Obesity and metabolic correlates among the Inuit and a general Danish population

Marit E. Jørgensen

Steno Diabetes Centre, Gentofte, Denmark

ABSTRACT

Objectives. Obesity and central fat pattern are associated with several cardiovascular risk factors including insulin resistance, glucose intolerance, hypertension and dyslipidemia in most populations. The study aims to assess the occurrence and metabolic correlates of obesity among Greenlanders and Danes. Study design. From 1999 to 2001, 917 adult Inuit participated in a health survey in Greenland. The examination included an oral glucose tolerance test. Body Mass Index, waist circumference, and blood pressure were measured. P-glucose, s-insulin, and lipids were measured. Data from the Danish study ’Inter99’ (n=5606) conducted in 1999-2000 were used for comparison. Results. Compared with the Inter99 population, a larger proportion of Inuit women were centrally obese (58.1% vs. 17.8%, p<0.001) and central obesity was present in 15.9% of Inuit men vs. 8.3% of the Danish men (p<0.001). At any given level of obesity the Inuit had lower levels of 2-hour glucose and insulin, blood pressure, triglyceride, and higher levels of HDL cholesterol than the Danish participants. Fasting glucose and fasting insulin levels within obesity categories were not different in the two populations. Conclusion. Central fat pattern and obesity are more prevalent among the Inuit, but the obesity observed among the Inuit is not associated with the same degree of metabolic disturbances as in a general Danish population.

Keywords: Greenland, Inuit, Anthropometry, obesity, metabolic syndrome

INTRODUCTION

The rapid increase in obesity and diabetes prevalence among the Inuit indicates that these people are more susceptible to lifestyle changes than European populations. The question is whether the other components of the Metabolic Syndrome are more prevalent among the Inuit compared with Europeans. Thus, assuming that obesity and physical inactivity are the main cause of the metabolic syndrome, the aim of the present study is to assess whether the obesity observed among the Inuit of Greenland and in a general Danish population is associated with the same degree of metabolic disturbances as reflected in levels in p-glucose, insulin, HDL cholesterol, triglyceride, and blood pressure.

METHODS

From 1999 to 2001, 917 adult Inuit participated in a health survey in Greenland. The examination included an oral glucose tolerance test. Body Mass Index, waist circumference, and blood pressure were measured. P-glucose, s-insulin, and lipids were measured. The homeostasis model assessment (HOMA) of insulin resistance was used to calculate insulin resistance as: HOMA-IR = fasting insulin (µU/ml) x fasting glucose (mmol/l) / 22.5.

Data from the Danish study ’Inter99’ (n=5606) conducted in 1999-2000 were used for comparison. All participants in the two studies underwent the same procedures.

RESULTS AND DISCUSSION

Table I shows characteristics of the two populations by gender. Inuit women had the highest means of BMI, waist-to-hip ratio, waist circumference, HOMA insulin resistance and higher prevalence of overall and central obesity compared with Danish women, whereas 2-h-glucose,
2-h insulin, blood pressure, and triglyceride were lower, and HDL cholesterol higher among the Inuit women. A similar disparity prevailed in men with the exception of means of BMI and waist circumference, which were higher among Danish men. Inuit of either sex had a higher prevalence of diabetes.

Comparison between the Inuit and the Inter99 population (Figure 1) showed that the association between fat distribution and several metabolic risk factors differed in significant respects. Even though there was generally an increasing trend in levels of metabolic risk factors with central obesity in both populations, the Inuit had lower levels of 2-hour p-glucose and insulin, blood pressure, triglyceride, and lower levels of HDL cholesterol than the Danish participants at any given level of waist circumference. The main effects of ethnicity were unchanged after adjustment for physical activity, smoking, school education, and alcohol consumption. These population-specific differences in levels of glucose, insulin, lipids, and blood pressure presumably depend on an interaction between environmental factors and genetic factors that influence obesity and insulin sensitivity. Due to differences in the questionnaires used, we were unable to analyse the impact of diet and socioeconomic status on obesity and metabolic risk factors in the two populations. Especially the traditional Greenlandic diet, which is rich in omega-3 polyunsaturated fatty acids, may influence the metabolic activity in adipose tissue. An alternative explanation is that anthropometrical measurements such as BMI, WHR, and waist circumference do not reflect the same amount of adipose tissue in people living under considerably different conditions. Our data suggest that international guidelines for obesity are not necessarily applicable to the Inuit; however, only prospective studies can determine the impact of obesity on cardiovascular disease in different populations.

