanese women during pregnancy. Socioeconomic position was assessed by education, occupation, and household income. Dietary intake was estimated using a validated, self-administered, comprehensive diet history questionnaire. Education was associated positively with intake of protein; total n-3 and marine-origin n-3 polyunsaturated fatty acids; dietary fiber; cholesterol; potassium; calcium; magnesium; iron; vitamins A, D, E, and C; and folate 9 and inversely with that of carbohydrate. No associations were seen between education and intake of total fat; saturated, monounsaturated, and total and n-6 polyunsaturated fatty acids; alcohol; or sodium. Regarding food, higher education was associated with a higher intake of vegetables, fish and shellfish, and potatoes and lower intake of rice. Education was not associated with intake of bread, noodles, confectioneries and sugars, fats and oils, pulses and nuts, meat, eggs, dairy products, or fruit. For occupation, housewives had a higher intake of dietary fiber, magnesium, iron, vitamin A, folate, and pulses and nuts than working women. Household income was not associated with any nutrient or food examined. In conclusion, education, but not occupation or household income, was positively associated with favorable dietary intake patterns in a group of pregnant Japanese women.

Keywords: Education; Occupation; Income; Diet; Pregnant women
Abbreviations: DHQ, diet history questionnaire; OMCHS, Osaka Maternal and Child Health Study.

1. Introduction

In many Western countries, socioeconomic differences in health have been widely indicated, with higher socio-economic position associated with better health [1-3].

* Corresponding author. Tel.: +81 3 5841 7872; fax: +81 3 5841 7873.
E-mail address: kenmrkm@m.u-tokyo.ac.jp (K. Murakami).

[1] Other members of the Osaka Maternal and Child Health Study Group are listed in the Acknowledgments.

0271-5317/$ – see front matter © 2009 Elsevier Inc. All rights reserved.
doi:10.1016/j.nutres.2009.02.002

Socioeconomic differentials in diet have also been observed. Dietary intake studies have consistently shown that individuals with a higher socioeconomic position consume higher-quality diets than those with a lower position, including higher intake of whole grains, lean meats, fish, low-fat dairy products, and fresh vegetables and fruits, and lower intake of fatty meats, refined grains, and added fats, resulting in higher intake of key vitamins and minerals and dietary fiber [4-12]. Given the important role of nutrition in promoting health, this dietary intake pattern may be linked to inequalities in health [12,13].

Conversely, several Japanese studies have reported unclear or even inverse associations between socioeconomic position and health status. In a comparative analysis of Japan and England, Japanese men with a higher employment grade or education had a higher body mass index and waist-to-hip-ratio and lower (less favorable) high-density lipoprotein cholesterol level than those with a lower employment grade or education, whereas positive associations between socioeconomic position and health status were seen in England [14]. Other Japanese studies have observed unclear, rather than positive, associations of education and employment grade with several metabolic risk factors [15,16].

To our knowledge, however, the presence of socioeconomic differences in Japanese diets has not been examined. Given the similarity of socioeconomic gradients in health and diet in Western countries vs the differences in socioeconomic gradients in health between Western countries and Japan, the associations between socioeconomic position and diet between Western countries and Japan may differ. In addition, the association between socioeconomic position and diet has been poorly investigated among pregnant women, even in Western countries [17-21].

Here, using baseline data from the Osaka Maternal and Child Health Study (OMCHS), we conducted a cross-sectional study of the association between socioeconomic position and dietary intake in a group of pregnant Japanese women. We hypothesized that the association between socioeconomic position and dietary intake in Japanese somewhat differs from that observed in Western populations.

2. Methods and materials

2.1. Subjects

The subjects in this analysis were participants in the baseline survey of the OMCHS, an ongoing prospective cohort study investigating preventive and risk factors for maternal and child health problems. Details of the OMCHS have been published elsewhere [22,23]. Briefly, all pregnant women in Neyagawa City, Osaka Prefecture, were recruited between November 2001 and March 2003. Of 3639 eligible women, 627 (17.2%) took part in the study. An additional 375 pregnant women living in other neighborhood areas were enrolled between December 2001 and November 2003. A total of 1002 pregnant women completed the baseline survey and were included in this analysis. Basic characteristics of these 1002 women have been published elsewhere [23,24]. Written informed consent was obtained from each woman. The protocol of the OMCHS was approved by the ethics committee of the Osaka City University School of Medicine, Japan.

Table 1. Socioeconomic and dietary characteristics of the subjects (N = 1002)

