

SHORT COMMUNICATION

Validation of four questions on food habits from the Swedish board of health and social welfare by 3-day food records in medical and nursing students

Ellinor Fredriksson, Hilde K. Brekke and Lars Ellegård*

Department of Internal Medicine and Clinical Nutrition, Institute of Medicine, Sahlgrenska Academy, University of Gothenburg, Gothenburg, Sweden

Abstract

Background: The Swedish board for health and social welfare (SoS) has presented four questions on dietary habits as indicators of adherence to dietary recommendations. However, these questions have not been evaluated.

Objective: To evaluate if four questions on dietary habits correlate with dietary intake assessed by food records.

Design: A total of 279 medical and nursing students, 170 women and 109 men, completed four questions on usual consumption frequency of vegetables, fruits, fish, and sweets. Depending on scoring from 0 to 12 points, subjects were classified as having low (0–4 points), average (5–8 points), or high (9–12 points) adherence to dietary recommendations as proposed by SoS. Nutrient intake was calculated from 3-day food records. Mean dietary intake, expressed per 10 MJ of fibre, ascorbic acid, folate, vitamin D, sucrose, fish, and fruits and vegetables, was analysed for each group and differences assessed by ANOVA.

Results: Energy intake was 11.8 ± 3.0 MJ in male and 8.5 ± 2.2 MJ in female students. Most students, 64%, were classified as average adherers to dietary recommendations, whereas only 6% were classified as low and 30% as high. Dietary intake of fibre, ascorbic acid, and folate was significantly higher in the high adherence group compared to both the other groups ($p < 0.01$), but vitamin D significantly so only compared to the average group ($p = 0.002$). Intake of fruits and vegetables was significantly different between all groups ($p < 0.003$), with increasing amounts with increasing adherence. The low adherence group had higher intake of sucrose than the other groups ($p < 0.005$). Median fish intake was nil in the low and average adherence groups, with significant difference between high and average adherence groups ($p = 0.001$).

Conclusions: Four questions on the consumption frequency of vegetables, fruits, fish, and sweets correlate well with the dietary intake of fibre, ascorbic acid, folate, vitamin D, fish, sucrose, and fruits and vegetables as assessed by 3-day food records in health-conscious medical and nursing students.

Keywords: *food habits; food questionnaire; food record; nutrition recommendations*

Received: 25 November 2013; Revised: 15 September 2014; Accepted: 1 October 2014; Published: 31 October 2014

Nutrition recommendations are issued by both national and international agencies, in order to inform the public on how to make healthy dietary choices. The compliance to these recommendations is mostly unknown, partly because it is cumbersome to perform dietary surveys. In order to simplify the assessment of the compliance to contemporary nutrition recommendation, the Swedish board of health and social welfare (SoS) has introduced four self-instructed questions (1). If these questions actually will reflect such compliance is unsubstantiated at the moment.

We have addressed this topic by combining the results of these questions with food records completed by medical and nursing students. The dietary assessment exercise has been performed since 1983 in the early, preclinical stage of the medical programme at the Sahlgrenska Academy in Gothenburg, and in later years also among nursing students (2, 3). It is a pedagogic exercise, not primarily focused on the result in dietary intake, but rather to experience different methods to investigate it. Each student completes a 3-day food record, from which his or her dietary intake is calculated. The method has previously

been validated using the excretion of nitrogen in urine as a biomarker for protein intake (2).

The aim of this study was to investigate if four simple questions would correlate to the dietary intake of relevant nutrients or food items as assessed from food records in medical and nursing students.

Subjects

The dietary assessment exercise was performed during 2011–2013 at the Sahlgrenska Academy by 204 medical students (109 women and 95 men) and 75 nursing students (61 women and 14 men) with an average age of 23 ± 4 years. Mean body weight in male students was 75.5 ± 8.8 kg, corresponding to a BMI of 22.9 ± 2.4 (range 18.7–29.1). Mean body weight in female students was 60.4 ± 8.4 kg, corresponding to a BMI of 21.8 ± 2.6 (range 16.9–28.1). In addition, 65 medical students were given the four questions on two different occasions to check the reproducibility.

Methods and materials

Four questions regarding consumption of 1) vegetables and root vegetables, 2) fruits and berries, 3) fish and shellfish, 4) rolls, sweets and chocolates, and sugar-sweetened drinks (1) were answered during an introductory lecture before completing the food diary. Each question could yield 0–3 points depending on the frequency of consumption, with higher scores for more frequent consumption on the first three questions, and the other way round on the fourth question. Depending on scoring from 0 to 12 points, subjects were classified as proposed by SoS to have low (0–4 points), average (5–8 points), or high (9–12 points) adherence to dietary recommendations.

During 3 consecutive days (2 weekdays and 1 day in the weekend), the students registered their food intake in a food diary, where they reported type and amount of food eaten. They measured (or when not possible; estimated) the amount as volume or weight of each foodstuff which were entered into the computer programme DIETIST XP version 3.2 (Kost och Näringsdata, Bromma, Sweden).

