The metabolic syndrome, cardiovascular disease and carbohydrate

by Alexandra Chisholm*

Dietary intervention is a cornerstone in the treatment of the metabolic syndrome (MetS) and cardiovascular disease (CVD), both of which are responsible for a growing burden of death and disability globally. Several definitions exist for MetS, however the common elements comprise obesity (especially central obesity), insulin resistance or glucose intolerance, dyslipidaemia, and hypertension, with CVD potentially occurring alongside MetS.

KEY POINTS
• Effect of dietary carbohydrate on metabolic syndrome and cardiovascular disease is complex and must be seen in the context of a total eating pattern.
• Diets rich in plant foods that include PUFA fats at the expense of SFA may beneficially affect components of metabolic syndrome and cardiovascular disease.

EFFECTS OF CARBOHYDRATES
A volume of work exists on the metabolic effects of fat on these conditions; however carbohydrate (CHO) is a major component of our diets and has pathophysiological relevance to these disease states.

The effects of the proportion of dietary CHO on weight loss have been a particular focus of recent investigations. In fact, intervention studies indicate that both lower CHO and higher CHO interventions can achieve similarly successful weight loss and metabolic outcomes\(^1,2\); although results may be influenced by dietary adherence\(^1\) and intensity of contact in advice delivery\(^2\). Obese women (mean BMI 32±6) randomly assigned to isocaloric diets of either lower CHO (46% CHO, 34% protein) or higher CHO (64% CHO, 17% protein) with good adherence over twelve weeks both achieved significant reductions in weight (7.3±0.3kg)\(^3\). In this study, fasting LDL, HDL, insulin, free fatty acids and C-reactive protein (CRP) all reduced with weight loss. However, those who began the study with higher triglycerides (>1.5mmol/L) and were on the lower CHO diet lost more fat mass (P<0.05) and had a greater reduction in triglycerides (P<0.05). Thus, while weight loss is largely dictated by the degree of caloric deficit (independent of macronutrient composition), this may suggest that tailoring diet for different metabolic profiles is warranted.

In the longer term, lower CHO diets have not been found to be more effective for weight loss than diets higher in wholegrain CHO\(^2,4,5\), with caloric deficit still seen to be key\(^6\); and there is consistent evidence that overall, high CHO (low fat) diets are not associated with heightened CVD risk\(^7,8\).

Effect of dietary CHO on MetS and CVD is clearly complex and requires discussion of CHO quality. Plant-based foods may not only beneficially effect energy balance, but also lower the risk of coronary heart disease and beneficially influence glycaemia.

The World Health Organisation has stated that 31% of deaths from ischemic heart disease and 11% of deaths from stroke worldwide were caused by diets poor in fruit and vegetables\(^9\). Additionally, there is good evidence that greater consumption of wholegrain cereals, such as oats and barley, is associated with reduced risk of CVD\(^10\) with clinical trials showing reduction in total and LDL cholesterol levels (see National Health and Medical Research Council\(^11\)).

Plant foods high in specific fibres such as β-glucans found in oats and barley may facilitate a lower rise in both post-prandial triglycerides and glucose\(^12,13\). Foods high in other viscous or gelling fibres and a higher proportion of resistant starch may also favourably influence acute blood glucose responses\(^14,15\); however, effects are dependent on the specific fibre and food matrix\(^16\).

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Carbohydrate and its effect on chronic disease has been a fascinating conversation piece amongst dietitians and nutrition scientists for some time, and has recently been discussed with some fervour. While dietary carbohydrate was once favoured as a replacement for saturated fat in cardiovascular disease risk reduction, a 2009 pooled analysis of eleven cohort studies provided further impetus for debate\(^1\). The authors found that dietary saturated fats should be replaced by polyunsaturated fats, but not monounsaturated fats or carbohydrate for prevention of coronary heart disease. However in nutrition research, study design and dietary compliance can impact on the ability to clearly expose the effects of different dietary treatments. In this issue, Alexandra Chisholm outlines recent literature on metabolic and cardiovascular health effects of carbohydrates and fats and highlights the need to focus on nutrition quality.

