Risk Factors for Coronary Heart Disease Among Immigrant Women from Iran and Turkey, Compared to Women of Swedish Ethnicity

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Objectives: The aim of the study was to compare a group of immigrant women from the Middle East living in Sweden to Swedish-born controls regarding the prevalence of certain cardiovascular risk factors.

Design: Health survey of randomly selected foreign-born women and women native in Sweden.

Setting: Uppsala, Sweden

Subjects: A total of 107 immigrant women aged 35–64 years from the Middle East (Iran [*N*=71] and Turkey [*N*=36]) living in Uppsala and residents in Sweden for at least three years and a control group of ethnic Swedish women (*N*=50).

Main Outcome Measures: A questionnaire and a clinical examination specially directed towards measuring cardiovascular risk factors and prevalence of obesity, diabetes mellitus, and hypertension.

Results: A less beneficial cardiovascular risk profile was found among immigrant women than among ethnic Swedish women. Turkish women had substantially higher body mass index (BMI), larger waist, higher waist/hip ratio and sagittal abdominal diameter, higher levels of serum triglycerides, and lower HDL cholesterol concentration compared with Swedish-born women. A similar tendency was seen also for Iranian women.

Conclusion: The present study shows important ethnic differences in cardiovascular disease risk factor pattern. Immigrant women from Iran and Turkey are heavier than women born in Sweden and have a higher prevalence of abdominal obesity, an unfavorable lipid profile, and a high degree of physical inactivity during leisure time, which may predispose for a higher incidence of diabetes and atherosclerotic cardiovascular disease. (*Ethn Dis.* 2005;15:213–220)

Key Words: Cardiovascular Factors, Immigrants, Iranian, Turkish, Swedish, Middle East, Health Survey, Smoking, Unemployment

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Introduction

Sweden has become a country of immigration during recent decades. According to Statistics Sweden (SCB), during 1988 a large percentage (38%) of immigrants in Sweden originated from countries outside of Europe, eg, the Middle East, Southeast Asia, and the horn of Africa. The second largest group (33%) originated from non-Nordic Europe, eg, the former Yugoslavia and Eastern Europe.

According to recent reports, immigrants in industrialized countries[1–4] such as Sweden are a vulnerable group in terms of health.[5–8] Increases in the prevalence of chronic diseases among immigrants to Western industrialized countries may be attributable to changes in lifestyle, including an altered psychosocial situation as well as altered physical activity patterns and changes in diet and nutritional status.[9–12] Numerous studies on immigrant health in other industrialized countries[13–15] also report a change in the pattern of cardiovascular disease (CVD) risk factors in people migrating to an area with higher CVD prevalence.

In Sweden, as in most industrialized countries, CVD accounts for most death and disability.[8] Morbidity and mortality rates are related to primary CVD risk factors such as low physical activity, smoking, hypercholesterolemia, hypertension, overweight, and type 2 diabetes mellitus. Mortality from CVD in Sweden decreased during 1980–1997 among both men and women,[8] but this reduction preferentially occurred in more affluent residential areas.[16] A difficult social or economic situation is associated with increased CVD morbidity and mortality, and socioeconomic difficulties are common among immigrants.[1,17,18]

Even though controlled studies on how somatic health is affected by migration are somewhat scarce in Sweden,[19] strong evidence supports that chronic diseases are overrepresented among immigrant groups. A recent report shows that immigrant men from Finland, Poland, Bosnia, Turkey, and Arab countries and immigrant women from Finland, Iraq, and Bosnia have higher CVD morbidity compared to native Swedes, while immigrants from Africa and Latin America are found to be at lower risk.[8] Apart from fundamental psychosocial changes associated with migration, many immigrant groups switch from a physically active lifestyle and a principally grain-based diet, often rich in tubers, vegetables and fruits, to an "affluent" diet characterized by a high proportion of animal fat and protein and a low intake of dietary fiber.[20,21] These changes may contribute to poor health. A good understanding of lifestyle patterns, nutritional status, and food habits among immigrants is essential to address the causative factors leading to increased rates of chronic disease, including CVD, in these groups in Sweden.

