

Dietary intake in Swedish medical students

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Abstract

Background: A 3 day food record is a part of the medical curriculum in Göteborg, and the dietary intake of medical students from 1987 to 1993 has been reported previously.

Objective: To study dietary intake in medical students, detect changes over time and qualitative differences between men and women, and compare with nutrition recommendations, intake in the Swedish population in general and in medical students in other countries.

Design: A 3 day estimated food record of 1737 students during the years 1994–2006, performed at the medical school at Göteborg University.

Results: Mean energy intake for men and women was 10.9 and 7.8 MJ, respectively, without significant differences between 1994 and 2006. Proportions of energy from fat, protein, carbohydrates and alcohol were 29/30, 16/16, 51/53 and 2/3E% in female/male students, respectively. The dietary intake of folate and dietary fibre was higher in 2006 than in 1994 in both genders, whereas the percentage of energy from saturated fat and dietary iron intake decreased over time.

Conclusions: Energy intake was stable during 1994–2006. Significant and mostly positive differences over time were observed. The dietary intake in medical students compared quite well with Nordic Nutrition Recommendations, and in some aspects was better than in the general population.

Keywords: *dietary assessment; energy intake; folate; food record; time trends; vitamin C*

Introduction

During the second year at the medical school in Göteborg, students are requested to undertake a 3 day recording of dietary intake as part of the medical curriculum. This is a way of making the students aware of their total energy requirements and to learn more about different methods of dietary surveys and the nutritional value of different foods. The dietary survey methods used in these medical students' surveys have been successfully validated by urinary nitrogen, as reported previously (1).

This study was a follow-up of that from 1993 (1) aiming to investigate differences in dietary intake among medical students between 1994 and 2006. Qualitative differences between men and women were considered and the intake of fruit and vegetables was studied particularly during the autumn of 2006. Dietary intake data were compared with reports regarding medical students in Greece (2) and the USA (3), and with the dietary intake of the Swedish population in general (4).

Methods

Subjects

The study included students from the second year of the medical curriculum in Göteborg. The size of each course varied from 52 to 85 students. In total this report covers the years from 1994 to 2006 and includes 1737 students, 994 women and 743 men. The average age was 24.5 years.

General outline

A 3 day estimated food record was performed twice yearly in 1994–2006. For technical reasons there are no data available from the autumn term 1995, and for 1999 there is only information on energy intake and calculated energy expenditure. For some other courses there are no data on some variables, because the questions and analysis have varied slightly over the years. From spring 1996 to spring 2000 there are no data available for each individual, but the average values for men and women are known.

The students registered their estimated intake of food and beverages, as well as time of meals in a food diary. They were asked to measure, if possible, the weight and volume of the food and beverages. Registrations were made on two weekdays and one day during the weekend. In 2000, 2001 and autumn 1999 the computer program was MAT, version 4.03 (Rudans Lättdata, Västerås, Sweden), based on a nutrition database from 1999. During all other courses DIETIST/WINDIET was used. During 1994–1998, DIETIST version 5.6 (DOS) (Kost och Näringsdata, Bromma) was used. This version used nutrition data from the Swedish National Food Administration, assessed before 1994. During the remaining courses WINDIET version 1.3 was used, also based on data from the Swedish National Food Administration.

Statistics

The results are presented as mean values and standard deviation (SD) derived from each course, with men and women presented separately or all together. Statistical analyses with *t*-tests and linear regression were performed in Microsoft Excel (Microsoft® Office Excel 2003, Microsoft Corporation) and in SPSS (version 14.0, SPSS), respectively. A level of $p \leq 0.05$ was considered significant.

Basal metabolic rate, energy expenditure and energy sources

The students were asked to calculate their basal metabolic rate (BMR), by using World Health Organization (WHO) equations, based on gender, weight and age (5). According to Goldberg et al. (6), there is a cut-off limit for what can be seen as a plausible amount of energy intake during the actual measurement period, when allowing a certain day-to-day variability. The cut-off limit for a 3 day food record is thus set to $1.04 \times \text{BMR}$ (1). Comparing “all students” and “only valid students” from 2003 ($n = 142$ and $n = 121$, respectively), no significant differences were detected between the groups. Hence, this report is based on all students.