Variable	Value
Education	
Low (≤12 y)	323 (32.2)
Medium (13-14 y)	413 (41.2)
High (≥15 y)	266 (26.6)
Occupation	
Housewife	714 (71.3)
Outside work	288 (28.7)
Household income	
Low (≤2 419 999 yen/y)	312 (31.1)
Medium (2 420 000-3 619 999 yen/y)	379 (37.8)
High (≥3 620 000 yen/y)	311 (31.0)
Nutrient intake	
Protein (% of energy)	13.4 ± 1.9
Total fat (% of energy)	29.9 ± 5.3
Saturated fatty acids (% of energy)	8.4 ± 2.0
Monounsaturated fatty acids (% of energy)	10.3 ± 2.3
Polyunsaturated fatty acids (% of energy)	6.7 ± 1.5
n-6 polyunsaturated fatty acids (% of energy)	5.6 ± 1.2
n-3 polyunsaturated fatty acids (% of energy)	1.16 ± 0.34
Marine-origin n-3 polyunsaturated fatty acids (% of energy) [a]	0.38 ± 0.22
Carbohydrate (% of energy)	55.7 ± 6.3
Alcohol (% of energy)	0.22 ± 1.53
Dietary fiber (g/4184 kJ)	6.4 ± 1.7
Cholesterol (mg/4184 kJ)	164.7 ± 58.6
Sodium (mg/4184 kJ)	2036 ± 440
Potassium (mg/4184 kJ)	1149 ± 258
Calcium (mg/4184 kJ)	295.4 ± 93.9
Magnesium (mg/4184 kJ)	120.9 ± 25.1
Iron (mg/4184 kJ)	3.63 ± 0.79
Vitamin A (μg retinol equivalents/4184 kJ)	336.6 ± 298.0
Vitamin D (mg/4184 kJ)	3.31 ± 1.71
Vitamin E (mg α-tocopherol/4184 kJ)	4.22 ± 0.92
Vitamin C (mg/4184 kJ)	58.5 ± 27.0
Folate (μg/4184 kJ)	155.8 ± 46.9
Food intake (g/4184 kJ)	
Rice	134.3 ± 55.0
Bread	38.7 ± 22.0
Noodles	41.4 ± 31.7
Potatoes	15.0 ± 10.8
Confectioneries and sugars	34.0 ± 16.8
Fats and oils	13.5 ± 6.3
Pulses and nuts	25.4 ± 16.0
Fish and shellfish	26.2 ± 14.1
Meat	32.3 ± 15.4
Eggs	18.0 ± 12.9
Dairy products	106.1 ± 67.2
Vegetables	113.8 ± 66.6
Fruits	93.3 ± 83.0

Values are number (percentage) of subjects for socioeconomic variables and means ± SD for dietary variables.

[a] Sum of eicosapentaenoic, docosapentaenoic, and docosahexaenoic acids.

2.2. Measurements

Baseline assessment of the OMCHS was primarily conducted using a set of 2 self-administered questionnaires. The participants mailed the answered questionnaires to the data management center. Research technicians completed missing or illogical data by telephone interview.

One of the self-administered questionnaires elicited information on the socioeconomic position of the participant, including education, occupation, and household income. Educational level was determined from age at the completion of education. Based on the starting age of compulsory education in Japan (7 years of age), the following 3 education groups were created: low (12 years or less), medium (13-14 years), and high (15 years or more). Occupation information was obtained from the participant's current occupation at the time of the survey and categorized as housewife and outside work. Annual household income (sum of the participant's and her partner's income) before taxation was obtained with 11

Table 2. Selected characteristics according to categories of education, occupation, and household income (N = 1002)

