

Food consumption and nutrient intake among individuals with long-standing spinal cord injury in Norway

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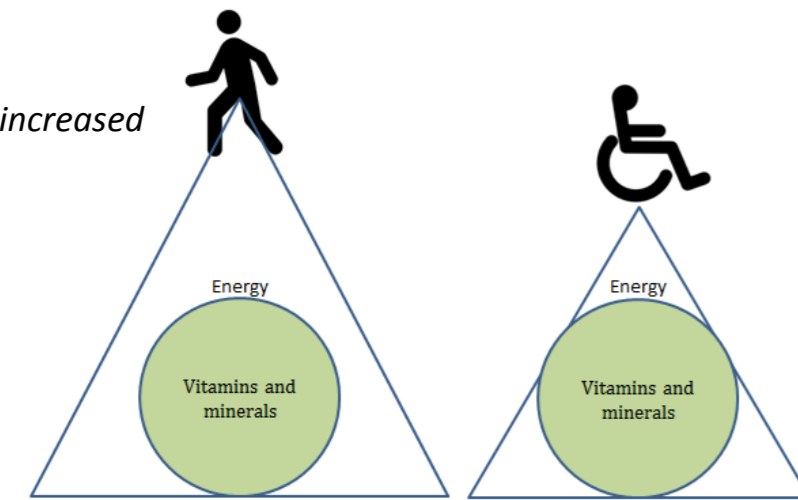
CONCLUSIONS

The SCI study population seems more compliant with dietary guidelines than the general Norwegian population; however, insufficient intakes of several micronutrients were identified.

INTRODUCTION

Previous studies suggest suboptimal nutritional intake in spinal cord injury (SCI) populations (1). Consequences of SCI includes loss of muscle mass, reduced basal metabolic rate and physical inactivity which has implications for nutritional needs (fig 1).

Figure 1: Reduced energy needs but same or increased needs of nutrients after SCI



Objectives

Characterize the diet of the SCI population in Norway, with regards to foods and beverage intake, energy, macro- and micronutrients and antioxidant intake. Compare intakes with reference populations, and proportion of the SCI population complying with the quantitative dietary guidelines.

Study design

A cross-sectional survey in a random sample of 400 persons with SCI (fig 2).