Table I. Characteristics of the two populations by gender Means with SD.

|                  | MEN                  | WOMEN                 |
|------------------|----------------------|-----------------------|
|                  | Greenland            | Denmark               | Greenland            | Denmark               |
| Number           | 485                  | 3302                  | 623                  | 3482                  |
| Age (years)      | 47.6 (12.1)          | 46.4 (7.9)            | 47.0 (12.4)          | 45.7 (8.0)            | 0.01                 |
| BMI (kg/m²)      | 26.3 (4.4)           | 26.8 (4.0)            | 26.8 (5.4)           | 25.9 (5.1)            | 0.01                 |
| Waist-to-hip ratio (%) | 0.94 (0.07)       | 0.92 (0.06)          | 0.89 (0.08)          | 0.80 (0.06)          | <0.001               |
| Waist circumference (cm) | 90.9 (11.9)    | 93.3 (11.0)          | 87.9 (13.3)          | 79.8 (14.6)          | <0.001               |
| % obese⁵         | 18.4                 | 17.7                  | 0.74                 | 24.9                 | 17.8                 | 0.001               |
| % with abdominal obesity⁴ | 15.9               | 8.3                   | <0.001               | 58.1                 | 17.7                 | <0.001               |
| Fasting glucose (mmol/l) | 5.9 (0.9)          | 5.8 (1.2)             | 5.8 (1.4)            | 5.4 (1.1)            | <0.001               |
| 2-h glucose (mmol/l) | 5.1 (2.2)          | 6.3 (2.5)             | <0.001               | 6.1 (2.9)            | 6.3 (2.0)            | 0.09                 |
| Fasting insulin (pmol/l)⁴ | 37 (5-259)       | 37 (4-296)            | 0.6                  | 42 (3-374)           | 34 (1-470)           | <0.001               |
| 2-h insulin (pmol/l)⁴ | 53 (7-1039)       | 138 (5-2838)         | <0.001               | 112 (5-1286)         | 173 (5-5006)         | <0.001               |
| HOMA-IR 5,6      | 9.3 (0.6-99.7)       | 9.6 (1.1-279)         | 0.43                 | 10.6 (0.9-82.5)      | 8.0 (0.7-178)        | <0.001               |
| % with diabetes  | 10.7                 | 7.8                   | 0.04                 | 8.9                  | 5.8                  | 0.004                |
| SBP (mmHg)       | 119 (17.1)           | 134 (16.6)            | <0.001               | 117 (17.8)           | 127 (17.8)           | <0.001               |
| DBP (mmHg)       | 75 (11.6)            | 85 (10.9)             | <0.001               | 72 (11.1)            | 80 (11.1)            | <0.001               |
| % with hypertension⁴ | 11.4               | 32.9                  | <0.001               | 9.5                  | 22.8                 | <0.001               |
| Triglyceride (mmol/l) | 1.1 (0.6)          | 1.6 (0.4)             | <0.001               | 1.1 (0.4)            | 1.2 (0.4)            | 0.17                 |
| HDL cholesterol (mmol/l) | 1.6 (0.5)         | 1.3 (0.4)             | <0.001               | 1.6 (0.44)           | 1.5 (0.40)           | 0.02                 |

¹ Analyses were restricted to the age-group 30-60.
² Defined as BMI ≥ 30kg/m².
³ Defined as waist circumference > 88 cm for women, waist circumference > 102 cm for men (9).
⁴ Defined as blood pressure ≥ 140/90 mmHg.
⁵ Geometric means with range in brackets.
⁶ The homeostasis model assessment of insulin resistance (HOMA-IR).
Figure 1. Means and 95% CIs of selected metabolic risk factors by category of waist circumference and ethnicity. Age adjusted values. Circles = Denmark, squares = Greenland.

Marit E. Jørgensen

Steno Diabetes centre
Niels Steensensvej 2
2820, Gentofte
Denmark
Email: maej@steno.dk