We present some results from a pioneer study conducted during 1998–2000 that investigated health status among immigrant women from two Middle Eastern countries, in comparison with an ethnic Swedish group of

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women residing in the county of Uppsala. The main purpose of this study was to test whether women born in the Middle East who were first-generation immigrants in Sweden were likelier to display a higher prevalence of CVD risk factors than native Swedish women.

MATERIAL AND METHODS

The study included first-generation immigrant women born in a Middle Eastern country between the years 1933–1962, residing in the municipality of Uppsala for at least 3 years.

As of January 1, 1996, a total of 1,086 women aged 35–64 years from the Middle East were living in Uppsala, most (80%) of whom had emigrated either from Iran or Turkey. We therefore decided to concentrate on women born in these two countries.

We sought collaboration with SCB for drawing a random sample of 90 women from each of these countries who fulfilled the above-mentioned criteria. A group of 90 women born in Sweden during the same time period residing in Uppsala was also selected at random.

The sample, 180 immigrant women and 90 native controls, were initially contacted through the SCB with a letter of invitation describing the nature of the study and seeking their collaboration. Nonrespondents received two additional letters as reminders. Those who agreed to participate were approached by mail and telephone and asked to fill out a questionnaire and invited for a free health screening and clinical examination.

The Questionnaire

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

Health Screening

Participants were screened at the Metabolic Research Unit of the Department of Geriatrics of Uppsala University. The examination was directed at measuring the prevalence of obesity, diabetes mellitus, hypertension, and a clustering of metabolic risk factors indicative of the metabolic syndrome.[22]

Clinical Examination

The clinical examination with blood sampling was conducted in the morning between 07:15 and 09:00. Participants were instructed to fast for 12 h, restrain from smoking or snuff, and avoid alcohol and vigorous physical activity the day before the clinical examination.

Anthropometric Variables

Height was measured to nearest 0.5 cm, and body weight was measured on a digital scale to the nearest 0.1 kg without shoes in light indoor clothing. Body mass index (BMI) was calculated as the ratio of body weight (kg) divided by height (m) squared. Waist and hip circumference were measured in a supine position. Waist circumference was measured midway between the lowest rib and the iliac crest, and hip circumference was measured at the widest part of the hip, so waist to hip ratio (WHR) could be calculated. The sagittal abdominal diameter (SAD) was measured as the height of the stomach (cm) when lying on the back on a firm examination table with knees bent.

Blood Pressure and Pulse Rate

Blood pressure was measured in the right arm after the subject had been supine for 5 minutes, by indirect auscultation and with a mercury sphygmomanometer. Systolic and diastolic blood pressures were defined as Korotkoff phases 1 and 5, respectively. The pulse rate was recorded by palpating the radial pulse for 30 seconds before blood pressure measurement.

Blood and Urine Samples

Blood samples were drawn from an antecubital vein, and all serum and plasma samples were immediately chilled, kept on ice, centrifuged, and stored at −70°C until analyzed. The 24-hour urine sample was collected in a special aliquot cup (Diasho Co. Ltd., Osaka, Japan). In a cartridge at the bottom of the collection cup a small proportion (representative of and proportional to the whole urine volume) of the urine was sampled. The volume of the urine in the special cartridge was measured and noted. A representative sample from this cartridge was taken out with a pipette, frozen, and stored at −70°C.

Lipoproteins

Lipoprotein composition in serum was determined. Total cholesterol and triglyceride levels in serum were assayed by enzymatic techniques by using a Monarch apparatus (Instrumentation Laboratories; Lexington, Mass.). High density lipoproteins (HDLs) were isolated by centrifugation and precipitation with magnesium chloride/phosphotungstate.[23] Low density lipoprotein (LDL) cholesterol was calculated according to the formula of Friedewald: LDL=serum cholesterol - HDL cholesterol - (0.45 × serum triglycerides).

The concentrations of serum apolipoproteins (apo) A-1 and B were deter-

mined by immunoturbidimetry in a Monarch apparatus. Lipoprotein (a) was measured by a apo (a) radioimmmmunoassay method (Pharmacia, Uppsala, Sweden). The concentration is expressed in U/L. According to the manufacturer, one U of apo (a) is approximately equal to 0.7 mg LP(a). Serum free fatty acids (FFA) were determined by an enzymatic-colorimetric method using a commercial kit (Wako Chemicals GmbH, Neuss, Germany) applied for a Monarch centrifugal analyzer.