Variable	Education				Occupation			Household income			
	Low (n = 323)	Medium (n = 413)	High (n = 266)	P^a	Housewife (n = 714)	Outside work (n = 288)	P^a	Low (n = 312)	Medium (n = 379)	High (n = 311)	P^a
Age				.41			.12				<.0001
≤28 y	135 (41.8)	156 (37.8)	89 (33.5)		285 (39.9)	95 (33.0)		176 (56.4)	113 (29.8)	91 (29.3)	
29-31 y	79 (24.5)	126 (30.5)	94 (35.3)		203 (28.4)	96 (33.3)		70 (22.4)	138 (36.4)	91 (29.3)	
≥32 y	109 (33.8)	131 (31.7)	83 (31.2)		226 (31.7)	97 (33.7)		66 (21.2)	128 (33.8)	129 (41.5)	
Gestational age				.014			.95				.040
≤14 wk	127 (39.3)	150 (36.3)	80 (30.1)		254 (35.6)	103 (35.8)		120 (38.5)	142 (37.5)	95 (30.6)	
15-20 wk	106 (32.8)	131 (31.7)	92 (34.6)		236 (33.1)	93 (32.3)		91 (29.2)	140 (36.9)	98 (31.5)	
≥21 wk	90 (27.9)	132 (32.0)	94 (35.3)		224 (31.4)	92 (31.9)		101 (32.4)	97 (25.6)	118 (37.9)	
Parity				.033			<.0001				<.0001
Nulliparous	143 (44.3)	205 (49.6)	141 (53.0)		314 (44.0)	175 (60.8)		140 (44.9)	119 (31.4)	230 (74.0)	
Multiparous	180 (55.7)	208 (50.4)	125 (47.0)		400 (56.0)	113 (39.2)		172 (55.1)	260 (68.6)	81 (26.1)	
Cigarette smoking				<.0001			.40				.0001
Never	166 (51.4)	307 (74.3)	224 (84.2)		486 (68.1)	211 (73.3)		196 (62.8)	263 (69.4)	238 (76.5)	
Former	53 (16.4)	45 (10.9)	23 (8.7)		98 (13.7)	23 (8.0)		42 (13.5)	48 (12.7)	31 (10.0)	
Current	104 (32.2)	61 (14.8)	19 (7.1)		130 (18.2)	54 (18.8)		74 (23.7)	68 (17.9)	42 (13.5)	
Family structure				.0047			1.00				.82
Nuclear	274 (84.8)	354 (85.7)	247 (92.9)		624 (87.4)	251 (87.2)		271 (86.9)	332 (87.6)	272 (87.5)	
Expanded	49 (15.2)	59 (14.3)	19 (7.1)		90 (12.6)	37 (12.9)		41 (13.1)	47 (12.4)	39 (12.5)	
Changes in diet in the previous 1 mo				.011			.33				.0001
Never or seldom	118 (36.5)	119 (28.8)	63 (23.7)		221 (31.0)	79 (27.4)		113 (36.2)	114 (30.1)	73 (23.5)	
Slight	123 (38.1)	184 (44.6)	128 (48.1)		306 (42.9)	129 (44.8)		133 (42.6)	162 (42.7)	140 (45.0)	
Substantial	82 (25.4)	110 (26.6)	75 (28.2)		187 (26.2)	80 (27.8)		66 (21.2)	103 (27.2)	98 (31.5)	
Physical activity				.0045			.0073				.39
Low	221 (68.4)	229 (55.5)	153 (57.5)		449 (62.9)	154 (53.5)		195 (62.5)	203 (53.6)	205 (65.9)	
Medium or high	102 (31.6)	184 (44.6)	113 (42.8)		265 (37.1)	134 (46.5)		117 (37.5)	176 (46.4)	106 (34.1)	
Partner's education				<.0001			.16				<.0001
Low (≤12 y)	192 (59.4)	161 (39.0)	47 (17.7)		296 (41.5)	104 (36.1)		167 (53.5)	151 (39.8)	82 (26.4)	
Medium (13-14 y)	52 (16.1)	88 (21.3)	32 (12.0)		119 (16.7)	53 (18.4)		53 (17.0)	71 (18.7)	48 (15.4)	
High (≥15 y)	79 (24.5)	164 (39.7)	187 (70.3)		299 (41.9)	131 (45.5)		92 (29.5)	157 (41.4)	181 (58.2)	
Education				–			<.0001				<.0001
Low (≤12 y)	323 (100)	0 (0)	0 (0)		255 (35.7)	68 (23.6)		129 (41.4)	126 (33.3)	68 (21.9)	
Medium (13-14 y)	0 (0)	413 (100)	0 (0)		298 (41.7)	115 (39.9)		129 (41.4)	172 (45.4)	112 (36.0)	
High (≥15 y)	0 (0)	0 (0)	266 (100)		161 (22.6)	105 (36.5)		54 (17.3)	81 (21.4)	131 (42.1)	
Occupation				<.0001			–				<.0001
Housewife	255 (79.0)	298 (72.2)	161 (60.5)		714 (100)	0 (0)		255 (81.7)	299 (78.9)	160 (51.5)	
Outside work	68 (21.1)	115 (27.9)	105 (39.5)		0 (0)	288 (100)		57 (18.3)	80 (21.1)	151 (48.6)	
Household income				<.0001			<.0001				–
Low (≤2 419 999 yen/y)	129 (39.9)	129 (31.2)	54 (20.3)		255 (35.7)	57 (19.8)		312 (100)	0 (0)	0 (0)	
Medium (2 420 000-3 619 999 yen/y)	126 (39.0)	172 (41.7)	81 (30.5)		299 (41.9)	80 (27.8)		0 (0)	379 (100)	0 (0)	
High (≥3 620 000 yen/y)	68 (21.1)	112 (27.1)	131 (49.3)		160 (22.4)	151 (52.4)		0 (0)	0 (0)	311 (100)	

Values are number (percentage) of subjects.
[a] Mantel-Haenszel χ^2 test.

response alternatives. To take account of differences in household size and composition, household income (midpoint of each income category) was divided by the household's equivalent adult size using the modified Organization for Economics Cooperation and Development equivalence scale: the respondent, 1; other adult (ie, partner), 0.5; and each child, 0.3 [25]. This household income variable was then categorized into approximate tertiles of low (2 419 999 yen/y or less), medium (2 420 000-3 619 999 yen/y), and high (3 620 000 yen/y or more).

The other self-administered questionnaire used was a validated, self-administered, comprehensive diet history questionnaire (DHQ) that assessed dietary habits during the preceding month [26-29]. The DHQ is a 16-page structured questionnaire that asks about the consumption frequency and portion size of selected foods commonly consumed in Japan as well as general dietary behavior and usual cooking methods [26]. Estimates of daily intake for foods (150 items in total), nutrients, and energy were calculated using an ad hoc computer algorithm for the DHQ [26,29] based on the Standard Tables of Food Composition in Japan [30,31]. Nutrient and food intake values were energy-adjusted using the density method (ie, percentage of energy for energy-providing nutrients and the amount per 4184 kJ of energy for other nutrients and foods) to minimize the influence of dietary misreporting, an ongoing controversy in studies that collect dietary information using self-report instruments [32].