Total energy expenditure (TEE) was calculated using physical activity level (PAL), thus $\text{TEE} = \text{BMR} \times \text{PAL}$ (6), and until spring 2004 was calculated according to the WHO standard for a sedentary lifestyle, with PAL assigned a value of 1.56 for women and 1.55 for men (5). From autumn 2004 onwards the students were allowed to select their degree of physical activity and thus obtain

their individual PAL. One gram of fat, 1 g of carbohydrate, 1 g of protein and 1 g of alcohol were calculated to contribute 37.8, 16.7, 16.7 and 29.3 kJ, respectively. The contribution of alcohol as an energy source was calculated by the difference from 100% after subtraction of the energy provided from fat, carbohydrate and protein.

Nutritional supplements

The calculation of dietary intake did not include nutritional supplements. During the courses in 2002, 2005, 2006 and autumn 2004, 485 students in total were asked whether they used any nutritional supplements.

Fruit and vegetables

The amounts of fruit, berries, vegetables, root vegetables, leguminous plants and fruit juice were calculated for the autumn course of 2006 from the food diaries of 56 students (26 men and 30 women) to check the compliance with contemporary dietary recommendations on daily intake of fruit and vegetables (7). Estimated weight was taken from standard weight tables (8), and from the DIETIST computer software when the weight of the food was not specified in the food diaries. The results are presented as mean dietary intake of fruit and vegetables with fruit juices included, and also as mean dietary intake of fruit juices only.

Recommendations

Intake data were evaluated according to Nordic Nutrition Recommendations (NNR) (9), and related to average requirement (AR) and lower intake levels (LI), as well as recommended intake (RI) for planning of diets.

Results

Energy and macronutrient intake

The mean energy intake for the whole period 1994–2006 was 7.8 MJ for women and 10.9 MJ for men (Table 1) and there was no significant trend over time. The energy intake was 91% and 84% of the calculated energy expenditure for men and women, respectively. The dietary food records of 80% of women ($n = 593$) and 90% of men ($n = 367$) were valid using to the cut-off limit of energy intake $> 1.04 \times \text{BMR}$ (10). The mean reported energy intake per kilogram body weight was 129 (8.5) kJ for women, range 120–150 kJ (13 courses

Table 1. Dietary intake in medical students between 1994 and 2006 (left), Nordic Nutrition Recommendations (middle) (9) and Swedish dietary intake according to Riksmaten 1997–98 (4)

	1994–2006 ^a		NNR						Riksmaten	
	Women	Men	RI women	RI men	LI women	AR women	LI men	AR men	Women	Men
<i>n</i>	994	743							202	195
Energy (MJ)	7.8 (0.5)	10.9 (0.9)							7.9	10.3
Fat (E%)	29 (1.7)	30 (1.5)	25–35	25–35					33	34
Carbohydrate (E%)	53 (2.0)	51 (1.9)	50–60	50–60					49	48
Protein (E%)	16 (0.7)	16 (0.9)	10–15	10–15					16	15
Alcohol (E%)	2 (1.1)	3 (1.3)	Max. 5	Max. 5					2	3
Saturated fat (E%)	12 (1.1)	13 (0.9)	Max. 10	Max. 10					14	14
Monounsaturated fat (E%)	10 (0.8)	11 (0.7)	10–15	10–15					13	13
Polyunsaturated fat (E%)	4 (0.4)	4 (0.6)	5–10	5–10					5	5
Fibre (g)	21 (1.8)	25 (2.4)	25–35	25–35					15	17
Iron (mg)	13 (2.4)	18 (3.4)	15	9	5 ^{b,c}	10 (6 ^b)	7	7	10	12
Vitamin C (mg)	123 (17)	127 (21)	75	75	10	50	10	60	84	77
Calcium (mg)	925 (65)	1173 (75)	800	800	400	–	400	–	961	1128
Folate (µg)	257 (38)	305 (43)	400	300	100	200	100	200	208	228
Vitamin A (µg)	1153 (195)	1264 (186)	700	900	400	500	500	600	947	1160
Vitamin D (µg)	4.0 (0.7)	5.4 (1.0)	7.5	7.5	2.5 ^d	–	2.5 ^d	–	4.4	5.6
Vitamin E (mg)	7 (0.8)	9 (0.9)	8	10	3	5	4	6		
Vitamin B ₁ (mg)	1.5 (0.4)	1.9 (0.2)	1.1	1.4	0.5	0.9	0.6	1.2		
Vitamin B ₂ (mg)	1.7 (0.1)	2.2 (0.2)	1.3	1.6	0.8	1.1	0.8	1.4		
Vitamin B ₁₂ (µg)	4 (0.6)	6 (0.9)	2	2	1	1.4	1	1.4		
Fibre (g MJ ⁻¹)	2.7 (0.2)	2.2 (0.2)							1.9	1.7
Iron (mg MJ ⁻¹)	1.7 (0.3)	1.6 (0.3)								