Glucose and Insulin

Blood glucose concentrations were measured by the glucose oxidase method.[24] Serum insulin was analyzed using an enzyme immunoassay ELISA-kit (Mercodia AB, Uppsala, Sweden) in a Coda Automated EIA analyzer (Bio-Rad laboratories AB, Scandinavia).

Dietary Intake

Dietary intake was assessed through four repeated 24-hr food intake records. This part of the study will be presented in a separate paper.

STATISTICAL ANALYSES

The statistical analyses were performed by using SAS for Windows (SAS Insitute, Cary, NC, USA). The basic statistical analysis included comparisons between the two groups of immigrant women and the group of Swedish-born women. For continuous variables an analysis of variance model was performed. When the overall F-test of all three groups was statistically significant at the 5% level, the three pairwise comparisons were performed. For variables with skewed distributions (Sharpiro Wilk's W-test$<$0.95), a logarithmic transformation was made before the statistical analysis. The results are presented as means $\pm$ standard deviation (SD). For categorical variables the three groups were compared by using Fisher's Exact Test. All tests were two-sided, and a P value$<$.05 was regarded as statistically significant. However, as several comparisons were performed between the three groups, the importance of the weakest statistical differences should be interpreted with care to avoid a type 1 error.

ETHICAL ASPECTS

The Ethical Committee of the Medical Faculty of Uppsala University, Sweden, approved the study. All subjects gave informed consent before entering the study.

RESULTS

Response Rate

One hundred fifty-seven women (71 from Iran, 36 from Turkey, and 50 Swedish-born) agreed to participate and completed the screening process. Response rate was low (40%) among Turkish women, intermediate (54%) among Swedish women, and highest (79%) among Iranian women.

Education and Some Lifestyle Factors

Table 1 shows the level of education and other lifestyle factors of importance for risk to develop CVD. The mean age was significantly higher among ethnic Swedish women than among immigrants (Table 2). Therefore, risk factor levels were adjusted for age when compared between immigrants and Swedish women when presented below.

Turkish women had the lowest level of educational attainment. Further, unemployment was significantly higher among Turkish women compared with native Swedes. Smoking rates did not differ among groups, but the number of ex-smokers was significantly higher among Swedish women. Iranian women reported significantly less physical activity during leisure time compared with Swedish-born women, while heavy occupational work was more common among Turkish women than among the two other groups, although not significantly so.

Age and Anthropometric Findings

Table 2 shows mean values for age and anthropometric measurements in the two groups of immigrant women and in the control group. BMI and SAD were significantly higher in women from Turkey than in those from Iran. Swedish-born women had a significantly lower BMI and SAD than the two other groups. Waist circumference was significantly higher in Turkish women than in women from Iran and Sweden, respectively.

Serum Lipoprotein Concentrations, Glucose, Insulin, and Blood Pressure

Lipid and lipoprotein data, glucose, insulin, and blood pressure are presented in Table 3. While differences in total blood cholesterol were not significant, both Turkish and Iranian women had significantly higher triglyceride levels than native Swedes. However, Swedish-born women had significantly higher HDL cholesterol levels than the two other groups. Low-density lipoprotein (LDL) cholesterol was not significantly different between the three groups.

The LDL/HDL ratio was significantly higher in Iranian women than Swedish-born women. Insulin levels were significantly higher in Turkish women than Swedish-born women. No significant differences were found among the women regarding glucose and blood pressure levels.

Disorders Associated with the Metabolic Syndrome

Table 4 shows the proportion of individuals with disorders associated with the metabolic syndrome. Turkish women had a significantly higher prevalence of metabolic syndrome indicators than Swedish-born women, illustrated by a higher prevalence of obesity, abdominal

Table 1. Percentage of women of Iranian, Turkish, and Swedish origin reporting education, unemployment, smoking, and physical activity

Background	Iranian ♀ N=71	Turkish ♀ N=36	Swedish ♀ N=50	P Value (a)	P Value (b)	P Value (c)
Education (illiteracy) %	0	26	—	—	<.0001	—
Low education (0–6 years) %	11	60	—	—	<.0001	—
Unemployment %	52	69	20	.0006	ns	<.0001
Smokers %	21	17	10	ns	ns	ns
Ex-smokers %	27	43	55	.0046	ns	ns
Low physical activity during leisure time %	49	34	18	.0009	ns	ns
High and moderate physical activity at work %	14	28	22	ns	ns	ns

ns = non significant; a = significant difference ($P \leq .05$): Iranian vs Swedish women; b = significant difference: Iranian vs Turkish women; c = significant difference: Turkish vs Swedish women. *P* adjusted for age.

obesity, low HDL cholesterol, and fasting glucose. A similar tendency, but only significant for obesity and low HDL cholesterol, was found for Iranian women.

