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Advocating whole grains consumption as a key approach in diabetes prevention

The evidence for dietary carbohydrate management for diabetics is clear

Advisory on dietary carbohydrate has been an integral part of clinical practice guideline for secondary intervention of diabetes (MOH, 2014). Management of carbohydrate quantity and quality in clinical setting reliably reduces elevated blood glucose. A recent 2016 American Diabetes Association position paper stated consumption of carbohydrate-rich processed foods as one of the reasons for hyperglycaemia among diabetic patients.

The effects of carbohydrate portioning and substitution from refined to unrefined sources are immediate and well documented (Feinman et al., 2004, Ley, 2014; AlEssa, 2015). These clinical improvements are supported by established principles in carbohydrate biochemistry and physiology.

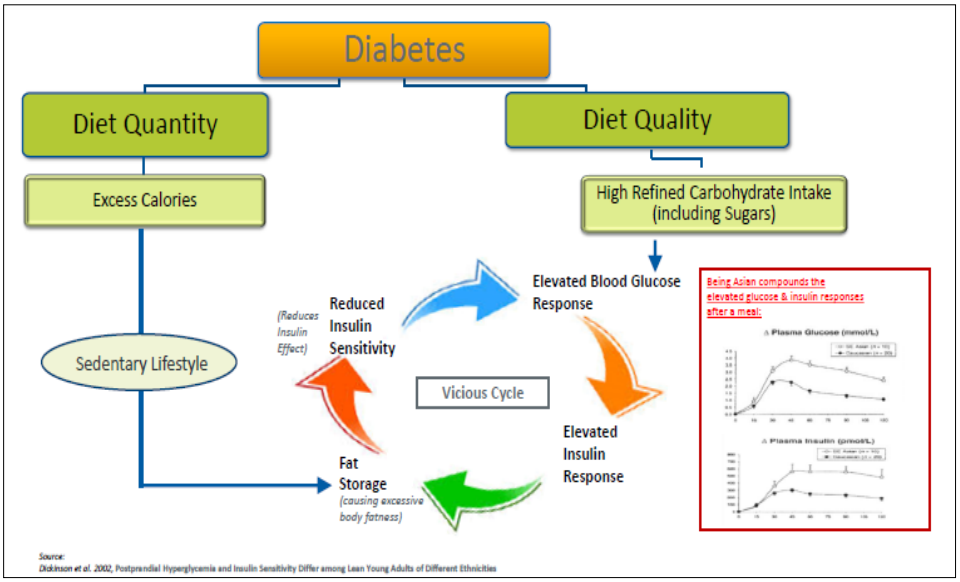
The health benefits to diabetic individuals, when refined carbohydrates are replaced by whole grains in the diet are further supported by a series of evidence-based research (Sun et al. 2010, Ye et al. 2012, Aune et al. 2013 and Wang et al. 2013). Individuals with diabetes are encouraged to replace refined carbohydrates and added sugars with whole grains, legumes, vegetables, and fruits. The consumption of sugar –sweetened beverages and "low-fat" or "non-fat" products with high amounts of refined grains and added sugars should be discouraged (ADA, 2016)

The carbohydrate strategy - an urgency to move from secondary management to primary prevention at the population level

Similarly, in the context of primary setting, evidence from both epidemiological & randomised control trials, is emerging that there is a dose-response relationship between levels of consumption of refined carbohydrate foods (white rice, noodles, white breads), and risk of developing type 2 diabetes (Chanson-Rolle, 2015). On average, every additional serving (250g plate) of white rice increases the risk of type 2 diabetes by >11% (Hu et al., 2012). Randomised control trials have similarly shown that substituting brown rice for white rice can lower the risk of type 2 diabetes. (Hsu et al., 2008; Panlasigui & Thompson, 2006).

