A cross-national comparative study of metabolic syndrome among non-diabetic Dutch and English ethnic groups

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Background: Evidence suggests a higher prevalence of type 2 diabetes (T2D) in The Netherlands than in England, although generalized obesity prevalence is substantially lower in The Netherlands. Metabolic syndrome (MS) is more strongly associated with the risk of progression to T2D than generalized obesity. Therefore examining MS may help to better understand the differences in T2D between the two countries. We assessed whether the Dutch and English differences in T2D prevalence reflect similar differences in MS in Whites, South-Asian Indians and African-Caribbeans living in these two countries.

Methods: Secondary analyses of population-based studies of 3010 participants aged 35–60 years. Metabolic syndrome was defined according to the International Diabetes Federation criteria. Prevalence ratios (PRs) were estimated using regression models. Results: In general, the Dutch ethnic groups had a higher prevalence of MS than their English counterparts. Adjusted PRs were 1.37 (95% confidence interval (CI) (1.03–1.82) and 1.52 (1.06–2.19) in White-Dutch men and women compared to White-English men and women; 2.20 (1.14–4.26) and 1.46 (0.96–2.24) in Dutch-African-Caribbean men and women compared to English-African-Caribbean men and women and 0.97 (0.74–1.27) and 1.42 (1.00–2.03) in Dutch-Indian men and women compared with their English-Indian peers, respectively. Similar patterns were also observed for some MS components, e.g. raised fasting glucose in men and central obesity in women.

Conclusion: The comparatively high prevalence of MS among Dutch ethnic groups may contribute to their high prevalence of T2D. The high levels of some MS components, e.g. raised fasting glucose in men and central obesity in women add to the high prevalence of MS in Dutch ethnic groups.

Introduction

Evidence suggests there is a higher prevalence of type 2 diabetes (T2D) in The Netherlands than in England.¹² The recent estimated prevalence of T2D (adjusted for the world population), for example, was 5.3% in The Netherlands compared with 3.6% in England in 2010.¹ Our recent work also indicates similar patterns in the prevalence of T2D between Dutch and English ethnic minority groups. For example, similar to Whites, the prevalence of T2D was higher in Indian men (27.7%) and women (27.4%) and African-Caribbean women (15.5%) in The Netherlands than in Indian men (20.1%) and women (9.7%) and African-Caribbean women (5.6%) in England.³ Although the prevalence of T2D is higher in The Netherlands than in England, the prevalence of generalized obesity is substantially lower in The Netherlands.² Similar patterns are also observed when England is compared with the rest of Western Europe in general.¹,² These inconsistencies have also been observed among the ethnic minority groups living in these countries. In our recent study, for example, despite the comparatively high prevalence of T2D among the Dutch Indians and African-Caribbeans, their generalized obesity levels were similar to the equivalent Indian and African-Caribbean groups in England.⁴ These observations raise the question of which factors may underlie the relatively high prevalence of T2D in The Netherlands as compared to England despite the lower prevalence of generalized obesity in The Netherlands.² Prospective observational studies show a strong association between metabolic syndrome (MS) and the risk for subsequent development of T2D and cardiovascular diseases (CVD).⁵–⁷ In a meta-analysis of 16 cohort studies, the relative risk of developing diabetes ranged from 3.5 to 5.2. As compared to generalized obesity, MS captures a more complex set of metabolic risk factors, including abdominal obesity, low levels of HDL cholesterol and elevated levels of triglycerides, blood pressure and blood glucose. In several cohorts, the risk of T2D increased with an increasing number of components of the MS.⁹,⁰⁻¹² The increased risk also appears to be related to the risk factors clustering rather than simply to obesity. In the Framingham study, obese people without MS did not have a significantly increased risk of diabetes or CVD.¹³ Obese people with MS, however, had a 10-fold increased risk for T2D relative to normal weight individuals without MS. Therefore, the observed differences in the prevalence of T2D between The Netherlands and England might reflect similar patterns of differences in MS in both Whites and the ethnic minority groups living these countries.

