Dietary intake in Swedish medical students during 2007-2012

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Dietary intake in Swedish medical students 2007-2012

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ABSTRACT (244 words)

Background: Dietary intake in Swedish medical students has been reported for the periods 1987-1993 and 1994-2006.

Objective: To analyse dietary intake in medical students between 2007-2012, in relation to Nordic Nutrition Recommendations, to previous surveys and to a contemporary Swedish population.

Design: Nutrient intake was calculated from 3-day food records conducted by 698 medical students. Differences between surveys were evaluated by t-test and changes over time by linear regression.

Results: Energy intake in valid female and male reporters was 8.7 and 11.9 MJ respectively. Intake of protein, fat and alcohol as proportion of energy (E %), and dietary fibre was within recommendations. Intake of most micronutrients was above recommendations, except for vitamin D, and in women, iron and folate. In women E % fat increased between 2007 and 2012, while E % carbohydrate decreased. Compared to 1994-2006, medical students in the present survey consumed less carbohydrates and more fat, more folate and more vitamin E. The students were more compliant with the dietary recommendations than the same age group of the Swedish population.

Conclusion: Energy intake in medical students, and dietary intake with some exceptions, have been stable from 1987 to 2012, and close to the Nordic Nutrition Recommendations for most nutrients. Between 2007 and 2012 fat intake increased and carbohydrate intake decreased significantly in women and tended to so in men. Similar trends were seen in the Swedish population, possibly indicating the impact of diet trends such as Low Carb-High Fat (LCHF).

Keywords: food record, nutrition recommendations, time trends, macronutrient composition, micronutrients

INTRODUCTION

The Swedish National Food Agency has published nationwide surveys on dietary intake, from 1989, 1997-98 and 2010-11[1-3]. These reports show energy intake to be stable in the Swedish population in general. Protein intake as proportion of energy (E %) has increased, while fat intake decreased and carbohydrate intake remained unchanged. In young Swedish adults aged 18-30 years E % fat seems to have increased in women, while E % carbohydrate has decreased over the last decade among both women and men [2, 3].

A dietary assessment exercise has been performed since 1983 in the early, preclinical stage of the medical programme at the Sahlgrenska Academy in Gothenburg.

As higher education is associated with better dietary habits [4], it is of interest to assess dietary intake among students in higher medical education and compare it to the dietary intake of participants of the same age group in the national dietary surveys. Furthermore, with repeated measurements over time it is possible to detect temporal changes in dietary intake. The aim of this study was to describe dietary intake and any changes over time in medical students during 2007-2012. The dietary intake is compared to the Nordic Nutritional Recommendations 2004[5], to previous surveys in medical students [6, 7], and to a contemporary Swedish population sample of the same age group, reported in Riksmaten 2010-11 [3].

SUBJECTS

The dietary assessment exercise was performed at the Sahlgrenska Academy by 698 medical students (373 women and 325 men) during 12 semesters between 2007 and2012. The assessment was the last of several compulsory laboratory exercises during the preclinical courses, although it was during some semesters (autumn 2011 and during 2012) possible to skip one laboration. The number of students performing the dietary assessment varied between 27 and 76 per semester, corresponding to 26% and 92% of the students.

METHOD AND MATERIALS

During three consecutive days (two weekdays and one weekend day) the students registered their food intake in a food diary, where they reported type and amount of food eaten, weighed if possible, otherwise estimated. The method has previously been validated using the excretion of nitrogen in urine as a biomarker for protein intake [6]. Measured or estimated amounts as volume or weight of each foodstuff, excluding any vitamin and mineral supplements, were entered into the computer programme DIETIST XP version 3.2 DkNoSe (Kost och Näringsdata, Bromma, Sweden), based on the official Swedish food composition database. Data was collected from the lab exercise as average intake per day in a spread sheet format, using Microsoft® Office Excel 2010 Pro, Microsoft Corporation. Both the Swedish food composition database as well as DIETIST XP was updated almost yearly during 2007-12 (personal communication, Claes Wallentinson, Kost och Näringsdata). One major change to the database between former study periods and the current is the addition of energy from dietary fibre (2 kcal/g) that was performed in 2005-2006 (personal communication, Anna-Karin Lindroos, SLV).