Basal metabolic rate (BMR) and predicted total energy expenditure (TEE) were calculated by the students during the lab exercise, using equations from Table 9.1 in NNR 2004 (4). TEE was calculated as $BMR \times$ physical activity level (PAL), which was selected by each student from Table 9.9 in NNR 2004 (4). Energy intake from 3-day food records was validated by comparison to the calculated BMR. We used a lower cut-off limit of $BMR \times 1.04$ as suggested by Goldberg et al. (5).

Statistical methods

Mean values of dietary intake were calculated in Microsoft® Office Excel 2010 Pro for all the selected nutrients for both genders and presented as mean \pm standard deviation. 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. Medians and 25–75 percentiles were used for non-normally distributed variables. In comparisons, nutrient density per 10 MJ was used, and differences assessed by ANOVA with Bonferroni post hoc test (Table 1). Non-normally distributed variables were log-transformed before statistical testing. Correlations between adherence groups and dietary intake of nutrients and food items were assessed by Spearman's correlation coefficient.

Table 1. Mean dietary intake expressed per MJ divided between groups with low, average and high adherence to contemporary dietary recommendations in 279 medical and nursing students, 170 women and 109 men, as assessed by four questions from the Swedish board of health and social welfare (1).

	Adherence groups			P-values for differences between groups		
	Low (0–4p)	Average (5–8p)	High (9–12p)	Low vs. average	Low vs. high	Average vs. high
n (%)	16 (6)	178 (64)	85 (30)			
Energy (MJ)	8.5 ± 1.7	9.5 ± 2.6	9.8 ± 2.4	ns	ns	ns
Fibre (g/MJ)	2.0 ± 0.4	2.6 ± 0.8	3.2 ± 1.4	$p < 0.01$	$p < 0.001$	$p < 0.001$
Vitamin C (mg/MJ) ^a	6 (6–10)	11 (7–16)	12 (12–23)	$p < 0.04$	$p < 0.001$	$p < 0.001$
Folate (μ g/MJ)	26 ± 5	35 ± 16	43 ± 16	ns	$p < 0.001$	$p < 0.001$
Vitamin D (μ g/MJ) ^a	0.5 (0.5–0.7)	0.5 (0.3–0.7)	0.7 (0.4–1.1)	ns	ns	$p = 0.002$
Sucrose (g/MJ) ^{a, b}	6.2 (5–8)	3.8 (2–5)	3.3 (2–4)	$p = 0.04$	ns	ns
Fruits and vegetables (g/MJ) ^{a, b}	26 (15–24)	43 (27–51)	67 (45–81)	$p = 0.01$	$p < 0.001$	$p < 0.001$
Fish (g/MJ) ^{nd, b}	0 (0–3)	0 (0–5)	5.0 (2–9)	$p = 0.004$	ns	$p = 0.001$

P-values from pair wise comparison of the groups by ANOVA with Bonferroni post hoc test. ns = not significant.

^and = not normally distributed parameter, presented as median values (percentiles 25–75) and log-transformed before testing.

^bOnly students from autumn semester 2012 ($n = 114$), divided into low adherence group $n = 7$, average adherence group $n = 69$, and high adherence group $n = 38$.

Results

Calculated BMR and calculated TEE were on average 7.6 ± 0.5 MJ and 13.8 ± 1.9 MJ in male and 5.9 ± 0.4 MJ and 10.3 ± 1.8 MJ in female students, respectively. Estimated PAL was thus 1.80 in male and 1.77 in female students. Energy intake in male and female students was 11.8 ± 3.0 MJ and 8.5 ± 2.2 MJ, corresponding to PAL values of 1.55 ± 0.39 and 1.46 ± 0.34 .

Reproducibility between assessments with the four questions tested twice in 65 medical students showed no significant difference in mean score, 6.92 versus 7.05 ($p = 0.63$). Fifty-five per cent had the same number of points on both occasions, whereas 20% increased their scores and 25% decreased their scores. Four individuals changed from lowest to middle adherence group, and three from middle to highest group, whereas two changed in the opposite direction for each cut-off point.

No significant differences in scores were found between men and women or between medical and nursing students for each gender. Most students, 64%, were classified as having average adherence to dietary recommendations, whereas only 6% were classified into low adherence, and 30% into high adherence. Dietary intake of fibre, ascorbic acid, and folate was significantly higher in the high adherence group compared to both the other groups ($p < 0.01$). In the low adherence group, median intake of ascorbic acid was 63 mg (44–78), compared to 100 mg (63–147) and 149 mg (112–202) in the average and high adherence groups, respectively. One student in the average adherence group reported an intake of only 8 mg ascorbic acid, which is below lower intake level (LI) of 10 mg/day according to NNR 2004 (4). In the low, average, and high adherence groups, median intake of folate was 211 ± 64 mg, 312 ± 131 mg, and 413 ± 166 mg, and the proportion of students reporting folate intake below LI (< 200 µg/day) was 31%, 9%, and 0%, respectively.