The main objective of this article was therefore to assess Dutch and English differences in MS among non-diabetic people. Comparisons will be made separately for European, Indian and African-Caribbean ethnic groups living in The Netherlands and England. With this analysis, we aim to shed more light on these observed differences in T2D between these two countries. We hypothesized that (i) the prevalence of MS would be higher in the White-Dutch...
than in the White-English and (ii) similar differences would be observed between Dutch and English Indian and African-Caribbean ethnic minority groups living in these two countries as a reflection of the higher prevalence of T2D in White-Dutch, Indian, and African-Caribbean ethnic groups in The Netherlands. Since our main aim was to assess whether the Dutch and English differences in T2D prevalence reflect similar differences in MS, we excluded all individuals with diabetes.

**Methods**

The full details of the study methods, definition of ethnic groups and brief histories of migration have been given elsewhere. The SUNSET study was carried out to assess the cardiovascular risk profile of Dutch-Africans, Dutch South-Asians and White-Dutch. The UK data were from the Health Survey for England (HSE) and the Newcastle Heart Project (NHP). Full details of the studies have been published elsewhere. The short descriptions of the studies are given below.

**Study population**

We collected data from population-based surveys that collected standardized data on CVD and risk factors in the South-Asian and African origin populations in the UK and The Netherlands. All of the studies were population-based health surveys with data on ethnic minority and White populations. Each collaborator agreed to provide anonymized individual participants’ data on risk factors, anthropometry, lifestyle, SEP and demographics. The data on the Dutch ethnic groups came from the SUNSET Study. The UK data were from the Health Survey for England (HSE) and the Newcastle Heart Project (NHP). Full details of the studies have been published elsewhere. The short descriptions of the studies are given below.

**Health surveys for England**

The HSE comprises a series of annual surveys commissioned, until recently, by the Department of Health and designed to provide regular information on a range of aspects concerning the nation’s health that cannot be obtained from other sources. The HSE 1999 and 2004 focused on the health of ethnic minority groups. In these years, the general population had no nurse visit, so data from HSE 1998 and 2003 have been used to allow comparisons with the general population. This was possible because of the comparability of the questionnaires across the survey years. The individual response rate for the ethnic minority sample was 60% for surveys in 1999 and 63% for 2004; the equivalent figures for the general population were 69% in 1998 and 66% in 2003. Ethnic groups were classified according to the self-reported ethnic origin. The HSE datasets are freely available for use.

**The Newcastle Heart Project**

The NHP was carried out between 1994 and 1997 to compare CHD risk factors in English-Indians, -Pakistanis and -Bangladeshis and also compared combined South-Asian groups with White-English people. The White-English sample was drawn from the family health services authority register for the Newcastle health and lifestyle survey. The South-Asian samples were drawn from the full register. The sampling frames were each divided into 10 year age and sex strata, and equal numbers from each stratum were randomly selected. The response rate was 67.5% for South Asians and 64.2% for White people. Ethnic groups were classified by name analysis confirmed by self-report and grandparents’ place of birth.

**The SUNSET study**

The SUNSET study was carried out to assess the cardiovascular risk profile of Dutch-Africans, Dutch South-Asians and White-Dutch people. A study sample of 35 to 60-year-old people was drawn from the Amsterdam population register. People were approached for an oral interview between 2001 and 2003. The overall response rate was 60% among the Surinamese and 61% among White-Dutch. Ethnic groups were classified according to the self-reported ethnic origin of the respondent and/or the ethnic origin of the mother and father.

All the studies had similar focus and design and were carried out, in part, to assess CVD and risk profiles among different ethnic groups. This makes them suitable for the present study. In addition, a cross-standardization of data was undertaken to ensure that measurement techniques and questionnaire were as comparable as possible between studies. To achieve this, two workshops attended by all the collaborators and a methodologist were held at the Academic Medical Centre, Amsterdam, to discuss methodological issues related to the datasets including standardization of content, formatting and analytic programs. The workshops provided a platform to share experiences and to discuss the possible drawbacks and solutions. A standardization protocol was then developed, and all the individual datasets were merged.