Basal metabolic rate (BMR) and predicted total energy expenditure (TEE) were calculated by the students during the lab exercise, using equations from NNR 2004 [5]. TEE was for pedagogic reasons calculated both as BMR x PAL (physical activity level, which was selected by each student from a PAL-table [5]) and from the standardized TEE as presented by DIETIST XP. Energy intake from 3-day food records was compared to the calculated BMR. We used a cut-off limit of BMR x 1.04 as suggested by Goldberg [8]. In the present report under-reporters are excluded from analysis and presentations where dietary intake in medical students is compared to NNR 2004. When comparing nutrient densities to previous reports in medical students and to Riksmaten, all students (also under-reporters) are included as in the

previous studies [6, 7], as well as in the national surveys [1-3].

Statistical methods

Mean values of dietary intake were calculated in Microsoft® Office Excel 2010 Pro for all the selected nutrients for both genders. Energy yielding nutrients are presented as proportion of energy intake (E %). The variables were plotted in histograms and compared with normal distribution curves, to define whether a nutrient was normally distributed or not. Statistical analyses were made using SPSS® software version 20.0 (SPSS Inc., Chicago, IL, USA). A p-value of <0.05 was considered statistically significant. Changes over time in mean nutrient intake per semester were analysed using linear regression. Vitamins A, D, C, E and kobalamin, selenium and alcohol were non-normally distributed variables.

As raw data was not available for surveys other than those performed in medical students, nutrient density was calculated from reported mean values. In comparisons, nutrient density per 10 MJ was used as presented in the Riksmaten survey 2010-11 [3]. Comparisons between the dietary surveys were performed using one-sample t-test. Non-normally distributed variables were log-transformed before statistical testing, and to facilitate comparison to previous studies these are presented as mean and SD. Bonferroni correction was performed on the p-values, to adjust for multiple testing. Proportions were compared using Pearson chi-square test.

RESULTS

Energy intake and PAL values

Average energy intake was 8.2 MJ (range 1-16) MJ for all women and 11.3 (range 3.3-24) MJ for all men. Using the cut-off limit by Goldberg et al [8], 18% of the female students and 11% of the male students were defined as under reporters. Energy intake for valid students and under reporters is presented in **table 1**. Under reporters had similar calculated TEE but a lower energy intake, a lower intake of dietary fibre, but a higher E% of protein, compared to the valid reporters. PAL values calculated as EI/BMR were similar between sexes at 1.38±0.36 (range 0.16-2.54) in all women, and 1.49±0.41 (range 0.41-3.25) in all men.

The proportion of students reporting taking any form of dietary supplements was 20% in women and 15 % in men, with no significant difference between sexes or between valid reporters or under reporters. Micronutrient intake from food was not different between students taking or not taking supplements (data not shown).

Self-selected TEE was overestimated in men by 7% compared to standardized TEE but by only 1% in women. Neither overestimations nor energy intake or macronutrient composition were significantly different between the three semesters with low participation rate (<50%) compared to those with high participation (data not shown).

Macronutrients and micronutrients 2007-2012

Macronutrient composition was similar between sexes, with the exception of alcohol which was consumed more among men. Intakes of macronutrients and micronutrients in the students are presented in **table 1** and **table 2**, as are the proportions of students reaching RI (Recommended Intakes), AR (Average Requirements) and LI (Lower limits of Intake) for each nutrient according to NNR2004 [5].

Mean proportion of energy (E %) from fat was within recommendations although saturated fat exceeded recommendations. Only 4 women and 5 men reported fat intake above 50E%. Mean protein was within recommendations in both women and men, but 4 women and 13 men reported protein intake above 25E%. In addition, 48 women and 49 men reported carbohydrate intake below 40E%, and these reporters had significantly higher intake of alcohol (3.7E% and 6.7E% respectively) and fat (40.3E% and 39.6E% respectively) compared to the rest.