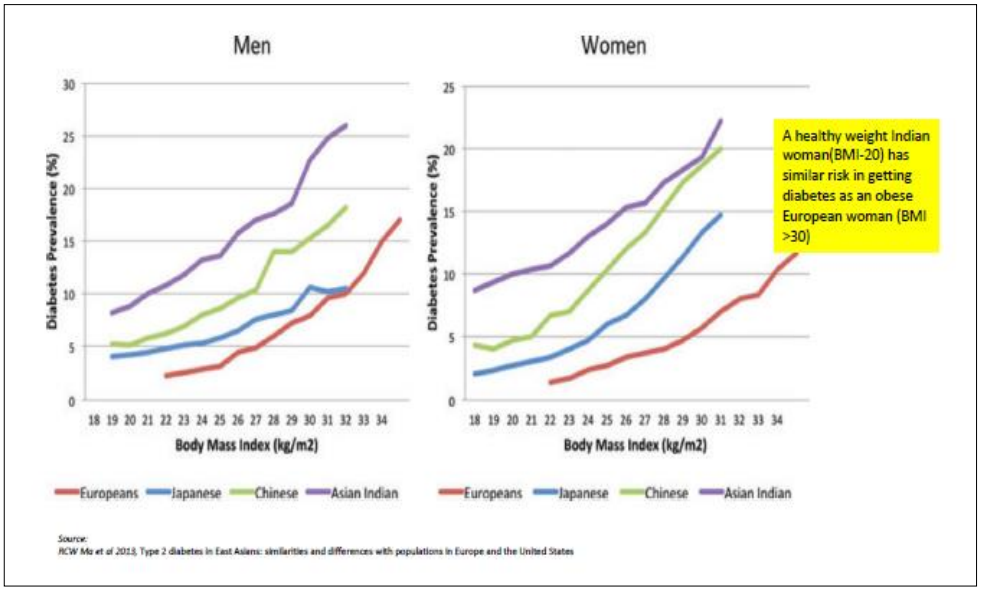
The effect is especially pronounced in Asians. The diabetes risk in Asian populations (Japanese and Shanghai cohorts) was 55%, whereas the corresponding risk was 12% in Western (U.S.) populations. This is because Asians are predisposed to stronger blood glucose and insulin responses to carbohydrate intake, what researchers call the 'Asian Phenotype' (Dickinson et al., 2002), with implication for a metabolic syndrome that favours body fat storage and reduced insulin sensitivity, glucose intolerance and higher risk of diabetes (Figure 1).

Figure 1: For the same carbohydrate load, Asians would mount stronger blood glucose and insulin responses than Caucasians



There is compelling data across population groups to show that at the same BMI, Asians have 3-4% more body fat or are more “metabolically obese”, and have higher diabetes prevalence than Europeans (Ma and Chan, 2013) (Figure 2).

Figure 2: The Asian Phenotype - Asians develop diabetes at much lower BMI compared to Europeans

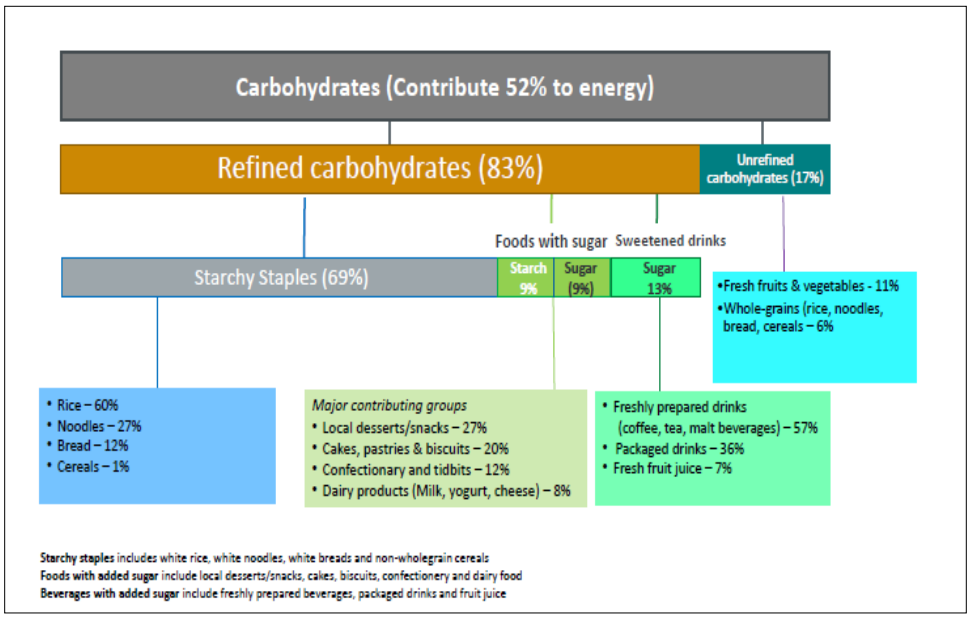


Given Asian's predisposition to diabetes, and that more than half (52%) of our dietary calories comes from carbohydrate (and much of this carbohydrate [83%] are highly refined), it is imperative that we draw attention to the need for a population level carbohydrate intervention strategy as a first approach for diabetes prevention.

Sources of carbohydrate – why we need to go beyond simple sugars to address starchy refined staples

In Singapore, we consume far more refined carbohydrates from starchy staples like rice and noodles than sugar from cane sugar in sugary drinks, at a ratio of 9:1 (2010 National Nutrition Survey). Please refer to Figure 3.