**Measurements**

All the studies had measurements on fasting glucose, lipids, anthropometry and similar questions on lifestyle, socio-demographic factors and self-reported doctor diagnosis and treatment of diabetes, cholesterol and hypertension. In all studies, height was measured without shoes with a measuring tape. Weight was measured with the subject lightly clothed. The height and weight were measured once in the UK studies and twice in the Dutch study; hence, the first reading was used in the analyses. Waist circumference was measured twice at the midpoint between the lower rib and the upper margin of the iliac crest in all studies. The mean of the two measurements was used in the analyses. The NHP used mercury sphygmomanometer for BP measurement, whereas others used electronic devices. In the SUNSET study, Omron M-4 device was used for BP measurement. In the HSE 2003 and 2004, BP was measured using the Omron HEM 907. Before 2003, Dinamap 8100 monitors were used for all HSE BP readings. Since Dinamap 8100 monitors tend to overestimate systolic BP, a calibration study was carried out by HSE investigators to provide suitable regression equations to derive predicted Omron readings from Dinamap readings. The derived Omron readings were used in this study to enhance comparability.

In all studies, participants were asked to fast from 22:00 h the night before, and a fasting venous blood sample was taken for the measurement of glucose and lipids. In 1999 HSE, measurement of plasma glucose was done using the Bayer DAX-72 automated analyser using the glucose oxidase method. In 2004, the measurement of plasma glucose was determined using the Hexokinase method on an Olympus 640 analyser. HDL cholesterol was determined by cholesterol oxidase assay method. The measurements were carried out by the Biochemistry Department at RVI. In the NHP, glucose was measured by the glucose oxidase method on a Hitachi 717 analyser. HDL cholesterol was measured using precipitation method. In the SUNSET study, glucose was measured by the dehydrogenase method using P800 Roche Diagnostics analyser. HDL cholesterol was measured using the homogenous enzymatic colorimetric method. Triglyceride concentrations were estimated using an enzymatic method in all studies.

In all studies, participants completed a similar questionnaire that included educational level and employment status, physical activity (playing sport and brisk walking), smoking and doctor diagnosed of diabetes (yes or no). Educational level was based on the highest qualification gained and was classified as ‘less than Secondary School or an A-level certificate’, ‘A’-levels or Dutch ‘A’-level equivalent (VWO) graduation certificate’ and ‘those with polytechnic or university degrees’. Employment status was classified as ‘employed or in fulltime education’, ‘unemployed’ and ‘other economic inactive or retired’. Playing sports was classified into yes or no. Brisk walk was categorized into no brisk walk or brisk walk ≥1/week.

**Definition of metabolic syndrome**

MS was defined according to the recent International Diabetes Federation (IDF) criteria.
Data analysis

The age distribution of the participants in HSE was ≥ 16 years, in the NHP was 25–74 years and in the SUNSET study was 35–60 years. Due to variations in the ages covered in the different studies, only those aged 35–60 were included in the analyses. The HSE utilized a complex survey design; consequently, the samples were weighted to correct for the unequal probabilities of selection for different classes of respondents. The prevalence rates were age-standardized in order to remove the effect of age from comparisons between groups. Direct standardization was applied for both sexes, with the standards being the age distribution of the total population. Chi-square tests were used to assess differences in categorical variables. Differences in continuous variables were assessed by means of analyses of variance. Prevalence ratios (PRs) of MS and their 95% confidence limits were calculated by means of Poisson regression with robust variance34 to examine ethnic differences and adjusted for measured individual factors that are known to be associated with MS: age, socio-economic status (education level and employment status), physical activity, smoking, alcohol intake, BMI and duration of residence.19,25 In addition, we adjusted all the analyses for year of survey, because the time frame over which the studies were performed varied both within and between studies. All analyses were performed using STATA 11.0 (Stata Corp, College Station, TX).