Mean intake in medical students was close to RI for most micronutrients whereas intake of vitamin C, vitamin E, thiamine, riboflavin, kobalamin and zinc well exceeded RI. Mean intake of vitamin D was below RI for both women and men. In women mean intakes of iron and folate were slightly below RI. In women 75-81% did not reach RI for iron, folate and vitamin D while in male students 72% did not reach RI for vitamin D.

Mean dietary intake for single semesters were compared to detect any significant changes over the years 2007-2012. In women, E % fat increased from 29 to 36 and E % carbohydrates decreased from 53 to 43 within this period, $p<0.05$ for both. Corresponding intakes for men showed the same trend but with only borderline statistical significance, ($p=0.05$). Intake of vitamin E increased from 8 to 12 mg per day in both female and from 9 to 10 mg per day in male medical students during 2007-2012, $p<0.05$ for both.

Comparison to previous surveys in medical students

When comparing nutrient densities to previous reports in medical students all students (also under-reporters) are included. Energy intake in the present survey did not differ compared to previous reports (**table 3 and figure 1**)). E% carbohydrate was lower and E % protein was higher than previously reported. E % fat was higher than in the 1994-2006 cohort, primarily

due to higher intake of unsaturated fats. Intake of dietary fibre was higher than in previous reports.

Energy adjusted intake of iron was lower than reported in the previous cohorts of medical students [6, 7]. Folate and vitamin E were not reported in the study from 1987-1993, but compared to 1994-2006, the students in the present survey had higher energy adjusted intake of these nutrients.

Comparison to the Swedish population

Comparisons of dietary intake in all medical students and Swedish population in general in this age group [3] are presented in **table 4**. Energy intake was higher in all medical students than among subjects 18-30 years as reported in the Riksmaten survey. The proportion of under-reporters, defined as outside 95% CI, in this age group in Riksmaten, with a 4-day food record, was 19% in women and 30% in men, compared to 18% in women and 11% in men among the students. Differences in under-reporting between our survey and Riksmaten were significant in men ($p<0.001$), but not in women.

Medical students reported lower E % fat and higher E % carbohydrates compared to Riksmaten, whereas E % saturated fat did not differ significantly. Female students reported higher E % protein than the subjects in Riksmaten, whereas the opposite was true in male students.

Because of the difference in reported energy intake between the medical students and Riksmaten, the remaining nutrients were further analysed as intake/10 MJ (nutrient density).By doing so, students were found to have a higher nutrient density for dietary fibre, iron, folate, thiamine and riboflavin than their peers in Riksmaten [3].

DISCUSSION

We found the intake of most nutrients to be stable for medical students during the period

2007-2012. Compared to the Swedish population in general the students had a more nutritious intake, fairly well in compliance with the NNR2004. However, during this period mean E % fat increased significantly in the female students, while E % carbohydrates decreased. This trend was also detectable in comparison to previous surveys in medical students at the University of Gothenburg.

Energy intake, macronutrients and micronutrients 2007-2012

Intake of energy, macronutrients and micronutrients was stable between 2007 and 2012 except for a shift in E % for carbohydrates and fats. For most micronutrients mean intake was well above recommended intake (RI). However, for some nutrients RI was hard to reach; as many as 75% of female students did not reach (RI) of iron and as many as 81% of the female students did not reach RI for folate, despite higher intake levels compared to previous reports. This illustrates that is difficult to achieve the general nutrition recommendations for some nutrients through food intake only. Still, only 0,3% of female students reported iron or folate intake below lower intake level (LI). In addition, it must be admitted that this was based on a 3-day estimated food record which is inadequate to capture "usual" intake of micronutrients, especially for retinol. Only about half of the students reached RI for vitamin A, and roughly 15% did not even reach lower intake level which most probably is accounted for by ceased or decreased retinol fortification during the study period. Recommended levels of vitamin D intake seem hard to achieve by dietary means for both female and male medical students. This is illustrated by the fact that roughly 75% of the students did not reach RI, and 23% of the female and 14% of the male students did not even reach LI, as recommended in NNR4. NNR5, published during 2014 [9], recommend LI for vitamin D to be used mainly for people over 60 years of age, and LI for iron mainly for post menopausal women, thus these comparisons should not be taken as indicators of deficiency in other populations. NNR5

suggest an increase in RI for vitamin D to 10µg/day for both genders, making it even harder to comply with the recommendations,

