

# Public health guidance for obesity and physical activity: Is it time to take ethnicity into account?

It is well established that obesity is a strong risk factor for type 2 diabetes (Abdullah et al, 2010), and there is also a large and consistent body of prospective epidemiological data showing that low levels of physical activity (Gill and Cooper, 2008) and low levels of cardio-respiratory fitness (Wei et al, 1999) are important diabetes risk factors. Because of this – and the effects of obesity and low physical activity (or low fitness) on other health-related outcomes – there are national and international public health guidelines for a healthy body weight and for appropriate levels of physical activity.

It is generally recommended that a BMI of less than 25 kg/m<sup>2</sup> indicates a healthy weight, with BMI values of 25–30 kg/m<sup>2</sup> and >30 kg/m<sup>2</sup> conventionally adopted to define “overweight” and “obesity” respectively. In a similar manner, most national and international physical activity guidelines recommend that adults accumulate at least 150 minutes of moderate intensity (e.g. walking briskly) or 75 minutes of vigorous intensity physical activity per week for optimal health (e.g. World Health Organization [WHO], 2010). However, the evidence underpinning these health recommendations is largely based on an evidence base from populations of White European ethnic origin, and it not clear whether this guidance is also appropriate for populations of non-White ethnicity.

## Role of ethnicity in diabetes risk

Public health guidelines are adopted to minimise disease risk in the population, but in Westernised environments, diabetes risk is higher than that observed in White Europeans in virtually all major non-White ethnic groups. For example, for a given BMI, diabetes prevalence in African-Americans is about twice as high as White Americans (Zhang et al, 2009), and, similarly in the UK, diabetes prevalence is more than twice as high in the

Black compared to White population (Sproston and Mindell, 2006; Ntuk et al, 2014). Even more striking, prevalence of diabetes in South Asians living in the UK is 3 to 4-fold higher than in the White European population (Ntuk et al, 2014). However, prevalence of diabetes in rural India, and in African countries with limited urbanisation, is low (Mohan et al, 2008; International Diabetes Federation, 2009). Thus, the data suggest that Black and South Asian populations exhibit low diabetes risk when they are living in rural environments (and are likely lean and active) but have a disproportionately large increase in diabetes risk when they adopt urbanised lifestyles with greater availability of energy-dense foods and low levels of physical activity.

## Ethnic differences in the association between BMI and diabetes risk

Using data from almost 500 000 adults in UK Biobank, we recently demonstrated that the association between indices of adiposity (BMI, waist circumference, percentage body fat and waist-hip ratio) and diabetes prevalence was ~3 to 4-fold stronger in South Asians and ~1.5 to 2-fold stronger in Black adults than the White European population (Ntuk et al, 2014). In other words, each kilo of extra weight (fat) carried increases diabetes risk in a South Asian person to a much greater extent than it does in a White European person.

It has been hypothesised that this is due to South Asians having a more limited capacity to store fat safely in superficial subcutaneous adipose tissue leading to earlier overflow into more harmful deep subcutaneous, visceral and ectopic depots (Sattar and Gill, 2014), and work to test this hypothesis is currently ongoing in our labs. However, there is also an important corollary for public health. For equivalent risk of diabetes as a white European adult with a BMI of 30 kg/m<sup>2</sup>, a South Asian adult would require a BMI of just ~22 kg/m<sup>2</sup> and a Black



Jason Gill

Reader, BHF Cardiovascular Research Centre, University of Glasgow, Glasgow

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adult would need a BMI of  $\sim 26$  kg/m<sup>2</sup>. Thus, in terms of using BMI to target diabetes screening and implement lifestyle interventions to reduce diabetes risk, it is clear that lower thresholds for action are needed in non-White ethnic groups.

