Introduction

The metabolic syndrome has been proposed to include a set of metabolic and anthropometric characteristics of which glucose intolerance and associated cardiovascular disease risk factors in men and women aged 50 to 69 years. Participants with the metabolic syndrome are at risk of developing type 2 diabetes and coronary heart disease. The metabolic syndrome is an important marker of increased risk for both cardiovascular disease and type 2 diabetes,1-7. The lack of an accepted definition has impeded epidemiological research on this disorder. Two definitions of the syndrome have been proposed, one by the World Health Organization (WHO) and a second definition in the US Third Report of the National Cholesterol Education Program, Adult Treatment Panel, ATP III, 2001, subsequently modified by the Irish National Nutritional Surveillance Unit to reflect the Irish diet. Analyses with the metabolic syndrome as the dependent variable we observed a significant, independent inverse association with physical activity level (OR=0.60; 95%CI, 0.39−0.90 for moderate and OR=0.51; 95%CI, 0.28−0.93 for high level of activity relative to the low level of activity group). Ex-drinkers had a higher prevalence of the syndrome (OR=2.70; 95%CI, 1.68−4.36; N=403). The prevalence of the metabolic syndrome was not significantly associated with current alcohol consumption or with smoking status. These data highlight the importance of physical inactivity in the aetiology of the metabolic syndrome.

Methods

Participants were classified according to the type of lifestyle questionnaire, smoking status, alcohol intake, physical activity and body mass index. Alcohol intake was estimated primarily from the food frequency questionnaire data, cross−checked with the data from the self−completed questionnaire. Analyses were based on the mean of the second and third of three BP measurements. Data on the use of anti−hypertensive drugs was obtained from the self−completed questionnaire.

Blood Pressure Measurements

Blood Pressure was measured with the subject seated, with left arm at heart level, and cuff adjusted for arm circumference. Three measurements were made with a validated digital portable blood pressure monitor, (Omron HEM−705CP), and the mean of the second and third of three BP measurements. Data on the use of anti−hypertensive drugs was obtained from the self−completed questionnaire.

Anthropometric Measurements,

Urine Samples and Fasting Blood Samples

Blood samples were collected after a 4 hours overnight fasting and used for analysis of glucose, insulin, and lipids. The metabolic syndrome was defined according to the criteria in a sample of men and women aged 50 to 69 years, participants of the National Cholesterol Education Program, Adult Treatment Panel, ATP III 2001, subsequently modified by the Irish National Nutritional Surveillance Unit to reflect the Irish diet. Analyses were based on the mean of the second and third of three BP measurements. Data on the use of anti−hypertensive drugs was obtained from the self−completed questionnaire.

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Definition of the metabolic syndrome

According to the current WHO criteria, (MS WHO), the metabolic syndrome is defined on the basis of the following criteria: participants with glucose intolerance (impaired fasting glucose and type 2 diabetes) and or insulin resistance (defined as the upper quartile of Glucose Homeostasis Model Scores (HOMA scores) with at least 2 of the following additional abnormalities: hypertension (defined as SBP> 140 mmHg and /or DBP > 90mmHg), dyslipidemia; defined as triglyceride > 1.7 mmol/L and/or low HDL < 0.9 mmol/L women, < 1.0 mmol/L men; obesity; defined as BMI > 30 Kg/m2 and/or WHR > 0.9 men, > 0.85 women; microalbuminuria: defined as albumin excretion rate of 20 micrograms/min or as microcreatinine ratio > 30 mg/g.

Glucose intolerance was defined as those participants with type 2 diabetes or impaired fasting glucose, according to the current ADA and WHO criteria,18. 19. Insulin resistance was estimated on the basis of fasting glucose and insulin, using the glucose homeostasis model, (HOMA scores).20 Pre-existing cardiovascular disease was determined based on the following: a self reported history of myocardial infarction or angina and/or a history of a Coronary Artery Bypass Graft (CABG) or a Coronary Artery Angioplasty or a positive Rose Questionnaire or a history of stroke, peripheral vascular disease or abdominal aortic aneurysm or evidence of a definite previous myocardial infarction (MI) on an analysis of the electrocardiographs (ECG) by a single experienced cardiologist i.e. pathological Q wave > 1mm wide and > 3mm deep.11

Statistical analysis

Associations between the prevalence of the metabolic syndrome and physical activity, smoking status and alcohol intake were examined using logistic regression analysis with adjustment for age, sex, socio-economic status, pre-existing CVD and other potential confounding factors.