The validity of the DHQ and its structure and the methods used to calculate dietary intake have been detailed elsewhere [26-28]. Briefly, Pearson correlation coefficients were 0.37 to 0.75 for energy-providing nutrients and 0.38 to 0.68 for other nutrients between the DHQ and 3-day estimated dietary records in 47 women [26]; 0.34 to 0.79 for energy-providing nutrients and 0.35 to 0.69 for other nutrients between the DHQ and 16-day weighed dietary records in 92 women, with Spearman correlation coefficients for food groups from 0.36 to 0.64 (S. Sasaki, unpublished observations, 2004); 0.23 for sodium and 0.40 for potassium between the DHQ and 24-hour urinary excretion in 69 women [27]; and 0.66 between the DHQ and serum phospholipid concentrations for marine-origin n-3 polyunsaturated fatty acids (sum of eicosapentenoic, docosapentaenoic, and docosahexaenoic acids) in 44 women [28].

The 2 self-administered questionnaires also elucidated information on potential confounding factors, including age (28 years or less, 29-31 years, and 32 years or more), gestational age (14 weeks or less, 15-20 weeks, and 21 weeks or more), parity (nulliparous and multiparous), cigarette smoking (never, former, and current), family structure (nuclear and expanded), changes in diet in the previous 1 month (never or seldom, slight, and substantial), physical activity (low; and medium or high), and partner's education (low [12 years or less], medium [13-14 years], and high [15 years or more]).

2.3. Statistical analyses

All statistical analyses were performed using SAS statistical software version 9.1 (SAS Institute Inc, Cary, NC). Using the PROC GLM procedure, linear regression models were constructed to examine the association of socioeconomic position (education, occupation, and household income) with dietary intake of selected nutrients and foods. Mean (and standard error) values of nutrient and food intake were calculated by categories of education, occupation, and household income with adjustment for potential confounding factors, including age, gestational age, parity, cigarette smoking, family structure, changes in diet in the previous month, physical activity, and partner's education. For each of the socioeconomic position variables, the other 2 socioeconomic position variables were further included as potential confounding factors. Trends of association were assessed by a linear regression model assigning consecutive integers to the levels of the socioeconomic position variables. All reported P values are 2-tailed, and a P value of less than .05 was considered statistically significant.

3. Results

Socioeconomic and dietary characteristics of the 1002 pregnant women are shown in Table 1. The percentage of women in the low, medium, and high education groups was 32%, 41%, and 27%, respectively, with about 71% housewives and 29% outside workers. Median household income was 3 000 000 yen, ranging from 280 000 to 9 500 000 yen, with the percentage of women in the low, medium, and high categories of 31%, 38%, and 31%, respectively. Mean percentages of intake of protein, total fat, and carbohydrate were 13.4%, 29.9%, and 55.7% of energy, respectively.

Associations between socioeconomic position and selected characteristics are shown in Table 2. Among those in the higher categories of education, fewer women had a younger gestational age or were multiparous, current smokers, or less physically active. Women with higher education also tended to live in a nuclear family, have changes in diet during the previous month, have a partner with higher education, work outside, and have a higher household income. Regarding occupation, the proportion of multiparous women and those who were physically inactive was larger among housewives than those with outside work. Housewives also tended to have a partner with lower education and lower household income than women working outside. Among women in the higher categories of household income, fewer had a younger gestational age, were multiparous, or were current smokers. Women with higher education also tended to have changes in diet during the previous month, have a partner with higher education, have higher education, and work outside.

Table 3 shows independent associations among socioeconomic position and dietary intake. Education was

Table 3. Dietary intake according to categories of education, occupation, and household income (N = 1002)