This has been recognised in principle by institutions such as the WHO Expert Consultation (2004) and NICE (2013). However, the recent UK Biobank data analysis suggests that the WHO- and NICE-recommended thresholds for BMI to trigger action to prevent type 2 diabetes amongst Asian populations (i.e. 23 kg/m<sup>2</sup> [versus 25 kg/m<sup>2</sup> for White Europeans] for “increased risk” and 27.5 kg/m<sup>2</sup> [versus 30 kg/m<sup>2</sup>] for “high risk”) may be too conservative (Ntuk et al, 2014). In UK Biobank, approximately 90% of South Asians had BMIs over 22 kg/m<sup>2</sup>, putting them at equivalent diabetes risk as obese White European adults. This stark observation suggests that, in practice, it may be most straightforward and cost-effective to target *all* South Asians for lifestyle intervention to reduce diabetes risk, irrespective of body weight. It may not be appropriate to recommend weight loss in someone with a BMI of 22 kg/m<sup>2</sup>, but other interventions such as increasing physical activity could reasonably be targeted to such individuals.

### **Physical activity, ethnicity and diabetes risk**

Analogous to the evidence that non-White ethnic groups, particularly South Asians, require lower levels of adiposity than White Europeans for equivalent diabetes risk, there is evidence that the level of physical activity required for optimal health may also differ between ethnic groups. A number of studies has shown that South Asians have a lower level of cardio-respiratory fitness than White Europeans (Hardy and Eston, 1985; Davey et al, 2000; Hall et al, 2010; Ghouri et al, 2013) and there is also evidence that fitness levels are lower in Black compared with White Americans (Ceaser et al, 2013). Our data suggest that lower fitness in South Asian men is not explained by lower levels of physical activity (Ghouri et al, 2013), and thus is likely to be innate, and that this lower fitness explains over two-thirds of the excess insulin resistance observed in our South Asian cohort (Ghouri et al, 2013). It is not

yet known whether lower fitness in UK or US Black populations might also contribute to the greater insulin resistance often observed in these groups. We have also shown that South Asian men oxidise about 50% less fat than White European men during submaximal exercise, and that the rate of fat oxidation during exercise is significantly associated with insulin sensitivity at both the whole body level and the level of insulin signalling in skeletal muscle (Hall et al, 2010). As increasing physical activity can both increase cardio-respiratory fitness and fat oxidation during exercise, these data suggest that, by undertaking higher levels of physical activity, South Asians could potentially overcome these innate differences in fitness and muscle metabolism, which may contribute to their excess diabetes risk. This raises the possibility that appropriate levels of physical activity for optimal metabolic health are likely to differ between ethnic groups and the present recommendation of 150 minutes of moderate intensity (or 75 minutes of vigorous intensity) physical activity per week (WHO, 2010), may not be appropriate for all.

To address this, we recently attempted to quantify the amount of physical activity that would provide South Asian men with an equivalent cardio-metabolic biomarker risk profile as BMI-matched White European men meeting the current recommendation of 150 minutes per week of moderate intensity physical activity (Celis-Morales et al, 2013). Our analysis indicated that South Asian men needed to undertake more than 250 minutes per week of moderate intensity physical activity to achieve an equivalent risk profile to the White European men achieving current physical activity guidelines. While further study is needed to replicate these findings in larger cohorts and extend these analyses to women, our data suggest that – like the BMI threshold for obesity – one size does not fit all ethnic groups for appropriate levels of physical activity.

### **Changes for the future?**

Thus, while we know that maintaining a healthy body weight and undertaking an appropriate amount of physical activity are the main tools in our arsenal for the prevention of type 2 diabetes, accumulating evidence suggests that the BMI and

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physical activity levels needed to ensure a low diabetes risk differ markedly between ethnic groups. This is starting to be recognised in public health guidelines for obesity, although BMI thresholds to denote high diabetes risk in non-White groups may need to be revised further downwards in the future. Research into appropriate levels of physical activity for non-White groups is at an earlier stage (see Gill et al [2014] for a review of the current evidence), but there is now an emerging rationale for future public health guidance on physical activity to move away from one-size-fits-all and also take ethnicity into account. ■

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