Figure 3: Much of refined carbohydrate in our diet comes from starchy staples



Referring to the rice-sugary drink comparison in The Straits Times article (Diabetes: The rice you eat is worse than sugary drinks, 6 May 2016), HPB's message was not that sugars or sugary drinks are better than white rice and can be consumed without restrictions. We have been encouraging Singaporeans to take lower or zero sugared drinks through our on-going promotional campaigns and will continue with this focus. The intent, instead, was to draw attention to the lesser known fact that Singaporeans are consuming significantly more refined carbohydrates from starchy staples than from sugary drinks. With Singaporeans consuming far more rice (especially the refined types) than sugary drinks, the sheer quantity in itself poses a serious risk.

Several authors, including Dr V. Mohan, the internationally renowned Asian-based WHO consultant on diabetes, have warned that the rise of diabetes in India (and Asia) in the late 1990s is explained, at least in part, by the shift seen in the quality of grains (rice) consumed from unpolished to highly polished varieties (Mohan et al., 2010). He has strongly advocated for the Indian Government to adopt promotion of low GI products as part of policy measures. Similarly, Dr Walter Willett, the pioneer of Nutrition Epidemiology at the Harvard School of Public Health, has also called for Asia to make a "cultural leap" to switch from white rice to brown rice, as such "small change" would have "huge impact" in slowing down the rising diabetes epidemic in Asia (Harvard Public Health, 2009). This same research centre emphasised the need to "reduce diabetes by improving the quality of staple foods through culturally-appropriate interventions" (Mattei et al, 2015).

Epidemiological trends of diabetes in Asia closely reflect economic and nutrition transitions

Asian countries undergoing economic and nutrition transitions have experienced rapid rates of increase in diabetes over short periods, characterised by an onset at a relatively young age and low BMI. In China for example, the prevalence of diabetes has increased from 1% in 1980 (Hu, 2011) to 9.8% in 2013 (IDF, 2016), with much higher rates in urban areas like Shanghai which has a 12.6% diabetes prevalence (Li et al., 2012). During this period of transition, the percentage of dietary calories from carbohydrate has remained relatively constant (55%-65%). What has changed, however, is the dramatic shift in sources of carbohydrate from unrefined to highly refined grains with the introduction of milling and refining in the 1960s to 1970s. The refining effectively removes the outer bran and germ portions of the rice and wheat grains leaving behind mainly the starchy endosperm.

The thinking that our ancestors were rice eaters with little ill effect, therefore needs to be corrected on a number of points: (1) While rice eating is culturally ingrained in Asia, the norm used to be unpolished rice, not polished white rice, which only became a feature of Asian diet in the last 50 to 60 years (Hu, 2011); (2) The transition from working in fields to working at desks or in factories means that people today are a lot more sedentary, with compromised tolerance to high glucose load (Popkin, 2012); and (3) Longer life expectancy is now increasing the likelihood of diabetes onset, with longer years of exposure to complications.

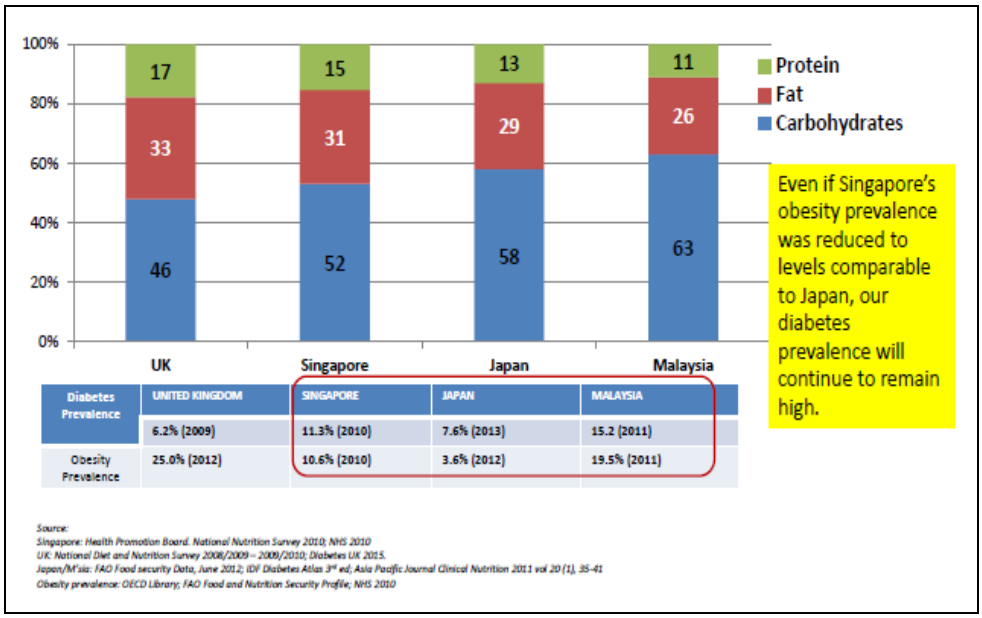
More than 60% of the world's diabetic population will be in Asia (Hu, 2011). Unlike in the West where older populations are most affected, the burden of diabetes in Asian countries is disproportionately high among the young to middle-aged adults (Ramachandran et al. 2012).

