

# Reported macronutrient intake and metabolic risk factors: immigrant women from Iran and Turkey compared with native Swedish women

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## Abstract

**Background:** Immigrants in general seem to be more vulnerable than the host populations to developing nutrition-related chronic conditions. This may be in part related to diverging dietary habits.

**Objective:** The aim of the study was to examine the nutrient intake and its relationship to metabolic variables among immigrant versus native Swedish women.

**Design:** A cross-sectional health survey of 157 randomly selected foreign-born and native Swedish women. This included 24 h dietary recall repeated four times and administered in the native language.

**Results:** Underreporting was significant, especially among immigrant women. There were no major differences in terms of energy distribution of the macronutrients between very low energy reporters and acceptable energy reporters, indicating that the dietary data reflected the qualitative composition in spite of the underreporting of energy intake. Immigrant women consumed less alcohol and obtained a lower proportion of their energy from saturated fatty acids, but a higher proportion from polyunsaturated fatty acids, sucrose and total carbohydrates. Associations between dietary variables and metabolic risk factors were relatively weak.

**Conclusions:** Underreporting might have attenuated possible associations between diet and risk factors. The study illustrates specific problems in the dietary assessment and the need to develop valid techniques when studying groups of people of diverging ethnic backgrounds.

**Keywords:** *dietary intake; immigrants; Iran; metabolic risk factors; Sweden; Turkey; underreporting*

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## Introduction

Sweden is a multicultural country with a population of approximately 9 million, of whom 12% were first generation immigrants in 2003 (Statistics Sweden, SCB). Immigrant groups bring their own dietary habits to their new country. However, they may modify their diets because of the available food supply, better economic status or a desire to integrate into their new culture (1). It has been suggested that such changes following migration may not be beneficial to health, but little is known about how changing food habits affect the health of immigrants in Sweden. Furthermore,

immigrants to Sweden and other Western countries generally seem more vulnerable to developing nutrition-related chronic conditions than do the host populations (2–4).

Previous studies have shown that dietary changes following migration to more affluent areas expose immigrants to an increased risk of diet-related chronic diseases connected to the metabolic syndrome, such as type 2 diabetes mellitus, cardiovascular disease, hypertension and obesity (5, 6). It is plausible that the increased prevalence of circulatory disease and type 2 diabetes mellitus among immigrants to Sweden is related to changes in

lifestyle factors, such as physical activity and diet (3, 4). A previous paper reported some results from this study concerning the health status of immigrant women from two Middle Eastern countries, compared with that of native Swedish women, showing a higher prevalence of abdominal obesity and an unfavourable lipid profile among immigrant women (7).

The present article investigates energy, fat, cholesterol, protein, carbohydrate, dietary fibre and alcohol intake of immigrant women from Iran and Turkey compared with that of native Swedish women, and the relationship between reported nutrient intake and metabolic variables such as body mass index (BMI), sagittal abdominal diameter (SAD), and serum lipid and insulin levels.

## Materials and methods

### Subjects

The study examined first generation immigrant women born in Iran and Turkey between 1933 and 1962 (i.e. 35–64 years of age), who had resided in the municipality of Uppsala, Sweden, for at least 3 years. The fieldwork was carried out from 1997 to 2000. A random sample was taken of 180 immigrant women and 90 women born in Sweden during the same period, all resident in Uppsala. The sampling was undertaken by Statistics Sweden (SCB). More details of the sampling procedure are given in Daryani et al. (8). The study was approved by the ethics committee of the Faculty of Medicine at Uppsala University and all subjects gave their informed consent before entering the study.

### The questionnaire

A self-administered questionnaire in the subject's native language, completed at home, was used to collect information regarding socioeconomic background, occupation, migration and health history, smoking, physical activity and dietary habits.

### Health screening and clinical examination

Participants were screened at the Metabolic Research Unit of the Department of Geriatrics, Uppsala University, Sweden. The examination was directed at measuring the prevalence of obesity, diabetes mellitus, hypertension and a cluster of metabolic risk factors indicative of the metabolic syndrome (9). The clinical examination with blood sampling was conducted in the morning after an overnight fast.