^aMean (SD).

^bRefers to non-menstruating women.

^cA lower limit cannot be stated without observing the woman's iron status.

^dA value that is primary for people aged >60 years, but not for people with scarce or no sun exposure.

RI: recommended intake; LI: lower intake; AR: average requirement.

included), and 145 (10.0) kJ, range 119–157 kJ, for men (14 courses included).

The mean saturated fat intake was 12 and 13 energy per cent (E%) for women and men, respectively. There was a significant decrease between 1994 and 2006 for both women ($p < 0.01$) and men ($p < 0.05$) (Fig. 1).

Vitamins and minerals

The reported dietary intakes of A, C and certain B vitamins (B₁, B₂ and B₁₂) were all sufficient, with mean intakes well exceeding RI (Table 1). Vitamin D intakes of 5.4 (1.0) µg for men and 4.0 (0.7) µg for women were above mean LI, but did not reach RI. Dietary intake of calcium was ample, at around 1 g daily in both genders. Between 1994 and 2006 there was a significant decrease in total iron intake ($p = 0.001$ for women and $p < 0.001$ for men) (Fig. 2) and iron density per MJ ($p < 0.001$ for both genders). Women had an average intake of

13 mg iron. The proportion of women eating less than AR for iron (10 mg) was 10% before 1996 ($n = 95$) and 40% from autumn 2000 to 2006

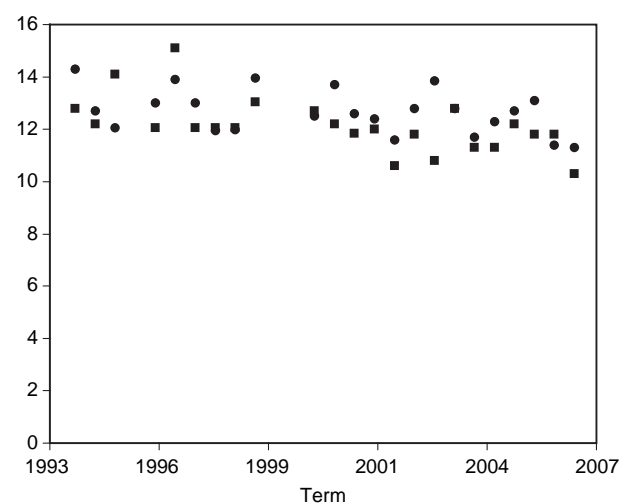


Fig. 1. Mean energy per cent saturated fat, in male and female medical students during 1994–2006. ■: Women; ●: men.