Results

Characteristics of the study population

Table 1 shows the characteristics of the study population. The Dutch ethnic groups were less obese, smoked more, and walked briskly less often than their English counterparts. White-Dutch people were more educated, but the Dutch-Indians and Africans were less educated compared to their English counterparts. The Dutch ethnic minority groups had a shorter length of stay than their English counterparts.

Prevalence of the components of MS within White, Indian and African groups

Table 2 shows the prevalence and adjusted PRs of MS components. After adjustments for educational levels, employment status,
smoking, alcohol intake, physical activity, BMI and year of survey, among men, the PRs of fasting glucose, reduced HDL cholesterol and raised BP were higher in all the Dutch ethnic groups than in their English equivalent groups. However, the differences were statistically significant only for the fasting glucose in all the ethnic groups and raised BP in the African group. In contrast, the adjusted PRs of raised triglyceride were lower in all the Dutch ethnic groups than in their English equivalent groups, although the difference was significant only in the South-Asian groups.

Among women, the adjusted PRs of central obesity, reduced HDL cholesterol and fasting glucose were higher in all the Dutch ethnic groups than in their English equivalent groups, although only the differences in central obesity in all the ethnic groups and raised BP in South-Asian groups were significant. The raised triglyceride levels, in contrast, were lower in all Dutch ethnic groups than in the English ethnic groups, although the difference was significant only in the White group.

### Prevalence of MS within White, Indian and African groups

Figure 1a and b shows the prevalence of MS by ethnic groups in men and women, respectively. Among Whites, after adjustments for other factors, the PRs were significantly higher in both White-Dutch men (PR = 1.37, 95% CI: 1.03–1.82) and women (PR = 1.52, 95% CI: 1.06–2.19) than their White-English counterparts (Table 3). Among Africans, Dutch-African men had a higher prevalence of MS than their English counterparts (PR = 2.20, 95% CI: 1.14–4.26). The Dutch-African women also had a higher adjusted prevalence than their English African counterpart, although the difference was non-statistically significant (PR = 1.46, 95% CI 0.96–2.24). Among Indians, Dutch-Indian women also had a higher adjusted prevalence of MS than English-Indian women (PR = 1.42, 95% CI: 1.00–2.03). Dutch-Indian men, however, had a similar prevalence of MS to English-Indian men (PR = 0.97, 95% CI: 0.74–1.27).

### Discussion

#### Key findings

We assessed the prevalence of MS among Dutch and English ethnic groups to shed more light on the higher prevalence of T2D in The Netherlands as compared to England. In general, the prevalence of MS was higher in Dutch ethnic groups than in their English equivalent groups except for Indian men.

#### Strengths and limitations

The main strength of our study is the use of the current IDF definition, which incorporates ethnicity-specific cut-off points for
waist circumferences. Our study also has some limitations. Variations in study methods might have introduced bias in the prevalence estimates. Nevertheless, all the studies used standardized methods and validated instruments. In addition, different methods used to determine plasma lipids and glucose such as glucose oxidase and hexokinase method have been shown to be highly correlated. Another limitation was that the English data were based on one medium-size city in England, and a sample of the population of England, whereas the Dutch data were based on one major city in The Netherlands, which may limit comparability of the study results. Nonetheless, the majority of ethnic minority populations in both countries live in cities.

Discussion of the key findings

The comparatively high prevalence of MS among the Dutch groups is consistent with their higher prevalence of T2D. The high rate of T2D among the Dutch groups seems difficult to explain especially given the relatively low prevalence of generalized obesity in The Netherlands. Numerous studies, however, indicate that individuals with the MS are at particularly high risk for T2D, more so than generalized obesity. Our current findings suggest that the between Dutch and English differences in T2D may also be more influenced by metabolic risk factor clustering than generalized obesity.