DISCUSSION

The aim of the study was to compare a group of immigrant women from the Middle East living in Uppsala with ethnic Swedish controls regarding the prevalence of certain nutrition-related risk factors for chronic conditions such as obesity, type 2 diabetes, and the metabolic syndrome. The most important finding was that immigrant women had a higher prevalence of risk factors for CVD.

Participation was lowest among Turkish women (40%) and highest among Iranian women (79%). Divergent response rates between these two immigrant groups partly reflects the fact that these two populations differ in several aspects, eg, origin (urban-rural), education, and cultural and socioeconomic background in the home country. Many women from Iran in this study had emigrated from a large city, where access to health care is readily available. On the other hand, many of the women from Turkey were of Kurdish ethnicity and had emigrated from small, rural communities, usually with a poor standard of living. This discrepancy is also evident in the level of education and Swedish language skills in the two immigrant groups. Inability to speak the local language complicates integration to the host society. These groups of women generally live isolated from the larger society and depend on family members to communicate. They are simultaneously exposed to negative influences in Swedish society with high unemployment and acculturative stress. The disadvantages of the exile situation may have been another factor influencing the low response rate among women born in Turkey.

The low participation in this group may also suggest that the recruitment method used in this study was not optimal. A better method may have been to approach participants through their own organizations and offer oral, instead of written, information. Written information is not an ideal recruitment method in a group with high illiteracy and a low level of education.

This study showed that immigrant

Table 2. Age and anthropometric characteristics for each group

	Iranian ♀ N=71	Turkish ♀ N=36	Swedish ♀ N=50	P Value (a)	P Value (b)	P Value (c)
Age (year)	47.1 ± 8.1	45.7 ± 7.3	51.1 ± 9.0	.0101	ns	.0036
Height (cm)	159.5 ± 5.28	157.2 ± 6.65	165.3 ± 5.88	<.0001	.0205	<.0001
Weight (Kg)	66.5 ± 10.91	70.2 ± 10.31	67.6 ± 9.65	ns	ns	ns
BMI (Kg/m²)	26.3 ± 4.59	28.4 ± 4.09	24.7 ± 3.35	.0025	.0036	<.0001
SAD (cm)	21.9 ± 2.74	23.3 ± 2.43	21.5 ± 2.32	.0338	.0016	<.0001
Waist (cm)	81.9 ± 10.19	86.3 ± 8.61	80.3 ± 9.20	ns	.0073	<.0001
WHR	0.80 ± 0.05	0.83 ± 0.06	0.80 ± 0.06	ns	.0045	.0035

BMI = body mass index; SAD = sagittal abdominal diameter; WHR = waist/hip ratio.

Mean ± SD.

ns = non-significant; a = significant difference ($P \leq .05$): Iranian vs Swedish women; b = significant difference: Iranian vs Turkish women; c = significant difference: Turkish vs Swedish women. *P* adjusted for age.

Table 3. Blood lipid parameters, glucose, insulin and blood pressure for each group