Comparison to previous surveys in medical students

Comparing our 2007-2012 cohort of medical students at the University of Gothenburg to the 1983-1993 and 1994-2006 cohorts, some secular changes over time in both male and female students can be detected: Fat intake increased between the 1994-2006 cohort and the present cohort, while carbohydrate intake decreased compared to both previous cohorts. Protein intake also increased since the previous reports. These findings are in line with diet trends such as high protein diets and Low Carbohydrate-High Fat diet [10], supporting the possibility of impact from such diets.

The increased intake of dietary fibre and folate might reflect a growing general interest for the quality of carbohydrates [4], but also changes in the composition of cereals and bread. A lower mean intake of iron, thiamine and riboflavin compared to previous surveys could likely be explained by diminished fortification as expressed in more recent versions of the official food data base.

Comparison to the Swedish population

Compared to the Swedish population of this age group, medical students seem to comply better with recommendations for most nutrients, supporting the positive association between higher education and better dietary habits [4], and possibly a selection bias in that medical students could be expected to be more health conscious than the general population. Trends indicating increased intake of fat and reduced intake of carbohydrates are seen also in the Riksmaten surveys [2, 3]. Interestingly, although students had a lower fat intake compared to the general population, the ratios between saturated and unsaturated fats were similar and hence dietary fat quality was probably not better among students. In addition, medical

students seem to have the same difficulties in reaching RI for vitamin D and for women also iron and folate as the Swedish population of the same age.

Strengths and limitations

This study is based on a pedagogic exercise not primarily aiming to evaluate dietary intake. Some students weighed but most estimated food intake, thus this would result in varying quality of the food record. Men overestimated their energy needs, while women did not. Also, the representativeness of the food records may have fluctuated as the proportion of students attending varied according to regulations, from 26% to 92%. Still, regardless of the proportion of students performing the food diaries, there were the same overestimation of energy needs in men and accurate estimation in women, supporting that the semesters were fairly comparable.

One limitation for the comparisons of dietary intake in this study to the previous reports emerges from the frequent revisions of the food data base. Energy during the last decades has been calculated originally without dietary fibre, but in the current study including energy from dietary fibre attributed (2 kcal/g). This energy is included in the energy from carbohydrates and could indicate that the true decrease in energy from carbohydrates over time is larger than observed in table 3 (about 50-60 kcal or 3 E%). However, energy intake has not been significantly different between the cohorts. On the other hand, fortification regulations vary over time for vitamin D, retinol and iron. For vitamin A as retinol, the database was revised towards lower retinol values in spring semester 2010[11], which might explain the nominally lower retinol intake reported in the present cohort. Hence, changes in micronutrient intake should be viewed with great caution as secular trends in food data bases could give the impression of dietary changes. Also an ever increasing diversity of food items fortified especially with vitamin D might make longitudinal comparisons of micronutrients beyond the

scope of a pedagogic exercise for medical students. However, with a substantial number of food records, and with underreporters excluded, we believe the results are valid on group level, and could be used to describe dietary intake, at least for macronutrient composition, in Swedish medical students. This method, with the same 3 day food diary, has also successfully been validated by urinary nitrogen [6].

CONCLUSION

Dietary intake of both energy and most nutrients has been stable in medical students between 2007 and 2012, with a composition close to the Nordic Nutrition Recommendations. During these years E % fat increased at the expense of E % carbohydrates compared to the previous cohort. This trend was also found in the Riksmaten survey, possibly reflecting the impact of popular diets such as Low Carbohydrate-High Fat diet (LCHF). The carbohydrates consumed by medical students seem to be of acceptable quality, considering a considerable intake of dietary fibre, and also of folate.