Variable	Education[a]				Occupation			Household income[b]			
	Low (n = 323)	Medium (n = 413)	High (n = 266)	P^c	Housewife (n = 714)	Outside work (n = 288)	P^c	Low (n = 312)	Medium (n = 379)	High (n = 311)	P^c
Nutrient intake											
Protein (% of energy)	13.1 ± 0.1	13.4 ± 0.1	13.8 ± 0.1	.0001	13.4 ± 0.1	13.2 ± 0.1	.16	13.4 ± 0.1	13.3 ± 0.1	13.4 ± 0.1	.74
Total fat (% of energy)	29.3 ± 0.3	30.1 ± 0.3	30.1 ± 0.3	.09	30.0 ± 0.2	29.6 ± 0.3	.33	29.8 ± 0.3	29.6 ± 0.3	30.2 ± 0.3	.47
Saturated fatty acids (% of energy)	8.3 ± 0.1	8.5 ± 0.1	8.5 ± 0.1	.15	8.5 ± 0.1	8.3 ± 0.1	.12	8.4 ± 0.1	8.4 ± 0.1	8.6 ± 0.1	.30
Monounsaturated fatty acids (% of energy)	10.3 ± 0.1	10.3 ± 0.1	10.4 ± 0.1	.53	10.4 ± 0.1	10.2 ± 0.1	.38	10.4 ± 0.1	10.2 ± 0.1	10.4 ± 0.1	.87
Polyunsaturated fatty acids (% of energy)	6.7 ± 0.1	6.6 ± 0.1	6.8 ± 0.1	.58	6.7 ± 0.1	6.6 ± 0.1	.09	6.8 ± 0.1	6.6 ± 0.1	6.7 ± 0.1	.87
n-6 polyunsaturated fatty acids (% of energy)	5.6 ± 0.1	5.6 ± 0.1	5.7 ± 0.1	.99	5.7 ± 0.1	5.5 ± 0.1	.11	5.7 ± 0.1	5.5 ± 0.1	5.6 ± 0.1	.70
n-3 polyunsaturated fatty acids (% of energy)	1.13 ± 0.02	1.16 ± 0.02	1.20 ± 0.02	.044	1.17 ± 0.01	1.13 ± 0.02	.11	1.17 ± 0.02	1.14 ± 0.01	1.18 ± 0.01	.66
Marine-origin n-3 polyunsaturated fatty acids (% of energy)[d]	0.35 ± 0.01	0.38 ± 0.01	0.42 ± 0.01	.0005	0.39 ± 0.01	0.36 ± 0.01	.16	0.38 ± 0.01	0.37 ± 0.01	0.39 ± 0.01	.71
Carbohydrate (% of energy)	56.4 ± 0.4	55.6 ± 0.3	55.0 ± 0.4	.014	55.6 ± 0.2	56.0 ± 0.4	.34	55.5 ± 0.4	56.1 ± 0.3	55.4 ± 0.4	.95
Alcohol (% of energy)	0.22 ± 0.09	0.13 ± 0.08	0.36 ± 0.1	.41	0.22 ± 0.06	0.23 ± 0.09	.88	0.32 ± 0.09	0.13 ± 0.08	0.24 ± 0.1	.48
Dietary fiber (g/4184 kJ)	6.2 ± 0.1	6.4 ± 0.1	6.7 ± 0.1	.0012	6.5 ± 0.1	6.1 ± 0.1	.0005	6.3 ± 0.1	6.4 ± 0.1	6.5 ± 0.1	.27
Cholesterol (mg/4184 kJ)	156.8 ± 3.5	168.6 ± 2.9	168.2 ± 3.8	.028	164.9 ± 2.2	164.1 ± 3.6	.85	165.2 ± 3.5	163.1 ± 3.1	166.0 ± 3.7	.93
Sodium (mg/4184 kJ)	2030 ± 26	2037 ± 22	2040 ± 29	.79	2042 ± 17	2020 ± 27	.50	2051 ± 26	2018 ± 24	2041 ± 28	.72
Potassium (mg/4184 kJ)	1101 ± 15	1161 ± 13	1188 ± 17	.0002	1159 ± 10	1124 ± 15	.06	1146 ± 15	1144 ± 13	1158 ± 16	.64
Calcium (mg/4184 kJ)	283.0 ± 5.3	297.0 ± 4.4	307.8 ± 5.9	.0031	298.0 ± 3.4	288.9 ± 5.5	.17	290.5 ± 5.3	295.8 ± 4.8	299.7 ± 5.7	.26
Magnesium (mg/4184 kJ)	118.0 ± 1.4	121.3 ± 1.2	123.7 ± 1.6	.013	122.1 ± 0.9	117.9 ± 1.5	.023	120.2 ± 1.5	120.2 ± 1.3	122.4 ± 1.6	.39
Iron (mg/4184 kJ)	3.52 ± 0.05	3.63 ± 0.04	3.75 ± 0.05	.0012	3.67 ± 0.03	3.52 ± 0.05	.010	3.65 ± 0.05	3.58 ± 0.04	3.66 ± 0.05	.93