	Iranian ♀ N=71	Turkish ♀ N=36	Swedish ♀ N=50	P Value (a)	P Value (b)	P Value (c)
Chol (mmol/l)	5.18 ± 0.09	5.23 ± 0.77	5.79 ± 0.86	ns	ns	ns
TG (mmol/l)	1.39 ± 0.61	1.37 ± 0.52	0.96 ± 0.52	<.0001	ns	.0003
LDL (mmol/l)	3.23 ± 0.83	3.29 ± 0.80	3.68 ± 0.90	ns	ns	ns
HDL (mmol/l)	1.32 ± 0.33	1.33 ± 0.32	1.68 ± 0.38	<.0001	ns	.0002
LDL/HDL	2.65 ± 1.08	2.62 ± 0.90	2.35 ± 0.93	.0234	ns	ns
FFA (mmol/l)	0.41 ± 0.17	0.45 ± 0.18	0.48 ± 0.28	ns	ns	ns
S-apo A-1 (g/l)	1.52 ± 0.36	1.44 ± 0.18	1.55 ± 0.20	ns	ns	ns
S-apo B (g/l)	1.02 ± 0.32	0.95 ± 0.20	0.95 ± 0.22	.0372	ns	ns
Glucose (mmol/l)	5.32 ± 1.60	5.70 ± 1.25	5.49 ± 2.25	ns	ns	ns
Insulin (mU/L)	8.19 ± 5.13	9.39 ± 3.98	7.29 ± 5.02	ns	ns	.0207
SBP (mm Hg)	116.96 ± 16.09	119.43 ± 19.91	122.24 ± 19.10	ns	ns	ns
DBP (mm Hg)	71.34 ± 9.67	72.46 ± 11.61	73.50 ± 8.80	ns	ns	ns

Chol = serum cholesterol; TG = triglycerides; LDL = low-density lipoprotein cholesterol; HDL = high-density lipoprotein cholesterol; FFA = serum free fatty acids; S-apo = serum apolipoproteins; SBP = systolic blood pressure; DBP = diastolic blood pressure. Mean ± SD.

ns = non-significant; a = significant difference ($P \leq .05$): Iranian vs Swedish women; b = significant difference: Iranian vs Turkish women; c = significant difference: Turkish vs Swedish women. *P* adjusted for age.

women have a less beneficial cardiovascular risk profile than Swedish-born women. Women born in Turkey, most of whom were of Kurdish ethnicity, had substantially higher BMI, larger waist circumference, higher waist/hip ratio and SAD, higher levels of serum triglycerides, and lower HDL cholesterol concentrations compared to native Swedish women. The same tendency, but only significant for BMI, SAD, serum triglycerides, HDL cholesterol, and LDL/HDL ratio was seen for women born in Iran.

Several studies support an association between various anthropometric indices of obesity and diabetes,[25] as well as stroke, angina pectoris, and all-cause mortality.[26,27] Diabetes, elevated serum cholesterol levels, and hypertension were two to five times more prevalent among women with higher BMI.[27] Other studies based on large populations followed up over long periods have shown a relationship between BMI and mortality from all causes.[28,29] Data from the Framingham study showed that cardiovascular risk is closely linked to abdominal as well as general adiposity.[28,29] Both waist circumference and SAD, indicating increased abdominal adiposity, were higher in immigrant women than ethnic Swedish women.

HDL cholesterol levels were significantly lower and triglyceride levels were significantly higher in the immigrant groups compared to the ethnic Swedes in this study. A 20-year follow-up of women in a prospective population study in Gothenburg, Sweden, showed that increased serum triglyceride concentrations and abdominal adiposity

Table 4. The proportion (%) of individuals with disorders associated with the metabolic syndrome for each group

	Iranian ♀ N=71	Turkish ♀ N=36	Swedish ♀ N=50	P Value (a)	P Value (b)	P Value (c)
Obesity BMI ≥30	13	36	8	ns	.001	.002
Abdominal obesity waist girth >88 cm	20	43	18	ns	.02	.02
High cholesterol >6.5 mmol/l	13	6	18	ns	ns	ns
Low HDL cholesterol <1.29 mmol/l	50	60	22	.002	ns	.0006
High triglycerides ≥1.69 mmol/l	25	20	12	ns	ns	ns
High blood pressure ≥130/85 mm Hg	6	14	8	ns	ns	ns
High fasting glucose ≥6.1 mmol/l	4	19	13	ns	.03	ns
Metabolic syndrome* ≥3 risk factors	13	30	10	ns	.06	.04

ns = non significant; a = significant difference ($P \geq .05$): Iranian vs Swedish women; b = significant difference: Iranian vs Turkish women; c = significant difference: Turkish vs Swedish women.

* The metabolic syndrome is defined as having three or more risk factors.[22]

The most important finding was that immigrant women had a higher prevalence of risk factors for CVD.

were associated with sharply increased risks of death from myocardial infarction and from all causes.[30] However, despite higher body weight, blood pressures tended to be lower among immigrants than among ethnic Swedish women. A lower rate of hypertension in spite of a higher body weight was earlier reported[31] among immigrants from the Middle East, in contrast to several other immigrant studies.[32] Possible genetic factors or diverging dietary habits between the groups may explain this difference.