Compared to the Swedish population, the students were more compliant with the nutrition recommendations, with a better dietary intake of most nutrients, except dietary fat quality. Thus, this suggests that medical students are more health conscious than the population in general and hence have slightly better dietary habits.

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Table 1. Energy and macronutrient intake in Swedish medical students 2007-2012

	Mean intake (SD) Valid reporters		Mean intake (SD) Under reporters		NNR2004
	Women	**Men**	**Women**	**Men**	
n =	*306*	*288*	*67*	*37*	
Energy (MJ)	8.7 (1.7)	11.9 (2.6)	5.5 (1)¤	6.8 (1.4)¤	
Predicted energy expenditure (MJ)	10.5 (1.3)[m]	13.8 (1.9)	10.8 (1.5)	14.3 (1.8)	
Fat (E %)	32.2 (6.9)	32.3 (7.0)	32.0 (9)	29.8 (7.0)	25-35
Carbohydrate (E %)	48.8 (8.3)[m]	47.2 (8.3)	46.2 (12)	49.1 (11)	50-60
Protein (E %)	15.8 (2.9)	16.1 (3.7)	18.7 (5.7)¤	19.0 (5.5)¤	10-20
Alcohol [nnd](E %)	1.8 (4.4)	3.4 (6.0)***	1.7 (4)	1.1 (3.6)	Max. 5
Saturated fat (E %)	12.8 (3.6)	12.9 (3.6)[m]	12.2 (4)	12.3 (4)¤	Max. 10
Monounsaturated fat (E %)	11.5 (3.0)	11.8 (3.0)[m]	12.1 (4)	10.3 (3)¤	10-15
Polyunsaturated fat (E %)	5.0 (2.1)[m]	4.8 (2.2)[m]	5.4 (2.6)	4.3 (1.8)[m]	5-10
Dietary fibre (g)	26 (11)	28 (10)***	18 (7)¤	18 (7)¤	25-35
Dietary fibre (g/MJ)	3.0 (1.1)	2.4 (0.8)***	3.3 (1.2)¤	2.7 (1)	3.0
Supplement users (%)	20 (40)	15 (35)	24 (43)	25 (44)	

*** *p>0.001 for difference between sexes by t-test*

¤ *p<0.05 difference between valid and under reporters of the same sex*

m *One or two missing values*

nnd *Not normally distributed variable*

Table 2. Micronutrient intake in Swedish medical students 2007-2012

	Mean intake (SD)		NNR 2004 (women/men):			Proportion below defined levels (Women/men %):		
	Women	**Men**	**RI**	**AR**	**LI**	**RI**	**AR**	**LI**
n	*306*	*288*						
Iron (mg)	13 (6)	16 (7)*	15/9	10/7	5/7	75/5	29/0	0.3/0
Iron (mg/MJ)	1.5 (0.5)	1.4 (0.6)*						
Vitamin C (mg) [nnd]	128	135	75	50/60	10	27/29	10/19	0.3/0.3
Calcium (mg)	956 (349)	1181 (442)*	800		400	34/19		2/2
Folate (µg)	324 (142)	357 (139)*	400/300	200	100	81/40	11/8	0.3/0
Vitamin A (µg) [nnd]	905[a]	1001	700/900	500/600	400/500	50/54	27/25	15/16
Vitamin D (µg) [nnd]	5.5	6.3*	7.5		2.5	75/72		23/14
Vitamin E (mg)	10 (4)	13 (6)*	8/10	5/6	3/4	30/35	3/3	0.3/0
Thiamine (mg)	1.5 (0.6)	1.9 (0.7)*	1.1/1.4	0.9/1.2	0.5/0.6	20/20	6/8	0/0
Riboflavin (mg)	1.7 (0.5)	2.2 (0.8)*	1.3/1.6	1.1/1.4	0.8	21/19	6/7	0.3/0.7
Kobalamin (µg) [nnd]	4.9	6.3*	2	1.4	1	6/2	3/2	0.7/0.3
Zink (mg)	11 (3)	15 (5)*	7/9	5/6	4/5	7/5	0/1	0/1
Selenium (µg)	41 (15)[b]	57 [nnd,c*]	40/50	30/35	20	52/46	20/17	4/3