Disparity between obesity and diabetes in Asia - dietary quality is a risk factor independent of obesity

Another common misconception is that countries like Japan, whose population also consume large quantity of refined white rice, have low diabetes prevalence. This is inaccurate. Japan's diabetes prevalence of 7.6% (IDF, 2016) must be considered in context of their obesity prevalence, which is considered low, at 3.6% (OECD, 2014). This should be seen in comparison to Singapore's diabetes prevalence of 10.6% (IDF, 2016)) and a higher obesity prevalence of 11.3% (MOH, 2010). Despite the low population BMI, Japan has comparatively high diabetes prevalence. Conversely, U.K. which has a high population BMI (OECD, 2014) has much lower diabetes prevalence than Singapore (IDF, 2016). This suggests that there are factors other than obesity predisposing to diabetes risk.

What is often overlooked is that Asians eat differently from Westerners. Asians consume proportionately more dietary energy in the form of carbohydrate than fat and protein. The percentage of dietary calories from carbohydrate in Japanese is 58% (FAO, 2012) and much of this is refined carbohydrate (derived mainly from white rice), compared to 52% and 46% respectively, in Singapore (HPB, 2010) and the U.K. (FAO, 2012) (Figure 4).

Figure 4: Our carbohydrate intake as a proportion of calories consumed is higher compared to a western diet. Much of this is refined carbohydrate. This is similar across Asia, possibly contributing to the higher prevalence of diabetes.



Diabetes Prevalence	UNITED KINGDOM	SINGAPORE	JAPAN	MALAYSIA
	6.2% (2009)	11.3% (2010)	7.6% (2013)	15.2 (2011)
Obesity Prevalence	25.0% (2012)	10.6% (2010)	3.6% (2012)	19.5% (2011)

Source:
Singapore: Health Promotion Board. National Nutrition Survey 2010; NHS 2010
UK: National Diet and Nutrition Survey 2008/2009 – 2009/2010; Diabetes UK 2015.
Japan/M'sia: FAO Food security Data, June 2012; IDF Diabetes Atlas 3rd ed; Asia Pacific Journal Clinical Nutrition 2011 vol 20 (1), 35-41
Obesity prevalence: OECD Library; FAO Food and Nutrition Security Profile; NHS 2010

Whole grains as part of chronic diseases management

There is an urgency for public health action, especially for the adoption of measures that can be delivered at scale to achieve population impact.

Systematic reviews and meta-analysis of prospective studies confirms the benefits of increasing whole grains intake to improve public health, including being protective against a range of chronic diseases, not just type 2 diabetes (Ye, 2012; Chen et al, 2016). The strategic thrust is to influence partial replacement of refined grains with whole grains. HPB's carbohydrate strategy, which targets both the quality as well as quantity of the carbohydrates consumed, aims to substitute 15-20% refined carbohydrate with whole grain carbohydrate as a practical and achievable strategy at the population level, while we continue to promote controlled portion sizing. This approach would yield significant shifts in population distribution of dietary profile, with associated diabetes risk reduction.

Consumer behaviour takes time to change, especially if entrenched in culture and habits, such as the daily consumption of white rice. However, we believe that scalable change is possible. Taking packaged bread as an example, the market has seen an unprecedented growth in demand for wholemeal bread, with the market share for wholemeal bread having grown from 18% in 2008 to 30% in 2015, gradually displacing white bread. Similarly, for rice, we are seeing a shift – retailers have made available a variety of whole grain rice, several offering a mix of unpolished to white rice with good consumer acceptance.

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As health professionals, we are in an important position to facilitate the adoption of behaviour change in Singaporeans to make healthier choices. With the growing concern of diabetes in Singapore and the need to increase awareness of the modifiable risk factors of the disease, we look forward to your support to educate Singaporeans on the need to replace their refined grains with whole grain options, and the health benefits this will bring in the prevention and management of diabetes. If you have any views on how we can partner on this, we look forward to hearing from you.

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Health Promotion Board

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