The metabolic syndrome is identified by the presence of three or more of the following indications: waist circumference  $>88$  cm (women), high-density lipoprotein (HDL)-cholesterol  $<1.29$  mmol l<sup>-1</sup> (women), triglycerides (TG)  $\geq 1.69$  mmol l<sup>-1</sup>, blood pressure  $\geq 130/85$  mmHg and fasting plasma glucose  $\geq 6.1$  mmol l<sup>-1</sup> (9).

### Physical activity

Physical activity level at work was scored using an ascending scale of intensity: 1 = very light (mainly sitting), 2 = light (mainly walking or standing), 3 = moderate (e.g. cleaning) and 4 = heavy (e.g. heavy industrial work). Physical activity during leisure time was also scored using an ascending scale of intensity: 1 = very light (no activity), 2 = light (walking), 3 = moderate (regular activity, approximately once a week), 4 = active (regular activity more than once a week) and 5 = very active (strenuous activity several times a week). Physical activity level (PAL) was estimated using a previously validated method (10, 11).

### Dietary assessment

Dietary data were collected using a 24 h dietary recall, administered four times on one personal visit and three telephone interviews, on three weekdays and one weekend day, respectively. The method is open ended, and a standardized protocol and interviewing procedure was used (12).

### Calculation of energy and nutrient intake

Because of the different food traditions of the studied groups, careful efforts were made to describe their recipes and cooking styles. Specific ethnic foods were included where necessary. Standard recipes were used to describe dishes eaten outside the home. After conversion to weight units, the food items were coded and energy and nutrient intake was calculated using commercial dietary analysis software, which includes the official Swedish food composition database.

Food intake level (FIL) was calculated as total reported energy intake divided by predicted basal metabolism rate (EI/BMR) (13). A subject was classified as a very-low-energy reporter (VLER) if the FIL was  $<1.06$ , and as an acceptable energy reporter (AER) if the FIL was  $\geq 1.06$  (14).

### Statistical analysis

Statistical analysis was performed using the statistical program package SAS for Windows (SAS Institute, Cary, NC, USA). An analysis of variance model was used for analysing continuous variables. For variables with skewed distributions (Shapiro–Wilk *W*-test  $<0.95$ ), a logarithmic transformation was done before the statistical analysis. Results are presented as means  $\pm$  standard deviation (SD). A *t*-test was used in comparing the two FIL groups. An analysis of covariance model was used for analysing continuous variables with adjustment for covariates, e.g. age. Spearman's rank correlation was used for the variables with skewed distributions (all tests were two-sided, and a *p*-value  $<0.05$  was taken to indicate statistical significance). Partial correlation was used to eliminate the discrepancy of e.g. the age distribution among the three groups.

### Results

Of the 270 women invited, 157 (71 from Iran, 36 from Turkey and 50 native Swedish) agreed to participate in the study. Three subjects, one from each group, were excluded from the dietary assessment because of incomplete 24 h recall. The attendance rate was low (40%) among Turkish women, intermediate (54%) among native Swedish women and highest among Iranian women (79%). The

Table 1. Clinical characteristics of the subjects<sup>a</sup>

	Iranian (n=71)	Turkish (n=36)	Swedish (n=50)
Age (years)	47.1 $\pm$ 8.1*	45.7 $\pm$ 7.3	51.1 $\pm$ 9.0‡
Education (illiteracy) (%)	0	26†	–
Low education (0–6 years) (%)	11	60†	–
BMI (kg m <sup>-2</sup> )	26.3 $\pm$ 4.6*	28.4 $\pm$ 4.1†	24.7 $\pm$ 3.3‡
SAD (cm)	21.9 $\pm$ 2.7*	23.3 $\pm$ 2.4†	21.5 $\pm$ 2.3‡
Chol (mmol l <sup>-1</sup> )	5.18 $\pm$ 0.09	5.23 $\pm$ 0.77	5.79 $\pm$ 0.86
TG (mmol l <sup>-1</sup> )	1.39 $\pm$ 0.61*	1.37 $\pm$ 0.52	0.96 $\pm$ 0.52‡
HDL-C (mmol l <sup>-1</sup> )	1.32 $\pm$ 0.33*	1.33 $\pm$ 0.32	1.68 $\pm$ 0.38‡
LDL-C/HDL-C	2.65 $\pm$ 1.08*	2.62 $\pm$ 0.90	2.35 $\pm$ 0.93
Insulin (mU l <sup>-1</sup> )	8.19 $\pm$ 5.13	9.39 $\pm$ 3.98	7.29 $\pm$ 5.02‡
Prevalence of metabolic syndrome <sup>b</sup>	13	30†	10‡

