

## EDITORIAL

# Type 2 diabetes in Asia: where do we go from here?

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There is a global burden of type 2 diabetes (T2DM), and the predicted escalation in its prevalence will be acutely felt by India and China. It was timely to seek the opinions of the key researchers in these countries and from around the world, so we may benefit from their understanding of the developmental, environmental and lifestyle factors that are pertinent to the disease. This special issue took on the enormous task of covering the spectrum of nutrition and health-related research that informs the problem of T2DM in this region—from the epidemiology to clinical to cellular/molecular insights including some exciting future areas. The goal was to highlight what was known and what was emerging from different models of observation. Ultimately, by identifying overlapping areas of concern in this region and gaps in our understanding, a renewed effort in controlling the escalation of this disease could follow.

In this issue, several authors have ascribed the increased incidence of T2DM in Asia to rapid changes in lifestyle behaviours.<sup>1–5</sup> Increased intakes of refined carbohydrate (including sugars), greater saturated and less monounsaturated fat intake, low-quality protein, and decreased fruit and vegetable intake have combined with increased sedentariness and reductions in voluntary physical activity. Ambient air pollution including particulate matter is also a major concern in India and China.<sup>6</sup> Air pollution will initiate and exacerbate a chronic inflammatory state that has effects on the growing foetus and the progression of adult disease.<sup>7,8</sup> Coincident with these environmental and lifestyle changes has been a rapid increase in economic prosperity, unplanned urbanization, a new culture of fast food consumption, and a continued high prevalence of smoking and tuberculosis.<sup>6</sup>

The research of Krishnaveni and Yajnik<sup>9</sup> reminds us that maternal nutritional status and metabolic state are equally important. Obesity and gestational diabetes influence birth outcome, and heavier babies have a greater risk of T2DM in adulthood.<sup>9,10</sup> However, subtle changes to nutrient intake (vitamin B12, for example) can, through epigenetic pathways, imprint the growing foetus towards a phenotype that is 'thin but fat' even at birth.<sup>9</sup> These are intergenerational effects. The recent emergence of an obesogenic environment in Asia would further modify the post-natal growth and metabolism of such babies, leading to the adult expression of the well-described 'Asian or Asian-Indian phenotype'. In an evolutionary perspective, Wells<sup>11</sup> brings these facets together in a model that discusses the interaction of two traits, 'metabolic capacity' and 'metabolic load', and how variations in each may explain the risk of T2DM in this region.

There is promise that cellular models will further our understanding of the metabolic basis for the increased predisposition of Asians to T2DM.<sup>12</sup> Uncontrolled T2DM, however, has multisystem manifestations that impose a huge financial cost to the individual and the nation.<sup>13</sup> Perhaps we also need to study the cross-talk between other major organ systems and the  $\beta$  cell, to better understand how best to control the disease.<sup>14</sup> Such information could conceivably also lead to newer drug targets and functional food development. Systemic inflammation and immune function are closely linked to metabolic disease.<sup>15</sup> Newer techniques now measure the bioenergetics of immune cells<sup>16</sup> and this could prove very useful, if early disparities in such bioenergetic indices

predicted future disease, or even signalled the normalization of metabolic dysfunction in response to treatment.

So where do we go from here? Do we need multisite, large-scale intervention trials targeting dietary and physical activity discrepancies common to these countries? Should there be a formal engagement between these countries at the highest level? And, do we place this issue at the top of our public health agenda? Gulati and Misra<sup>3</sup> and Rhodes *et al.*<sup>6</sup> in this issue subscribe to lifestyle interventions for T2DM. There is some discussion on using the Prevención con Dieta Mediterránea (PREDIMED) trial as a template for the United States, and possibly as a multi-country intervention for T2DM.<sup>17</sup> Increasing extra-virgin olive oil consumption and/or increased mixed nut intake were the key attributes of the PREDIMED success.<sup>18</sup> Whether such recommendations suit the diet of Asians and their traditional culinary methods, would be important to investigate, since there is little information.<sup>19,20</sup> However, there is also the view that 'movement is medicine'. Arena *et al.*<sup>21</sup> suggest a more personalized approach through technology-driven e-health/m-health platforms that could for instance, target a reduction in sedentary.

Faced with the concomitant obesity epidemic, primary prevention (that is, a population approach built on a policy framework), as well as controlled and culturally adapted lifestyle interventions in at-risk groups (malnourished mothers, women with a history of gestational diabetes, individuals with prediabetes, and so on) are needed in a life course approach to reduce the prevalence of T2DM in Asia.<sup>22</sup> Environmental health agencies in Asian countries would also have a major role in reducing air pollution. Moreover, the power of political influence, both at the national and international level, cannot be discounted. The success of smoking cessation was built around societal and political will among other measures, and supported by messages targeted at individuals.<sup>23</sup> Political decisions to impose a tax on fat and sugar-sweetened beverages coupled with incentives for increasing fruit and vegetable intake, have been advocated for obesity and T2DM.<sup>3</sup> Overall, the prevention of diabetes cannot reside within the health sector alone. Focusing on education, economic disparities, cultural diversity and human ecology would be important in formulating and sustaining a solution to this crisis. Perhaps, it is time we worked towards an integrated solution.<sup>24</sup>

## CONFLICT OF INTEREST

The authors declare no conflict of interest.

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