(valid reporters only; 67 female and 37 male students excluded, corresponding to 18% and 11% respectively).

nnd *Not normally distributed variable*

a) n=304 *RI = Recommended intake defined as meeting the requirement among all healthy adults* [5]

b) n=192 *AR = Average Requirement defined as RI minus 2 standard deviations* [5]

c) n=186 *LI = Lower limits of intake representing approximately the 97th percentile of the distribution of minimum requirement*

** p<0.01 between sexes by t-test*

Table 3. Dietary intake in medical students 2007-2012 compared by one-sample t-test to previous cohorts 1987-1993 and 1994-2006, all students.

	Women[a]			Men[a]		
	1987-1993	**1994-2006**	**2007-2012**	**1987-1993**	**1994-2006**	**2007-2012**
n	*240*	*912*	***373***	*318*	*686*	***325***
Energy (MJ)	8.1 (2.2)	7.9 (0.5)	**8.2 (2.0)**	11.5 (3.2)	11.1 (0.6)	**11.3 (3.0)**
Fat (E %)	31.3 (6.8)	29.0 (1.7)**	**32.1 (7.3)**	32.6 (6.7)	30.3 (1.5)**	**32.0 (7.0)**
Carbohydrate (E %)	52.1(8.1)***	53.3(2.0)***	**48.4 (9.1)**	49.6(8.2)***	50.7(1.9)***	**47.4 (8.6)**
Protein (E %)	15.0(3.1)***	15.5(0.7)***	**16.3 (3.7)**	14. (2.9) ***	15.6(0.9)***	**16.4 (4.0)**
Alcohol (E %)[b]	1.6 (4.7)**	2.3 (1.1) ***	**1.8 (4.3)**	2.9 (6.2)**	3.4 (1.3) ***	**3.1 (5.8)**
Saturated fat (E %)	13.4(3.7)***	12.0(1.0)***	**12.7 (3.7)**	14.0(3.5)***	12.7 (0.9)	**12.8 (3.6)**
Monounsaturated fat (E %)	-	10.1(0.8)***	**11.6 (3.2)**	-	10.8(0.7)***	**11.6 (3.0)**
Polyunsaturated fat (E %)	4.8 (2.1)	4.3 (0.4) ***	**5.0 (2.2)**	5.0 (2.2)	4.5 (0.6)	**4.7 (2.2)**
Fibre (g/10 MJ)	23***	27***	**30 (11)**	20**	22***	**25 (8)**
Iron (mg/10 MJ)	20***	17***	**15 (6)**	19**	16***	**14 (6)**
Vitamin C (mg/10 MJ)[nnd]	160	156	**157 (94)**	114*	114*	**120 (84)**
Calcium (mg/10 MJ)	1084	1171	**1120 (377)**	984	1057*	**1005 (340)**
Vitamin A (µg/10 MJ)[nnd]	-	1459	**1074 (800)**	-	1139	**889 (631)**

Folate (µg/10 MJ)	-	325***	**388 (166)**	-	275***	**314 (135)**
Vitamin D (µg/10 MJ) [nnd]	-	5.1	**6.5 (5.0)**	-	4.9	**5.6 (4.0)**
Vitamin E (mg/10 MJ)	-	9***	**12 (5)**	-	8***	**11 (4)**
Vitamin B1 (mg/10 MJ)	2.0*	1.9***	**1.7 (0.7)**	1.9*	1.7	**1.7 (0.6)**
Vitamin B2 (mg/10 MJ)	2.0	2.2***	**2.0 (0.6)**	2.0	2.0	**1.9 (0.6)**
Kobalamin (µg/10 MJ) [nnd]	-	5.1	**5.8 (3.4)**	-	5.5	**5.5 (3.0)**
Zink (mg/MJ)	-	-	**13.0 (3.2)**	-	-	**12.9 (3.5)**
Selenium (µg/MJ)	-	-	**51 (22)**	-	-	**51 (32)**

[a] *Mean (SD)*

[nnd] *Not normally distributed variable which was log-transformed before testing*

) p<0.05, **) p<0.01 , and *) p<0.001 compared to2007-2012*

Figures without superscript did not differ significantly.