<sup>a</sup> Data from Daryani et al. (8).

Data are shown as mean  $\pm$  SD.

<sup>b</sup> The metabolic syndrome is defined as having three or more risk factors (10).

BMI: body mass index; SAD: sagittal abdominal diameter; Chol: serum cholesterol; TG: triglycerides; HDL-C: high-density lipoprotein-cholesterol; LDL-C: low-density lipoprotein cholesterol; –: no data.

*p* adjusted for age. Significant differences ( $p < 0.05$ ): \*Iranian vs Swedish women; †Iranian vs Turkish women; ‡Turkish vs Swedish women.

immigrant women had been residents of Sweden for an average of 14  $\pm$  5 years.

The mean age was significantly higher among ethnic Swedish women than among immigrants (Table 1), so risk factor levels were adjusted for age. The metabolic syndrome was three times more prevalent in the Turkish (30%) than in the native Swedish women (10%), as indicated by a greater prevalence of obesity, abdominal obesity and low HDL-cholesterol among these immigrants. A similar tendency, but only significant for low HDL-cholesterol, was found for the Iranian women (7).

### Physical activity

The estimated physical activity level (PAL<sub>est</sub>) was significantly lower in Iranian women than in the two other groups (Table 2). The Iranian women reported significantly lower physical activity during leisure time than did native Swedish women, while heavy occupational physical activity tended to be

Table 2. Average daily intake of energy and macronutrient intake according to reported 24 h food recalls for each group and three pairwise comparisons

	Iranian (n=71)	Turkish (n=36)	Swedish (n=50)
Energy (MJ) <sup>a</sup>	5.6 $\pm$ 1.1*	5.7 $\pm$ 1.6	7.5 $\pm$ 1.5‡
Fat (g) <sup>a</sup>	46 $\pm$ 12*	56 $\pm$ 21†	67 $\pm$ 15‡
E%	31 $\pm$ 5*	35 $\pm$ 6†	33 $\pm$ 4
SFA (g) <sup>a</sup>	17 $\pm$ 5*	21 $\pm$ 10†	29 $\pm$ 7‡
E%	11 $\pm$ 2*	13 $\pm$ 3	14 $\pm$ 2‡
MUFA (g) <sup>a</sup>	17 $\pm$ 5*	21 $\pm$ 8†	24 $\pm$ 6‡
E%	11 $\pm$ 2	13 $\pm$ 3†	12 $\pm$ 2‡
PUFA (g) <sup>a</sup>	10 $\pm$ 4	10 $\pm$ 3	10 $\pm$ 4
E%	6 $\pm$ 2*	6 $\pm$ 2	5 $\pm$ 2‡
Cholesterol (mg)	173 $\pm$ 70*	206 $\pm$ 101	283 $\pm$ 92‡
Protein (g)	52 $\pm$ 11*	50 $\pm$ 15	71 $\pm$ 13‡
E%	16 $\pm$ 2	15 $\pm$ 2	16 $\pm$ 2‡
Carbohydrates (g)	174*	165 $\pm$ 43	209 $\pm$ 49‡
E%	53 $\pm$ 6*	50 $\pm$ 6†	47 $\pm$ 5
Dietary fibre (g)	16 $\pm$ 4*	15 $\pm$ 5	18 $\pm$ 5‡
Sucrose (g)	30 $\pm$ 15	32 $\pm$ 11	31 $\pm$ 14
E%	9 $\pm$ 4*	10 $\pm$ 2	7 $\pm$ 2‡
Alcohol (g)	1 $\pm$ 2*	0.2 $\pm$ 0.1	7 $\pm$ 8‡
E%	0.4 $\pm$ 1*	0.1 $\pm$ 0.3	3 $\pm$ 3‡
FIL <sub>est</sub>	0.96 $\pm$ 0.2*	1.01 $\pm$ 0.33	1.26 $\pm$ 0.26‡
PAL <sub>est</sub>	1.66 $\pm$ 0.14*	1.71 $\pm$ 0.12†	1.72 $\pm$ 0.12