Vitamin A (μg retinol equivalents/4184 kJ)	302.0 ± 17.4	328.6 ± 14.5	390.9 ± 19.4	.0016	349.9 ± 11.2	303.5 ± 18.1	.034	357.1 ± 17.5	315.7 ± 15.7	341.4 ± 18.7	.46
Vitamin D (mg/4184 kJ)	2.95 ± 0.10	3.32 ± 0.08	3.71 ± 0.11	<.0001	3.35 ± 0.06	3.21 ± 0.10	.27	3.29 ± 0.10	3.28 ± 0.09	3.36 ± 0.11	.63
Vitamin E (mg α-tocopherol/4184 kJ)	4.07 ± 0.05	4.25 ± 0.04	4.35 ± 0.06	.0008	4.26 ± 0.03	4.13 ± 0.06	.06	4.21 ± 0.05	4.17 ± 0.05	4.30 ± 0.06	.35
Vitamin C (mg/4184 kJ)	55.3 ± 1.6	59.4 ± 1.3	61.1 ± 1.8	.018	59.5 ± 1.0	56.1 ± 1.6	.08	57.3 ± 1.6	58.4 ± 1.4	59.9 ± 1.7	.29
Folate (μg/4184 kJ)	147.4 ± 2.7	157.4 ± 2.3	163.4 ± 3.0	.0002	158.1 ± 1.7	149.9 ± 2.8	.015	158.1 ± 2.7	152.8 ± 2.4	157.0 ± 2.9	.68
Food intake (g/4184 kJ)											
Rice	144.2 ± 3.2	128.8 ± 2.7	130.8 ± 3.6	.0056	132.5 ± 2.1	138.7 ± 3.4	.13	139.2 ± 3.3	133 ± 2.9	130.9 ± 3.5	.09
Bread	38.1 ± 1.3	40.1 ± 1.1	37.1 ± 1.5	.70	38.3 ± 0.8	39.6 ± 1.4	.44	38.4 ± 1.3	39.5 ± 1.2	37.9 ± 1.4	.88
Noodles	43.4 ± 1.9	39.1 ± 1.6	42.6 ± 2.1	.68	42.1 ± 1.2	39.8 ± 1.9	.34	41.2 ± 1.9	43.8 ± 1.7	38.7 ± 2.0	.48
Potatoes	13.0 ± 0.6	15.3 ± 0.5	17.0 ± 0.7	<.0001	15.3 ± 0.4	14.4 ± 0.7	.26	15.2 ± 0.6	15.2 ± 0.6	14.6 ± 0.7	.62
Confectioneries and sugars	32.2 ± 1.0	36.0 ± 0.8	33.0 ± 1.1	.47	34.1 ± 0.6	33.7 ± 1.0	.79	33.1 ± 1.0	33.9 ± 0.9	35.0 ± 1.1	.22
Fats and oils	13.6 ± 0.4	13.4 ± 0.3	13.4 ± 0.4	.66	13.5 ± 0.2	13.4 ± 0.4	.80	13.4 ± 0.4	13.3 ± 0.3	13.7 ± 0.4	.63
Pulses and nuts	24.9 ± 0.9	25.1 ± 0.8	26.3 ± 1.0	.36	26.4 ± 0.6	22.8 ± 1.0	.0019	25.4 ± 0.9	24.1 ± 0.8	26.9 ± 1.0	.39
Fish and shellfish	23.6 ± 0.8	26.6 ± 0.7	28.9 ± 0.9	<.0001	26.3 ± 0.5	26.2 ± 0.9	.93	26.2 ± 0.8	26.0 ± 0.7	26.6 ± 0.9	.76
Meat	32.5 ± 0.9	31.6 ± 0.8	33.3 ± 1.0	.66	32.6 ± 0.6	31.8 ± 0.9	.47	34.0 ± 0.9	31.2 ± 0.8	32 ± 1.0	.11
Eggs	17.4 ± 0.8	18.6 ± 0.6	17.8 ± 0.9	.68	18.0 ± 0.5	18.0 ± 0.8	1.00	18.0 ± 0.8	17.9 ± 0.7	18.1 ± 0.8	.96
Dairy products	103.8 ± 3.9	106.7 ± 3.3	107.9 ± 4.4	.50	105.8 ± 2.5	106.8 ± 4.1	.84	103.6 ± 3.9	105.7 ± 3.5	109.1 ± 4.2	.37
Vegetables	107.5 ± 3.9	113.2 ± 3.3	122.2 ± 4.3	.019	116.4 ± 2.5	107.3 ± 4.0	.06	116.2 ± 3.9	109.9 ± 3.5	116.1 ± 4.2	.88
Fruits	87.6 ± 4.9	97.8 ± 4.1	93.2 ± 5.4	.41	96.1 ± 3.1	86.5 ± 5.0	.11	85.8 ± 4.9	97.3 ± 4.4	96 ± 5.2	.14

Values are means ± standard errors. Adjustment was made for age (28 years or less, 29-31 years, and 32 years or more), gestational age (14 weeks or less, 15-20 weeks, and 21 weeks or more), parity (nulliparous and multiparous), cigarette smoking (never, former, and current), family structure (nuclear and expanded), changes in diet previous 1 month (never or seldom, slight, and substantial), physical activity (low, and medium or high), and partner's education (low [12 years or less], medium [13-14 years], and high [15 years or more]). For education, further adjustment was made for occupation and household income. For occupation, further adjustment was made for education and household income. For household income, further adjustment was made for education and occupation.

[a] Twelve years or less for low, 13-14 years for medium, and 15 years or more for high categories.

[b] 2 419 999 yen/y or less for low, 2 420 000-3 619 999 yen/y for medium, and 3 620 000 yen/y or more for high categories.

[c] Test for linear trend in general linear regression.

[d] Sum of eicosapentaenoic, docosapentaenoic, and docosahexaenoic acids.

associated positively with the intake of protein; total n-3 and marine-origin n-3 polyunsaturated fatty acids; dietary fiber; cholesterol; potassium; calcium; magnesium; iron; vitamins A, D, E, and C; and folate and inversely with that of carbohydrate. No associations were seen between education and intake of other nutrients, including total fat, saturated, monounsaturated, total and n-6 polyunsaturated fatty acids, alcohol, or sodium. At the food level, higher education was associated with a higher intake of vegetables, fish and shellfish, and potatoes and lower intake of rice. Education was not associated with the intake of other foods, including bread, noodles, confectioneries and sugars, fats and oils, pulses and nuts, meat, eggs, dairy products, or fruit. By occupation, housewives had a higher intake of dietary fiber, magnesium, iron, vitamin A, folate, and pulses and nuts than working women. No differences between the 2 occupation groups were seen in the intake of other nutrients or foods. Household income was not associated with any of the nutrients or foods.

4. Discussion

In this cross-sectional study of a group of pregnant Japanese women, higher education was associated with favorable dietary intake patterns, such as a higher intake of protein, total and marine-origin n-3 polyunsaturated fatty acids; dietary fiber; potassium; calcium; magnesium; iron; vitamins A, D, E, and C; and folate and a higher intake of vegetables, fish and shellfish, and potatoes. Conversely, occupation and household income did not seem to be materially associated with dietary intake, although housewives had higher intake than working women of several important nutrients including dietary fiber, magnesium, iron, vitamin A, and folate. To our knowledge, this is the first study to investigate the association of socioeconomic position with dietary intake in a Japanese population.