Table 4. Dietary intake in Swedish medical students 2007-2012 compared by one-sample t-test to the dietary intake in Riksmaten 2010-11 (RM), age group 18-30 years [3].

	Women			Men		
	Medical students	**RM**	**p-value**	**Medical students**	**RM**	**p-value**
n =	**373**	202		**325**	132	
Energy (MJ)	**8.2 (2.0)**	7.6 (2.3)	*p<0.001*	**11.3 (3.0)**	9.4 (3.5)	*p<0.001*
Fat (E %)	**32.1 (7.3)**	34.6 (5.7)	*p<0.001*	**32.0 (7.0)**	33.9 (6.7)	*p<0.001*
Carbohydrate (E %)	**48.4 (9.1)**	46.0 (6.7)	*p<0.001*	**47.4 (8.6)**	43.9 (7.3)	*p<0.001*
Protein (E %)	**16.3 (3.7)**	15.7 (3.0)	*p=0.008*	**16.4 (4.0)**	17.8 (4.7)	*p<0.001*
Alcohol (E %)[nnd]	**1.8 (4.3)**	1.8 (3.4)	*ns*	**3.1 (5.8)**	2.7 (5.1)	*p<0.001*
Saturated fat (E %)	**12.7 (3.7)**	13.1 (2.8)	*ns*	**12.8 (3.6)**	13.2 (3.4)	*ns*
Monounsaturated fat (E %)	**11.6 (3.2)**	13.1 (2.7)	*p<0.001*	**11.6 (3.0)**	12.8 (2.8)	*p<0.001*
Polyunsaturated fat (E %)	**5.0 (2.2)**	5.8 (2.1)	*p<0.001*	**4.7 (2.2)**	5.2 (1.9)	*p<0.001*
Fibre (g/10 MJ)	**30 (11)**	23 (7)	*p<0.001*	**25 (8)**	20 (7)	*p<0.001*
Iron (mg/10 MJ)	**15.3 (5.9)**	11.9 (3.1)	*p<0.001*	**14 (6)**	12 (4)	*p<0.001*
Vitamin C (mg/10 MJ) [nnd]	**157 (94)**	110 (57)	*p<0.001*	**120 (84)**	84 (61)	*p<0.001*
Calcium (mg/10 MJ)	**1120 (377)**	1073 (304)	*ns.*	**1005 (340)**	1040 (356)	*ns.*