<sup>a</sup> Data from Daryani et al. (8).

Data are shown as mean  $\pm$  SD.

E%: Energy per cent; FIL<sub>est</sub>: estimated food intake level; PAL<sub>est</sub>: estimated physical activity level.

*p* adjusted for age. Significant differences ( $p < 0.05$ ): \*Iranian vs Swedish women; †Iranian vs Turkish women; ‡Turkish vs Swedish women.

more common in Turkish women than in the other two groups, although not significantly so.

#### Energy and macronutrient intake

Table 2 presents the mean reported daily energy and key nutrient intakes for immigrant and native Swedish women. Native Swedish women reported a higher energy intake ( $7.5 \pm 1.5$  MJ) than did Turkish ( $5.7 \pm 1.6$  MJ) or Iranian women ( $5.6 \pm 1.1$  MJ) (Table 2). The food intake level ( $FIL_{est}$ ) was also significantly lower among immigrant women than among native Swedish women. The native Swedish women reported a significantly higher intake of total fat, saturated fatty acids (SFA) and monounsaturated fatty acids (MUFA), cholesterol, protein, carbohydrate, dietary fibre and alcohol than did the immigrant groups. Comparison of the relative distribution of energy from macronutrients (energy per cent,  $E\%$ ) showed that the proportions of energy obtained from total fat and SFA were significantly lower in Iranian than in native Swedish women. The proportion of energy obtained from MUFA was significantly higher in Turkish than in native Swedish women, while the proportions derived from polyunsaturated fatty acids (PUFA) and sucrose were significantly higher in both immigrant groups than in native Swedish women. The proportion obtained from total carbohydrate was significantly higher in Iranian women than in the native Swedish group. The intake of alcohol, however, was significantly higher in the native Swedish than in the Iranian or Turkish women, who had a very low consumption.

#### Association between metabolic and dietary variables

No significant correlations were found between metabolic variables [BMI, waist/hip ratio (WHR) and serum lipids] and dietary fat composition when immigrant and ethnic Swedish women were analysed separately (data not shown), so data concerning all subjects were pooled in the analysis. A significant, positive association was found between HDL-cholesterol and SFA  $E\%$ , while total cholesterol correlated negatively with PUFA  $E\%$ , the polyunsaturated fatty acid/saturated fatty acid ratio (P/S) and the monounsaturated fatty acid/saturated fatty acid ratio (M/S) (Table 3). After adjusting for alcohol, BMI and physical activity during leisure time, only the negative association between total cholesterol and P/S ratio remained significant (data not shown). Serum TG was positively related to weight with a correlation coefficient of 0.41 ( $p < 0.001$ ), while no significant association was found between TG and either total fat or carbohydrate consumption expressed as energy percent (data not shown).

Fasting insulin was found to be positively associated with body weight ( $r = 0.32$ ,  $p < 0.001$ ), BMI ( $r = 0.42$ ,  $p < 0.001$ ) and WHR ( $r = 0.25$ ,  $p < 0.002$ ), but not with the dietary variables. The associations did not change after adjusting for alcohol intake and for physical activity during leisure time.