A large number of Western studies have indicated positive association between socioeconomic position and diet quality. Generally, individuals with higher education, occupation, or income level have a higher intake of 'healthy' foods such as whole grains, lean meats, fish, low-fat dairy products, and fresh vegetables and fruits and a lower intake of 'unhealthy' foods such as fatty meats, refined grains, and added fats, resulting in higher intake of important nutrients such as dietary fiber, calcium, iron, and vitamin C [4-12]. The different socioeconomic indicators (ie, education, occupation, and income) appear to have similar, but independent, effects on nutrition and diet [4-8], although several studies have shown that education is the strongest determinant of socioeconomic differences in diet [9-12]. In this study, education, but not occupation or household income, was positively associated with favorable dietary intake patterns, a finding not fully consistent with previous Western studies. The strong influence of education (but not occupation or household income) on diet we observed may be due, at least in part, to the fact that the subjects were pregnant women. During pregnancy, women likely care more seriously about their diet and have a greater knowledge of dietary recommendations, and thus, their food choices are likely determined based on the ability to understand dietary recommendations (ie, education) rather than other socioeconomic factors (eg, occupation and income). In this regard, a small study of pregnant Austrian women reported that the influence of education on diet quality was stronger than that of occupation and income [17]. Positive associations between education and diet quality have also been reported in several other groups of pregnant women, although these studies did not take other socioeconomic factors sufficiently into account [18-21]. Alternatively, the inconsistency between our present and previous Western studies may reflect different socioeconomic-diet associations between Western countries and Japan. The present results support our hypothesis that the association between socioeconomic position and dietary intake in Japanese somewhat differs from that observed in Western populations. Further investigation in the general Japanese population is warranted.

The strengths of this study include the homogeneity of the study subjects, who consisted of pregnant Japanese women with a similar residential background; use of the 3 core indicators of socioeconomic position (ie, education, occupation, and income); assessment of habitual diets using a validated instrument (ie, DHQ); and adjustment for extensive information on potential confounding factors.

Several limitations also warrant mention. First, response rate for the 627 women living in Neyagawa City was only 17.2%, whereas that for the remaining 375 living in other areas could not be calculated because the exact number of eligible subjects among the sources from which they were recruited was not available. The participants were also women during pregnancy. Thus, the study subjects were likely not representative of Japanese women in the general population, and distribution of socioeconomic position in fact differed considerably from that in the general Japanese population (47.4% low, 32.1% medium, and 15.5% high education [33]; 67.6% outside work [34]; and median household income [adjusted for household size and composition] 2 627 000 yen) [35], although for intakes of energy, protein, fat, and carbohydrate at least, mean values in this study (1829 kcal/d, 61.0 g/d, 61.4 g/d, and 253.1 g/d, respectively) were relatively comparable with those of the general population (1771 kcal/d, 66.3 g/d, 53.9 g/d, and 244.6 g/d, respectively) [36]. Therefore, the present results may not be extrapolatable to the general Japanese population.

Second, as with many other studies, dietary intake information relied on the participants' self-reported dietary behavior. Higher socioeconomic groups generally have a greater knowledge of dietary recommendations [3] and may therefore be more inclined to report 'more favorable' dietary behaviors [37]. We used energy-adjusted values of dietary intake to minimize the potential dietary reporting bias associated with socioeconomic position [38]. We cannot quantify the effects of possible reporting error on the results of this study because of a lack of information on reporting bias associated with socioeconomic position. Nevertheless, it is unlikely that potential reporting bias fully accounts for our observed findings because the positive association with dietary intake was found only for education and not for occupation or income. Finally, the cross-sectional nature of the study hampers the drawing of conclusions on any causal inferences between socioeconomic position and dietary intake.

In conclusion, education, but not occupation or household income, was positively associated with favorable dietary intake patterns in a group of pregnant Japanese women. Nutrition education taking into consideration these socioeconomic differences in diet would be effective for pregnant Japanese women. Because the relation between socioeconomic position and dietary intake is an important public health topic, further research is needed to determine whether the results obtained in this specific group of subjects would also be observed in a more representative sample of the Japanese population.