Intake of fibre, ascorbic acid, and folate were all fairly well correlated to the adherence groups, with increasing intake from low to high adherence, $r_{\text{Spearman}} = 0.37, 0.35, 0.39$, respectively ($p = 0.01$ for all). Intake of vitamin D was less well correlated, with $r_{\text{Spearman}} = 0.15$ ($p < 0.05$). The proportions of students reporting vitamin D intake below LI (< 2.5 µg/day) were 6%, 12%, and 7% in the low, average, and high adherence groups, respectively.

Intake of sucrose was negatively correlated to adherence group, $r_{\text{Spearman}} = -0.22$ ($p < 0.05$), whereas intake of fish and fruits and vegetables was positively correlated to adherence groups, $r_{\text{Spearman}} = 0.32$ and 0.52 , respectively (both $p = 0.01$). The original score (0–12 points) was slightly higher correlated with the intake of fish and fruits and vegetables, $r_{\text{Spearman}} = 0.34$ and 0.58 , respectively ($p < 0.0001$).

Intake of fruits and vegetables was significantly different between groups, with increasing amounts with increasing adherence. The group with high adherence had

higher intake of fish and vitamin D than the average group ($p < 0.018$), whereas the low adherence group had higher intake of sucrose than the other groups ($p < 0.005$).

Discussion

This is the very first attempt to validate the four questions from SoS (1), suggested to be able to discriminate individuals with low compliance to dietary guidelines. Medical and nursing students are supposed to be more health conscious than the general population, which is mirrored in the high scores attained on the four questions. In these students, only 6% were classified as low adherers (which could reduce the statistical power to detect any differences) and 31% as high adherers, whereas outcome in the general population is reported to be approximately 20% and 10%, respectively (6).

We found the questions to be reproducible and to correspond well to the dietary intake of fibre, ascorbic acid, folate, and the intake of sucrose, fish, as well as fruit and vegetables reported in the food diaries. This in spite of the very simple method based on four questions with four pre-defined alternatives for consumption frequency.

Students in the low adherence group did not report different energy intake compared to the average or high adherence groups, nor did their actual *mean* intake of vitamin C, vitamin D, and folate fall below LI according to NNR, although it was lower than in the higher adherence groups.

The proportion of students reporting vitamin D intake below 2.5 µg/day was actually higher in the average adherence group. This could possibly be due to a high proportion of vegetarians and vegans among these students who, by not eating fish, would score 3 points less on the ratings, and thus be more likely to end up in the average rather than high adherence group. This could be taken as a weakness in the method, but will also be a consequence of the very limited amount of vitamin D in food items other than fatty fish.

Thus, based on these findings, these four questions could possibly be used to quickly and easily rank individuals according to their general adherence to dietary guidelines. The questions on fish and sweets regard weekly consumption, which a 3-day food record cannot be expected to cover fully. Still, we found significant differences in sucrose intake between the low and average adherence groups, and also significant differences in fish intake between the low adherence group and the other groups.

Conclusion

Four questions on the consumption frequency of vegetables, fruits, fish, and sweets are reproducible and correlate well with the in dietary fibre intake of fibre,

ascorbic acid, folate, vitamin D, fish, sucrose, and fruits and vegetables as assessed by 3-day food records in health-conscious medical and nursing students.

Conflict of interest and funding

The authors have not received any funding or benefit from any part for this study, and have no conflicts of interests to declare.

References

1. National guidelines for preventive measures - indicators. (in Swedish). National board of health and social welfare (Socialstyrelsen). <http://www.socialstyrelsen.se/nationellariktlinjerforsjukdomsforebyggandemetoder/Documents/nr-sjukdomsforebyggande-inikatorer.pdf> [cited 1 October 2012].
2. Ellegård L. Food habits in medical students. A survey of food records 1983–1993. *Scand J Nutr* 1994; 38: 134–40.
3. Tengvall M, Ellegård L. Dietary intake in Swedish medical students. *Scand J Food Nutr* 2007; 51: 79–84.
4. Alexander J, Anderssen JA, Aro A, Becker W, Fogelholm M, Lyhne N, et al. Integrating nutrition and physical activity. Copenhagen: Norden; 2004.
5. Goldberg G, Black A, Jebb S, Cole T, Murgatroyd P, Coward W, et al. Critical evaluation of energy intake data using fundamental principles of energy physiology: 1. Derivations of cut-off limits to identify under-recording. *Eur J Clin Nutr* 1991; 45: 569–81.
6. Becker W. Indicators for healthy food choices. Results from dietary interviews 2008. (in Swedish). Uppsala, Sweden: National Food Agency (Livsmedelsverket); 2009.

*Lars Ellegård

Department of Internal Medicine and Clinical Nutrition
Institute of Medicine, Sahlgrenska Academy
University of Gothenburg
P.B. 459, SE-40530
Sweden
Email: lasse.ellegard@nutrition.gu.se