#### Discussion

The data show some differences in the dietary composition among immigrant and native Swedish women. Both immigrant groups reported a signifi-

Table 3. Spearman rank correlation between metabolic and dietary intake variables

	SFA $E\%$		MUFA $E\%$		PUFA $E\%$		P/S		M/S	
	r	p	r	p	r	p	r	p	r	p
BMI	-0.12	0.15	0.006	0.94	0.06	0.47	0.09	0.26	0.08	0.31
WHR	-0.43	0.6	0.02	0.76	0.01	0.86	0.03	0.09	0.03	0.72
TG	-0.13	0.09	-0.11	0.16	-0.09	0.23	0.12	0.13	0.03	0.75
Chol	0.11	0.16	-0.06	0.47	-0.17	0.04*	-0.18	0.02*	-0.17	0.04*
HDL-C	0.2	0.02*	0.08	0.31	-0.17	0.03*	-0.21	0.01*	-0.11	0.18
LDL-C	0.12	0.14	-0.31	0.71	-0.12	0.12	-0.15	0.06	-0.15	0.06
LDL-C/HDL-C	-0.03	0.73	-0.06	0.46	0.02	0.78	0.01	0.86	-0.04	0.6

BMI: body mass index; WHR: waist/hip ratio; TG: triglycerides; chol: serum cholesterol; HDL-C: high-density lipoprotein-cholesterol; LDL-C: low-density lipoprotein-cholesterol; LDL-C/HDL-C: low-density lipoprotein-cholesterol/high-density lipoprotein-cholesterol ratio;  $E\%$ : energy per cent; SFA: saturated fatty acids; MUFA: monounsaturated fatty acids; PUFA: polyunsaturated fatty acids; P/S: polyunsaturated fatty acids/saturated fatty acids ratio; M/S: monounsaturated fatty acids/saturated fatty acids ratio.

\*Significant correlation ( $p < 0.05$ ).

cantly lower proportion of daily energy intake from SFA (expressed as  $E\%$ ) and a higher proportion from PUFA than the native Swedish women did, while the proportion from total fat varied. This reflects differences between food traditions in terms of types of fat used, i.e. use of vegetable oils or solid fats. The diet of the immigrant women also contained a higher proportion of carbohydrates, especially sucrose, while the intake of alcohol was minimal. Both the Iranian women and ethnic Turks and Kurds are Muslim and most of them adhere to the Islamic prohibitions on consuming alcoholic drinks (Koran, 2:219).

Attendance was lowest among the Turkish and highest among the Iranian women. The divergent response rates of these two immigrant groups reflects somewhat the fact that these two populations are very unequal in several aspects, for example, urban versus rural origins, education, and cultural and socioeconomic background in the home country. Many women from Iran examined in this study had emigrated from a big city with a relatively high standard of living. In contrast, many of the women from Turkey were of Kurdish ethnicity and had emigrated from rural communities where access to comprehensive healthcare was restricted. This difference in background is also evident in the difference in educational attainment and great difference in Swedish language skills between the two immigrant groups. Inability to speak the host society's language is a key factor complicating the integration of immigrants. It is generally known that these groups of women are somewhat isolated and are dependent on family members to communicate their needs. These disadvantages of the exile situation may have been another factor accounting for the low attendance of Turkish-born women. The low response rate, particularly of women born in Turkey, can be interpreted as a limitation. The random sampling method used among these two largest Middle-Eastern immigrant groups in Uppsala gives high reliability, especially because of the use of a common database covering all local women immigrants from Turkey. Results from other Swedish studies also show a low attendance rate for Turkish/Kurdish women (15, 16). It is known from other studies that those who attend health examinations are likely to have healthier lifestyles than those who do not (17). The results of the present study may thus give a

better picture of the health status and dietary habits of immigrant women of Turkish origin in general.