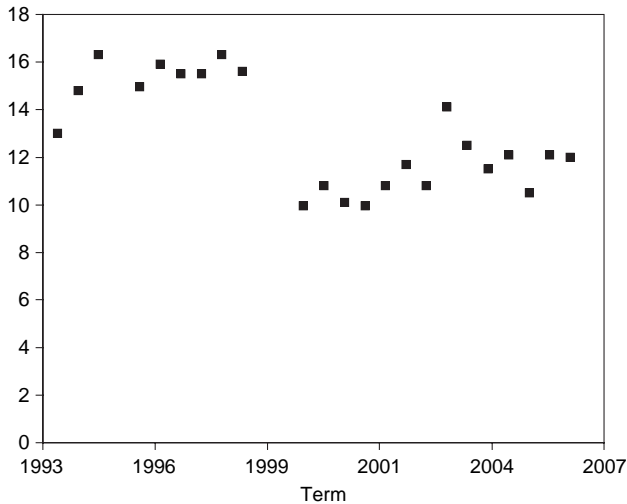


Fig. 2. Iron intake in female medical students during 1994–2006.

($n=551$). Many women also had a low intake of folate; 31% reported a dietary intake below the AR of 200 μg ($n=646$). However, there was a significant time trend, with increasing folate intake for both genders ($p < 0.001$ for women and $p = 0.05$ for men), and the proportion of women consuming less than 200 μg decreased significantly ($p < 0.01$).

Dietary fibre

Mean daily intake of dietary fibre was 21 (1.8) g in women and 25 (2.4) g in men. Between 1994 and 2006 there were significant increases in fibre intake ($p < 0.05$ for women and $p < 0.01$ for men) and dietary fibre per MJ ($p < 0.05$ for women and $p < 0.01$ for men) for both genders. The women in general consumed less fibre than men, but had a higher fibre intake per MJ (2.7 and 2.2 MJ^{-1} , respectively).

Nutritional supplements

There was a big variation in the use of nutritional supplements between the courses. In total, 485 students answered the question on whether they use any nutritional supplements. Nutritional supplement use was very similar between genders, with 21% users among women and 22% among men.

Fruit and vegetables

The mean daily intake of fruit and vegetables for men was 365 g, with 105 g fruit juice included. The corresponding intake for women was 408 g, of which 51 g was fruit juice. The proportion of women and

men who consumed 500 g or more was 30% and 23%, respectively.

Anthropometric characteristics

Body mass index (BMI) was reported during the courses in 2002–2006 ($n=595$). The mean BMI for women and men was 21.8 and 23.4, respectively. Five percent of women reported underweight (BMI < 18.5) and 10% reported overweight (BMI > 25) or obesity. No men reported underweight, but 22% were overweight or obese.

Discussion

The food records in this report were primarily performed for pedagogic purposes, and not for scientific evaluation. The authors are aware of the many possible biases in the food record method, e.g. underreporting or uninterested students. However, these sources of error could be assumed to be similar for all years. The method has previously been successfully validated by urinary nitrogen as an objective marker for protein intake in medical students (1), indicating that this study, based on 3 day food records, could give a reasonable estimate of the food habits among Swedish medical students during 1994–2006.

Energy intake was very stable between 1994 and 2006, and no significant time trend was detected. The average student obtained too much energy from saturated fat compared with current nutrition recommendations (9). However, there was a statistically significant decrease in energy percentage of saturated fat over time for both genders, in accordance with dietary guidelines, and the total contribution of fat as a percentage of energy was also in accordance with the recommendations. The larger difference between calculated and registered energy expenditure in the most recent years could possibly be explained by the fact that since autumn 2004 the students were allowed to choose their own PAL. Before 2004 all students were assigned to have a “sedentary lifestyle”, with a PAL of 1.56 for men and 1.55 for women.

Underreporting is a well-known and common problem when making food records (6, 10). The average energy intake for all students in the study from 1993 (1) was 11.5 MJ for men and 8.1 MJ for women. The average energy intake in the present study tended to be somewhat lower, at 10.9 MJ and 7.8 MJ, respectively. The previous study (1) showed

a statistically significant decrease in the energy percentage from fat from 37E% to just over 30E%, with a corresponding increase in carbohydrates from 46E% to just over 50E%. The present study shows that these figures have remained quite stable during the period 1994–2006.