The reasons for the higher prevalence of MS among the Dutch ethnic groups are by no means simple and suggest the need for further research. However, there were some consistent patterns of the prevalence of the MS components among the Dutch ethnic groups, which may contribute to their relatively high prevalence of MS. For instance, fasting glucose and reduced HDL cholesterol were consistently higher in all the Dutch ethnic groups than in their English equivalent peers in both men and women. In addition, central obesity levels were higher in all the Dutch ethnic groups in women than in their English counterparts. These consistent patterns seem to suggest that the national circumstances such as prevailing health behaviour, the national traditions regarding food as well as health-related policies may influence the prevalence of metabolic risk factors in different ways in different countries.

Lifestyle-related risk factors are influenced by national factors, and these factors may differ between England and The Netherlands. For example, policies on some of the important risk factors for MS such as tobacco control have been shown to be more robust in England than in the Netherlands. In addition, evidence suggests differences in emphasis on ethnic variations in health in national clinical guidelines between England and The Netherlands. The English guidelines on some of the components of MS such as hypertension and diabetes have been shown to give more attention to ethnic minority groups than the Dutch guidelines. Furthermore, of late, multidisciplinary ethnicity and CVD consensus group has issued a document that provides an overview of ethnicity and CVD in the UK, with management recommendations based on a roundtable discussion. These national policies and guidelines’ differentials may influence health behaviour as well as management of metabolic risk factors and consequently lead to differences in MS between the two countries. Furthermore, hypertension control rates were lower in Dutch-Indians and Dutch-Africans than in their English equivalent groups.

In conclusion, the higher prevalence of MS among Dutch ethnic groups as compared to their English counterparts may contribute to their relatively high of prevalence of T2D. The relatively high levels of reduced HDL cholesterol and raised BP add to the high prevalence of MS in Dutch ethnic groups. More work is needed to identify other factors that may underlie the observed differences in MS between countries.

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Conflicts of interest: None declared.

Key points

- In general, the prevalence of MS was higher in Dutch ethnic groups than in their equivalent English groups.
- The higher prevalence of MS among Dutch ethnic groups may contribute to their relatively high prevalence of T2D.
- National circumstances such as prevailing health behaviour may influence the prevalence of metabolic risk factors in different ways in different countries.

References

Introduction

Physical activity is an important public health issue and the benefits of an active lifestyle in relation to well-being and health have been strongly emphasized in recent years in Europe. Physical inactivity is associated with increased risk of chronic diseases and with other disease states, such as hypertension, diabetes, osteoporosis, particular forms of cancer, obesity and even psychological disorders. Therefore, the need to increase participation in regular physical activity has been identified as one of the most prevalent public health burdens of our times. In this regard, it is well known that European women are less physically active in their leisure time than European men. Attempts to explain this gender difference often do not succeed in raising the problem above the individual level. However, the size of the disadvantage for women varies considerably across countries, proving that leisure time physical (in)activity takes place in a broader societal context and must also be approached as such. In this sense, some authors have explained women’s lack of leisure time physical activity in terms of gendered power relations in society. Therefore, the present article postulates that over and above the individual effect of gender, there is an additional impact of a society’s gender-based (in)equality distribution. **Methods:** By means of the 2005 Eurobarometer survey (comprising 25 745 adults from 27 European countries), gender differences in leisure time physical inactivity (LTPI) were analysed by means of multilevel logistic regression analysis. National gender-based (in)equality was measured by the Gender Empowerment Measure and the Gender Gap Index. **Results:** Controlled for compositional effects, gender differences in LTPI varied as a function of gender-related characteristics at the macro-level. In particular, in countries characterized by high levels of gender-based equality, LTPI differences between men and women even disappeared. **Conclusion:** The findings underscore the need to adopt a society-level approach and to incorporate socio-contextual factors in the study of gender disparities in LTPI.