The reported mean daily energy intake was lower in the immigrant than in the native Swedish women. Compared with the Swedish Nutrition Recommendations (SNR 1997), the calculated mean energy intake was 38% lower in the Iranian group, 36% lower in the Turkish group and 17% lower in the native Swedish group. The FIL cut-off level chosen for the present study was 1.06, which corresponds to a level below which underreporting is statistically credible for a 4 day period. With this cut-off, the prevalence of underreporting was 65%, 47% and 20% for Iranian, Turkish and native Swedish women, respectively. There were no major differences in  $E\%$  of the macronutrients between VLER and AER, indicating that the dietary data reflected the qualitative composition in spite of the underreporting of energy intake. However, the BMI was significantly higher among VLER than among AER for both Iranian and native Swedish women (27 vs 24), whereas no difference was observed for Turkish women (29 vs 28).

Dietary data from all subjects were collected using the dietary recall method. This method was chosen as it was judged to be the most suitable for a survey including both immigrants and native Swedish subjects. Results of various studies using different methodologies and investigating different populations indicate that underestimation of dietary intake is common. Black et al. categorized underreporting by a dietary assessment method, and showed that 25%, 64% and 88% of the results fell below an acceptable cut-off value for energy intake using dietary history, records and recall, respectively (18). These data indicate that underreporting of energy intake may be especially prevalent when 24 h recalls are used; this is also seen in the present study.

There is some evidence that underreporting varies with subject characteristics, and that factors such as being female (19), older (19) and overweight (13, 20–22) are associated with underreporting of energy intake. Educational level has also been reported to influence underreporting, but such associations seem to vary between countries (22, 23). The immigrant women examined in this study had a higher BMI than did the native Swedish subjects, which might have contributed to the greater underreporting. The Turkish women studied had the lowest level of education, but it is difficult to assess whether educational level per se could have con-

tributed to the greater underreporting among the immigrant women. Further study is needed to assess the influence of the educational levels of subjects from various cultures on the quality of self-reported dietary intake data. Less physical activity, resulting in lower energy requirements, may be another explanation for the lower EI/BMR ratio among the immigrant women.

Several studies have shown that underreporting is not random but is usually selective for different foods, foods considered “unhealthy” apparently being underreported more than those considered healthy (13, 24, 25). This may affect the apparent nutritional composition of the diet, and may bias any association found between dietary factors and, for example, the metabolic syndrome. Although underreporting was more common among the immigrant than the native Swedish women, there were no major differences in energy distribution between VLER and AER, indicating that the dietary data reflected the qualitative macronutrient composition equally well for all subjects.

The present study analysed associations between the relative fat composition of the diet and serum lipids and insulin. Both total cholesterol and LDL-cholesterol were inversely related to the relative MUFA content, P/S ratio and M/S ratio, while HDL-cholesterol was positively related to the SFA level. However, after correcting for alcohol intake, body weight and physical activity during leisure time, only the association between total cholesterol and P/S ratio remained statistically significant. Serum TG levels were positively associated with body weight. For insulin, no significant associations with dietary composition were observed, whereas positive associations with body weight and WHR were evident. The differences in dietary composition and body weight both seem to contribute to the observed differences in serum lipid and insulin profile of the immigrant women.

Rosell et al. (11) showed that inaccurate dietary data can introduce spurious associations with metabolic parameters. They suggested that the association between dietary variables and the metabolic syndrome is greatly affected by underestimation of dietary intake. Several studies showed that associations can be changed when “underreports” are excluded (26, 27). Rosell et al. (11) found that the dietary composition of the underreporters differed from that of the normal reporters, in that they, for example, reported a lower consumption of

total and saturated fat. The present study found no major differences in dietary composition between subjects with extensive underreporting and those with a more adequate energy intake

In conclusion, the data show some differences in relative dietary composition between immigrant and native Swedish women. The dietary fat composition was related to serum cholesterol levels in an expected direction, but the apparent associations were moderate. After adjusting for factors such as body weight and alcohol intake, only the P/S ratio was significantly, and negatively, related to total cholesterol levels. No association was found between serum insulin and any dietary variables. The degree of underreporting was significant, especially among the immigrants, and underreporting was associated with higher body weight among Iranian and native Swedish women. Taken together, these factors might have attenuated possible associations. The study also emphasizes the specific problems in dietary assessment in immigrant groups and the need for more research in this area.

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