Dietary intake of iron decreased between 1994 and 2006 in both genders. The proportion of women consuming less than AR was 10% before 1996 and 40% after 1999, most probably due to the fact that iron fortification of flour ceased in Sweden in 1995. In the data this transition was not detected until 1999 due to a delay in updating the nutrition database, as described in Methods.

Average dietary intake of most vitamins was generally sufficient compared with nutrition recommendations. Nevertheless, 31% of women did not reach the AR for folate. However, in both genders there was an increase in folate intake over time. The average intake of vitamin D was below the RI value for all women and almost all men (except in 2005), but average intakes for all courses were above the LI level. The intake of vitamin C exceeded recommended levels.

Women had a dietary fibre intake below recommended values, but fibre intake per MJ was higher in women than in men (2.7 and 2.2 g MJ⁻¹, respectively). The proportion of students in this study who consumed at least 500 g of fruit and vegetables was also higher for women than for men. Moreover, there was a clear positive trend between 1994 and 2006, with more dietary fibre consumed by both genders. Despite this, the average student during autumn 2006 consumed less fruit and vegetables than the recommended target of 500 g (7).

According to a study of 951 medical students at the University of Crete (2), with dietary intake assessed by 24 h recalls during 1989–2001, female students had an average energy intake of 7.0 MJ and male students 10.4 MJ, i.e. slightly lower than the intakes in the present study. The Greek students had a higher total intake of fat (men 40E% and women 39E%) and a higher energy percentage from mono-unsaturated fat (17E% compared to 10E% among the Swedish medical students). The average intakes of folate were lower for both genders compared with the Swedish students, the female Greek medical students had a low iron intake (average value of 10 mg) and both genders had lower iron nutrient

density than the Swedish students. Greek men and women had low total intakes of dietary fibre, 17 g in men and 14 g in women, and the fibre density per MJ was also lower than that of the Swedish students.

An American study (3) performed during 1989–1992 examined the food habits of 616 first year medical students at the University of Alabama, by making a 24 h food record. The American students were, like the Swedish students, asked to weigh and measure the food and beverages whenever possible. Overall, the American study and the present study report very similar values, with average energy intake in US medical students at 11.3 MJ for men and 7.4 MJ for women. Energy percentages from fat, carbohydrate and protein were also very similar to those in the present study.

“Riksmaten 1997–98” (4) reports a national dietary survey including 1215 randomly chosen people aged 18–74 years who performed a 7 day dietary record (Table 1). Women aged 17–34 years had an average energy intake of 7.9 MJ, which is similar to that observed in the present study. Men aged 17–34 years consumed on average 10.3 MJ, i.e. slightly less than in the present study. The fat energy percentage was slightly higher in the Riksmaten report than in the present study. Both genders in Riksmaten had a lower intake of dietary fibre, iron and vitamin C. As for the medical students, there was a low intake of folate compared with RI, but the average values for both genders were above the AR. The average intakes of fruit and vegetables in Riksmaten were 326 g for women and 272 g for men (aged 17–34 years), with 103 g and 112 g fruit juice included, respectively. The medical students in the present study had a higher total intake of fruit and vegetables, although the female students consumed only about half the amount of fruit juice.

In summary, the Göteborg medical students generally reported a dietary intake that compared quite well with NNR. Nevertheless, despite a significant decrease over time, the average student still obtained too much of their energy from saturated fat. Dietary fibre intake increased between 1994 and 2006. Many female medical students had a lower than recommended dietary intake of iron and folate. The students in general had a higher intake of fruit and vegetables than the general population, although still lower than the recommended intake. Swedish medical students seem to

have dietary habits closer to the NNR than the general Swedish population in the corresponding age range. These findings correspond well with data reported from US medical students, and compare favourably with data reported for Greek medical students.

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