Results

Table 1 shows the prevalence of the metabolic syndrome and its components in this population. Three quarters of the sample met current criteria for central and/or overall obesity and almost half were hypertensive. The prevalence of the syndrome was 21.0% (95% CI. 18.3% –23.7%) in the entire group. It was higher in men (24.6%) than in women (17.8%) and it increased with age, (Fig 1).

Table 2 shows a logistic regression analysis with the metabolic syndrome as the dependent variable and physical activity as the independent variable before and after exclusion of participants with previously diagnosed diabetes. Physical activity was inversely and significantly associated with prevalence of the metabolic syndrome. This association was independent of age, sex, other environmental factors and pre-existing CVD. A dose–response gradient was also observed. The odds ratios for the metabolic syndrome associated with medium and high compared to low activity levels were 0.59 (95% CI: 0.38–0.93, P=0.02), 0.58 (95% CI: 0.33–1.02, P=0.06) respectively (P for trend = 0.01), in multivariate analysis, excluding those with previously diagnosed diabetes.

Table 3 shows a logistic regression analysis with metabolic syndrome (WHO) as the dependent variable and alcohol intake as the independent variable, before and after exclusion of already diagnosed type 2 diabetics, N=823*.

Table 4 shows the prevalence of the metabolic syndrome in different alcohol intake categories.

Discussion

Approximately one fifth of Irish men and women in the 50 to 69 years age group meet current WHO criteria for the metabolic syndrome. These findings reflect the extremely high prevalence of obesity in this population with approximately three quarters of the sample meeting current criteria for central and or general obesity. There was a clear inverse association between the prevalence of the metabolic syndrome and levels of physical activity. No
The inverse association between metabolic syndrome prevalence and physical activity must be interpreted cautiously given the cross-sectional design of this study. However the association is plausible, given the associations between physical activity and other lifestyle factors, such as obesity, glucose intolerance, and insulin resistance. The association was independent of potential confounders, including previously diagnosed diabetes, higher levels of central obesity, BMI and waist-hip ratio. In this study, we did not have information on previous diabetes diagnosis, thus we did not have data on diabetes status among those with metabolic syndrome, which may underestimate the magnitude of the association.

We found that ex-drinkers had a higher prevalence of the metabolic syndrome as compared with our reference category of occasional drinkers or wine-only drinkers. The association between ex-drinkers and metabolic syndrome was stronger than that of occasional drinkers, which may reflect a greater awareness of the metabolic syndrome in clinical practice to provide a focus for counselling on weight loss and lifestyle changes. This suggests that ex-drinkers have more opportunities to improve their health, which may explain the observed association.

We found no significant association between smoking status and prevalence of the metabolic syndrome. We also found no significant association between smoking status and prevalence of the metabolic syndrome in Never drinkers (OR = 0.93, 95% CI = 0.78-1.10) or Ever drinkers (OR = 0.95, 95% CI = 0.79-1.13). These results confirm the need to separate ex-drinkers from never drinkers in studies of alcohol-disease relationships.

We found no significant association between smoking status and prevalence of the metabolic syndrome. This was unexpected given the evidence of a possible link between smoking and insulin resistance and risk of type 2 diabetes. This may reflect the limited power of the study to examine this issue.

In summary, three quarters of this sample of middle-aged men and women are obese, almost half are physically inactive and one in five meet current international criteria for the metabolic syndrome. It is now clear that diabetes and cardiovascular disease share common environmental and lifestyle antecedents or causal factors. The metabolic syndrome is a critical component of the common causal pathway linking CVD and type 2 diabetes. The findings in this paper emphasise the scale of the challenge we face both in clinical practice and population health to contain the epidemic of CVD and type 2 diabetes. We now have evidence from intervention studies of the effectiveness of diet and exercise in the prevention of the metabolic syndrome, and type 2 diabetes in high risk subjects. There is a need for greater awareness of the metabolic syndrome in clinical practice to provide a focus for counselling on weight loss and exercise combined with appropriate pharmacological intervention, including anti-hypertensive and lipid lowering therapy. Ultimately we will need to consider broader societal level measures to tackle this problem, in particular measures designed to reduce calorie intake and promote higher levels of physical activity.

References