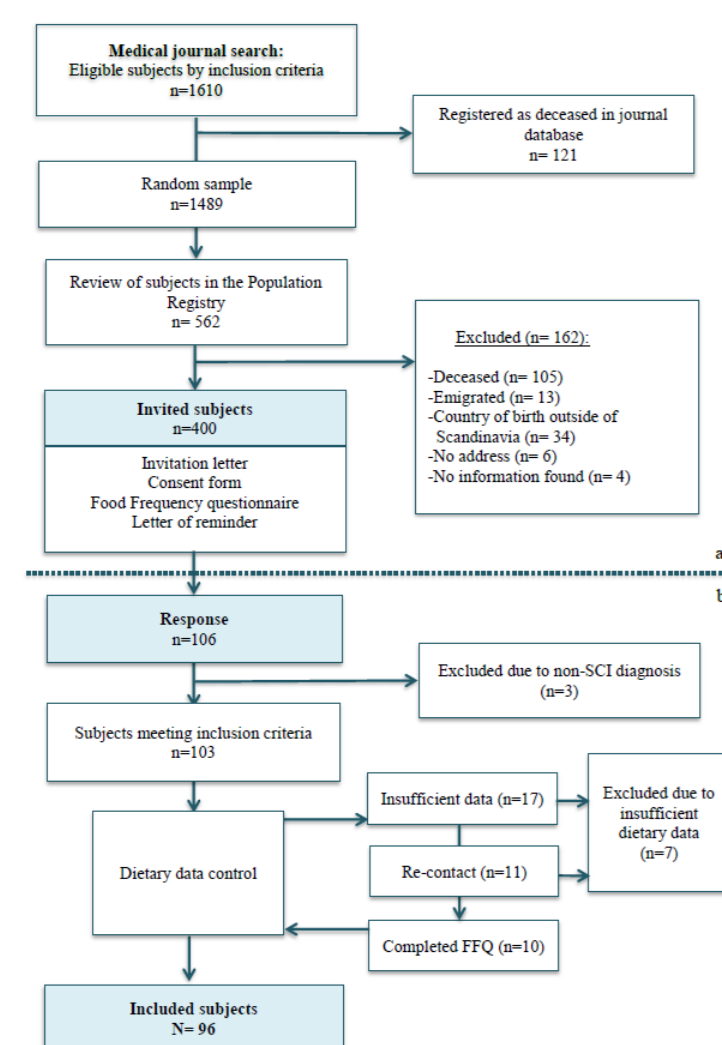


Figure 2a and b: Flow chart over study design, data collection and data control

METHODS

Assessment

Semi-quantitative food frequency questionnaire (FFQ)

Study population

Inclusion criteria: ≥ 2 years post injury, all cause, ASIA A-D

Reference population

Data from a nationwide survey Norkost3 (N3) (2), dietary guidelines and a Norwegian Antioxidant Study (3)

Characteristics

Table 1: Study population characteristics

	Men (n=64, 66.7%) Median (Range)	Women (n=32, 33.3%) Median (Range)	Total (n=96, 100%) Median (Range)
Age (years) ^a	59.0 (24 – 86)	52.5 (21 – 69)	58.0 (21 – 86)
Time since injury (years) ^b	14.5 (4 – 48)	14.0 (3 – 56)	14.5 (3 – 56)
Body mass index (kg/m ²)	24.9 (17.0 – 36.1)	24.9 (18.6 – 32.0)	24.9 (17.0 – 36.1)
Age, N (%)			
21-30 years	5 (8)	5 (16)	10 (10)
31-45 years	11 (17)	8 (25)	19 (20)
46-60 years	18 (28)	11 (34)	29 (30)
61-75 years	26 (41)	6 (25)	34 (35)
76+ years	4 (6)	0 (0)	4 (4)
Level of injury, N (%)			
C1-C4 ABC	1 (1)	2 (2)	3 (3)
C5-C8 ABC	10 (10)	4 (4)	14 (15)
T1-S5 ABC	24 (25)	7 (7)	31 (32)
AIS D All levels	16 (17)	11 (11)	27 (28)
Missing values	13 (14)	8 (8)	21 (22)
Living arrangement, N (%)			
Living alone	16 (25)	8 (25)	24 (25)
Living with family	45 (70)	22 (69)	67 (70)
Other	3 (5)	2 (6)	5 (5)
Tobacco use, N (%)			
No	55 (86)	28 (88)	83 (87)
Occasionally	3 (5)	1 (3)	4 (4)
Daily	6 (9)	3 (9)	9 (9)

^a Different from women, $p = 0.05$, ^b Missing value from one female

RESULTS

A total of 64 men and 32 women responded (response rate 26.5%). The study population had similar energy intake (EI) as the N3 population, however, men with SCI had 15% less EI compared to N3 men ($p=0.002$) (Table 2). Consumption of plant foods were higher in the SCI group than N3 ($p<0.001$) and coffee contributed 54% of total antioxidant intake in the SCI population (Table 3). Low intakes of vitamin D, -A, calcium, zinc and selenium were identified in parts of the SCI population (Table 4). Total water intake was significantly lower compared to N3 (410 g/d vs. 925 g/d) ($p<0.001$) and 81% used supplements.

Table 2: Energy intake and shares of men and women in the SCI and Norkost 3 populations complying with the quantitative Norwegian dietary guidelines.