Acknowledgment

We thank the Neyagawa City Government, Hirakata City Government, Katano City Government, Shijonawate City Government, Kaizuka City Government, Takaishi City Government, Hannan City Government, Neyagawa City Medical Association, Hirakata City Medical Association, and Kadoma City Medical Association for their valuable support, and Tomoko Shibazaki, Nahoko Nishimura, and Naomi Takaoka for their assistance. This study was supported by a Grant-in-Aid (13770206, 16790351) for Scientific Research from the Ministry of Education, Culture, Sports, Science and Technology and Health and Labour Sciences Research Grants, Research on Allergic Disease and Immunology from the Ministry of Health, Labour and Welfare. Other members of the OMCHS Group are as follows: Shoichi Miyamoto (Department of Public Health, Osaka City University Graduate School of Medicine); Ichiro Matsunaga, Toshiaki Yoshida, and Hajime Oda (Osaka Prefectural Institute of Public Health); Hideharu Kanzaki and Mitsuyoshi Kitada (Department of Obstetrics and Gynecology, Kansai Medical University); Yorihiko Horikoshi (Department of Obstetrics and Gynecology, Kansai Medical University Kori); Osamu Ishiko, Yuichiro Nakai, Junko Nishio, and Seiichi Yamamasu (Department of Obstetrics and Gynecology, Osaka City University Graduate School of Medicine); Jinsuke Yasuda (Department of Obstetrics and Gynecology, Matsushita Memorial Hospital); Seigo Kawai (Department of Obstetrics and Gynecology, Hoshigaoka Koseinenkin Hospital); Kazumi Yanagihara (Yanagihara Clinic); Koji Wakuda (Department of Obstetrics and Gynecology, Jujimoto Hospital); Tokio Kawashima (Kyoritsu Women's Clinic); Katsuhiko Narimoto (Ishida Hospital Obstetrics, Gynecology); Yoshihiko Iwasa (Iwasa Women's Clinic); Katsuhiko Orino (Orino Lady's Clinic); Itsuo Tsunetoh (Tsunetoh Obstetrics and Gynecology); Junichi Yoshida (Yoshida Clinic); Junichi Iito (Iito Obstetrics and Gynecology Clinic); Takuzi Kaneko (Kaneko Sanfujinka); Takao Kamiya (Kamiya Ladies Clinic); Hiroyuki Kuribayashi (Kuribayashi Clinic); Takeshi Taniguchi (Taniguchi Hospital); Hideo Takemura (Kosaka Women's Hospital); and Yasuhiko Morimoto (Aizenbashi Hospital).

References

[1] Lahelma E, Martikainen P, Laaksonen M, Aittomaaki A. Pathways between socioeconomic determinants of health. J Epidemiol Community Health 2004;58:327-32.
[2] Lantz PM, House JS, Lepkowski JM, Williams DR, Mero RP, Chen J. Socioeconomic factors, health behaviors, and mortality: results from a nationally representative prospective study of US adults. JAMA 1998; 279:1703-8.
[3] Winkleby MA, Jatulis DE, Frank E, Fortmann SP. Socioeconomic status and health: how education, income, and occupation contribute to risk factors for cardiovascular disease. Am J Public Health 1992;82: 816-20.
[4] Galobardes B, Morabia A, Bernstein MS. Diet and socioeconomic position: does the use of different indicators matter? Int J Epidemiol 2001;30:334-40.
[5] Darmon N, Drewnowski A. Does social class predict diet quality? Am J Clin Nutr 2008;87:1107-17.
[6] Dubois L, Girard M. Social position and nutrition: a gradient relationship in Canada and the USA. Eur J Clin Nutr 2001;55:366-73.
[7] Lopez-Azpiazu I, Sanchez-Villegas A, Johansson L, Petkeviciene J, Prattala R, Martinez-Gonzalez MA, for the FAIR-97-3096 Project. Disparities in food habits in Europe: systematic review of educational and occupational differences in the intake of fat. J Hum Nutr Diet 2003; 16:349-64.
[8] Sanchez-Villegas A, Martinez JA, Prattala R, Toledo E, Roos G, Martinez-Gonzalez MA, for the FAIR-97-3096 Group. A systematic review of socioeconomic differences in food habits in Europe: consumption of cheese and milk. Eur J Clin Nutr 2003;57:917-29.
[9] Irala-Estevez JD, Groth M, Johansson L, Oltersdorf U, Prattala R, Martinez-Gonzalez MA. A systematic review of socio-economic differences in food habits in Europe: consumption of fruit and vegetables. Eur J Clin Nutr 2000;54:706-14.
[10] Groth MV, Fagt S, Brondsted L. Social determinants of dietary habits in Denmark. Eur J Clin Nutr 2001;55:959-66.
[11] Friel S, Kelleher CC, Nolan G, Harrington J. Social diversity of Irish adults nutritional intake. Eur J Clin Nutr 2003;57:865-75.
[12] Roos E, Prattala R, Lahelma E, Kleemola P, Pietinen P. Modern and healthy?: socioeconomic differences in the quality of diet. Eur J Clin Nutr 1996;50:753-60.
[13] Smith GD, Brunner E. Socio-economic differentials in health: the role of nutrition. Proc Nutr Soc 1997;56:75-90.
[14] Martikainen P, Ishizaki M, Marmot MG, Nakagawa H, Kagamimori S. Socioeconomic differences in behavioural and biological risk factors: a comparison of a Japanese and an English cohort of employed men. Int J Epidemiol 2001;30:833-8.
[15] Nishi N, Makino K, Fukuda H, Tatara K. Effects of socioeconomic indicators on coronary risk factors, self-rated health and psychological well-being among urban Japanese civil servants. Soc Sci Med 2004;58: 1159-70.
[16] Hirokawa K, Tsutusmi A, Kayaba K. Impacts of educational level and employment status on mortality for Japanese women and men: the Jichi Medical School cohort study. Eur J Epidemiol 2006;21:641-51.
[17] Freisling H, Elmadfa I, Gall I. The effect of socioeconomic status on dietary intake, physical activity and body mass index in Austrian pregnant women. J Hum Nutr Diet 2006;19:437-45.