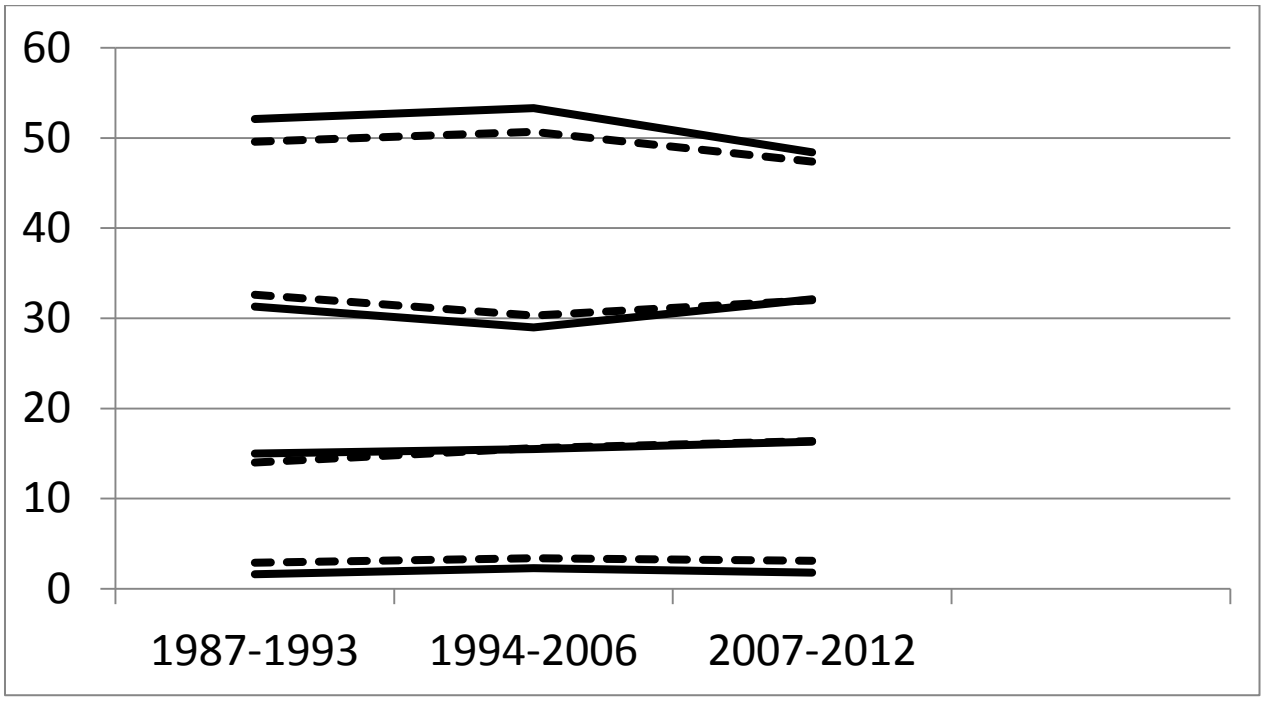
Vitamin A (µg/10 MJ) [nnd]	**1074 (800)**	858 (361)	*ns.*	**889 (631)**	795 (541)	*p=0.04*
Folate (µg/10 MJ)	**388 (166)**	298 (77)	*p<0.001*	**314 (135)**	266 (80)	*p<0.001*
Vitamin D (µg/10 MJ) [nnd]	**6.5 (5.0)**	6.7 (3.4)	*p<0.001*	**5.6 (4.0)**	7.0 (4.7)	*p<0.001*
Vitamin E (mg/10 MJ) [nnd]	**12.4 (4.9)**	13.8 (7.0)	*p<0.001*	**10.6 (3.7)**	13.7 (16.5)	*p<0.001*
Vitamin B1 (mg/10 MJ)	**1.7 (0.7)**	1.4 (0.3)	*p<0.001*	**1.7 (0.6)**	1.5 (0.3)	*p<0.001*
Vitamin B2 (mg/10 MJ)	**2.0 (0.6)**	1.8 (0.5)	*p<0.001*	**1.9 (0.6)**	1.8 (0.5)	*p=0.02*
Kobalamin (µg/10 MJ) [nnd]	**5.8 (3.4)**	5.3 (2.2)	*ns*	**5.5 (3.0)**	6.4 (3.4)	*p<0.001*
Zink (mg/10 MJ)	**13.0 (3.2)**	12.3 (2.7)	*p<0.001*	**12.9 (3.5)**	14.1 (4.1)	*p<0.001*
Selenium (µg/10 MJ) [nnd]	**51 (22)**	50 (17)	*ns*	**51 (32)**	59 (36)	*p<0.001*

ns = not significant

nnd = not normally distributed variable which was log-transformed before testing

Figure 1

Secular trends in macronutrient composition in three cohorts of Swedish medical students, 1525 female and 1329 male, during 1983-2012.



Legend: From top to bottom: E % carbohydrates, fat, protein and alcohol.

Unbroken line= female students, broken line= male students.