		SCI		Norkost 3	
		Men (n=64)	Women (n=32)	Men (n=833)	Women (n=905)
Energy intake (MJ) ^β		8.9 (7.1, 11.4)	7.8 (6.3, 10.0)	10.5 (8.4, 12.8)	7.8 (6.3, 9.5)
Daily consumption of:	RI ^α	%	%	%	%
Vegetables, fruit and berries ^{α,β}	≥ 500 g/d	57	56	17	19
Vegetables ^{α,β}	≥ 250 g/d	55	78	16	14
Fruits and berries ^{α,β}	≥ 250 g/d	44	44	25	30
Whole grain ^c	≥ 70 g/d/ ≥ 90 g/d	33	47	28	27
Fish, pure ^{d, p^β}	≥ 350 -400 g/d	67	50	40	32
Fatty fish ^{e, p^β}	≥ 200 g/week	44	28	16	18
Red meat, pure + processed ^f	< 500 g/week	28	66	42	61

^α Recommended intake according to Norwegian dietary guidelines

^β Median (P25, P75)

^{p^β}: significant difference between men; ^{p^β}: significant difference between women; Chi-square test ($p < 0.001$).

DISCUSSION

Results may be influenced by different assessment methods in the SCI and reference studies. Known challenges of FFQ's are overestimation of fruit and vegetables and underestimation of snacks. Generally a challenge of dietary assessment methods include motivated responders. In the future, other dietary assessment tools may shed light on the representativeness of these dietary findings for the SCI population.

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Table 3: Food and beverage contributions to antioxidant intake; presented as percentages of total antioxidant intake.

Percentage of antioxidants from:	SCI population			Antioxidant population			p
	Median (%)	5-perc.	95-perc.	Median (%)	5-perc.	95-perc.	
Breadproducts	1.3	0.0	6.7	3.9	1.0	13.0	<0.01
Vegetables	5.6	1.4	16.7	5.2	1.2	15.6	0.52
Fruit and berries	10.6	1.6	44.6	10.2	2.0	36.6	0.89
Fruit	6.5	0.9	28.8	6.1	0.7	22.0	0.38
Berries	3.1	0.1	19.5	2.0	0.2	10.6	0.10
Juices	0.8	0.0	10.8	1.9	0.0	14.4	<0.01
Nuts and seeds	0.4	0.0	8.1	0.5	0.0	8.2	0.49
Chocolate	1.2	0.0	9.7	1.2	0.0	12.8	0.64
Coffee	54.1	0.0	87.1	46.9	0.0	81.1	0.02
Tea	2.9	0.0	59.5	4.6	0.0	48.9	0.20
Wine	0.8	0.0	17.0	4.3	0.0	22.5	<0.01
Spices	0.5	0.1	3.8	1.9	0.2	5.4	<0.01

The presented antioxidant values in table 13 do not sum up to 100% due to presentation of only those food groups that contribute significantly to the antioxidant intake. Thus, the remaining antioxidant food sources are distributed among several other food groups, such as for example condiments, with small individual contributions to the total intake of antioxidants.

Table 4: Shares of men and women from SCI and Norkost 3 with micronutrient intakes at or above recommended levels.

Daily intake of	Recommendation	SCI		Norkost 3	
		Men (n=64)	Women (n=32)	Men (n=833)	Women (n=905)
Vitamin A	Men: 900 RAE, Women 700 RAE	50	72	46	46
Folic acid ^{α,β}	300 µg	52	56	36	18
Vitamin C ^{α,β}	75 mg	89	88	56	65
Vitamin D	10 µg	16	19	17	9
Vitamin E ^β	Men: 10 mg, Women: 8 mg	72	88	62	67
Calcium	800 mg	55	44	63	45
Zink	Men: 9 mg, Women: 7 mg	81	78	85	82
Iron	Men: 9 mg, Women 15 mg	72	19	80	9
Selenium	Men: 60 µg, Women: 50 µg	50	41	48	39
Magnesium	Men: 350 mg, Women: 280 mg	63	81	72	71

^α sign. difference between men from SCI and N3 ($p < 0.001$); ^β sign. difference between women from SCI and N3 ($p < 0.001$);

^c Folic acid supplementation of 400 µg is recommended for women planning pregnancy, otherwise recommended intake for women is 300 µg per day.

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