Unemployment rates were similar in the two immigrant groups. Iranian women, in spite of higher education and socioeconomic status, cannot find jobs commensurate with their qualifications in Sweden. Unemployment has, in previous reports, been associated with increased levels of CVD risk factors[33] and cardiac mortality.[34,35]

The immigrant groups reported significantly less physical activity during leisure time. Obesity and high body weight are strongly related to a lack of physical activity in the adult population of the European union.[36] Low leisure-time physical activity is also strongly associated with low income and low educational attainment.[37] In the United States the percentage of physical inactivity during leisure time is high among women, the elderly, and Mexican Americans (both immigrants and non-immigrants).[38] Asians living in Britain had higher waist/hip ratio, lower physical activity, and less favorable lipid levels, compared to Indians living in Asia.[14]

The risk of myocardial infarction among men that are not physically active during their leisure time is approximately double compared to physically active men.[37,39,40] However the effect of physical inactivity on risk for myocardial infarction does not seem to be quite as great among women as among men.[37,39]

Ethnic and lifestyle differences in risk factors for CVD are important to consider. Finnish immigrants, for instance, have an increased risk of hypertension and hypercholesterolemia compared with native Swedes, while Mediterranean men have an increased tendency to smoke and become overweight.[31] A Swedish population-based study revealed that Bosnian refugee women aged 42–59 years had substantially higher levels of general and abdominal obesity, higher levels of serum triglycerides and lower levels of HDL cholesterol.[41] Our findings agree with this previous report.

Strengths and Limitation of the Study

In recent decades, large numbers of people have emigrated to Western European countries from the Near East (particularly Turkey) and the Middle East (particularly Iran, Iraq, Lebanon, and Palestine). Approximately 57% of immigrants from non-European countries in Sweden come from the Middle East, including Turkey.

The culture, lifestyles, and dietary habits in this area of the world differ substantially from those in Sweden. An increasing body of epidemiologic evidence indicates a high prevalence of CVD in these groups.[8,17,27,31] However, the number of studies focusing on CVD risk factors at the level of the individual immigrant, particularly for women, from the Middle East in Europe are almost nonexistent. This type of micro-level information is needed for health workers in multicultural areas because it allows for culturally adjusted health care and planning of intervention programs targeting immigrants. The strength of this study is its focus on risk factors at the individual level. As such, this study is one of the very few of this type in Sweden. The method of random sampling among the two largest immigrant groups from the Middle East in Uppsala gives the study a high degree of reliability. Results from these groups are confirmed by similar findings reported by other authors.[8,42,43]

The low response rate, particularly from women born in Turkey, can be interpreted as a limitation. An analysis of reasons for non-response was not possible because of lack of access to the addresses and other background data of non-responders. Despite this setback, the collected data can be considered fairly reliable because of the random selection procedure that used a common data-base covering all female immigrants from Turkey living in Uppsala. If we instead had attempted to reach this sample of women through more informal and oral channels, we would perhaps have recruited more subjects, but intergroup variations of risk factors would likely have been larger. We know from other studies that those who attend health checks are likely to have a healthier lifestyle than non-participants.[44]

CONCLUSION AND FUTURE RECOMMENDATIONS

We show important ethnic differences in CVD risk factors in two groups of female immigrants from the Middle East. Immigrant women from Iran and Turkey are heavier with a higher prevalence of abdominal obesity and have an unfavorable lipid profile with high serum triglycerides, low HDL cholesterol, and a high degree of physical inactivity during leisure time.

We hope that this research will contribute to efforts to prevent CVD among these immigrant groups. In Sweden, increasing emphasis is placed on primary health care in the prevention of disease. To optimize preventive efforts, we suggest that immigrant women rep-

resenting specific risk groups be provided with diverse counseling about physical activity, diet, and social support as a part of patient-education programs. To the most practical extent, preventive programs should be presented in the native language of the participants. Unfortunately, the scarcity of culturally adapted educational material is a problem in Sweden. Educational material currently in use in primary health care should be adapted, considering concepts, methods, and dietary practices that are of relevance for the immigrant culture in question.

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