Elizabeth Dunford reports on recent activity supporting healthy food choice in quick service restaurants. Mandatory kilojoule menu board labelling (for larger quick service chains) was implemented in NSW earlier this year. Australians and New Zealanders frequently eat out, and whilst they may be concerned about the healthiness of fast foods, they may find it difficult to identify healthier options (see Dunford article). Indeed, implementation of caloric labelling has not been entirely successful elsewhere\(^2\).

Evaluation of the impact of mandatory labelling on fast food purchasing behaviour will be needed to establish whether this move can produce behaviour change. Some insight into the complexity of consumer behaviour change along with a suggested behaviour change model is provided by Unilever Nutrition and Health team member, Katherine Tocchini, in this issue.

Menu planning and nutrition standards in the much needed area of aged care has recently taken a step forward with the release of Dietitians Association of Australia’s scoping project\(^3\). Anne Schnieder and Liz Beaglehole summarise some of the main findings from this trans-Tasman report. Lastly, on the topic of sustainability, Corey Watts gives a summary of his presentation on ‘food miles’ recently hosted by the Dietitians Association of Australia Food and Environment Interest Group.

I trust you will enjoy this issue of Perspectives.

Janelle Gifford, PhD, Advanced Accredited Practising Dietitian.

References

**TABLE 1: ENERGY CONTENT (MEAN AND RANGE) OF FAST FOOD PRODUCT CATEGORIES PER 100G AND PER SERVE FROM 2010 AND 2012**\(^{4,5}\) (reference from page 3)

<table>
<thead>
<tr>
<th>Serving size (g)</th>
<th>Energy (kJ/100g) Mean (range)</th>
<th>Energy (kJ/serve) Mean (range)</th>
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</thead>
<tbody>
<tr>
<td><strong>Breakfast</strong></td>
<td></td>
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<tr>
<td>2010 (n=27)</td>
<td>160 (55–280)</td>
<td>1066 (860–1490)</td>
</tr>
<tr>
<td>2012 (n=22)</td>
<td>152 (55–248)</td>
<td>1059 (873–1275)</td>
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<tr>
<td><strong>Burgers</strong></td>
<td></td>
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<tr>
<td>2010 (n=56)</td>
<td>219 (95–383)</td>
<td>1000 (640–1266)</td>
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<tr>
<td>2012 (n=50)</td>
<td>223 (95–435)</td>
<td>1035 (754–1318)</td>
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<tr>
<td><strong>Chicken</strong></td>
<td></td>
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</tr>
<tr>
<td>2010 (n=43)</td>
<td>204 (17–600)</td>
<td>990 (440–1441)</td>
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<tr>
<td>2012 (n=28)</td>
<td>149 (24–464)</td>
<td>1050 (697–1441)</td>
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<td><strong>Pizza</strong></td>
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<tr>
<td>2010 (n=200)</td>
<td>77 (49–102)</td>
<td>1045 (786–1440)</td>
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<tr>
<td>2012 (n=185)</td>
<td>76 (38–298)</td>
<td>1013 (498–1320)</td>
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<td><strong>Salads</strong></td>
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<td>2010 (n=27)</td>
<td>258 (85–450)</td>
<td>351 (65–830)</td>
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<tr>
<td>2012 (n=16)</td>
<td>297 (90–450)</td>
<td>209 (62–673)</td>
</tr>
<tr>
<td><strong>Sandwiches</strong></td>
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</tr>
<tr>
<td>2010 (n=50)</td>
<td>219 (98–331)</td>
<td>768 (521–1350)</td>
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<tr>
<td>2012 (n=46)</td>
<td>207 (98–307)</td>
<td>665 (518–1300)</td>
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<td><strong>Sides</strong></td>
<td></td>
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<tr>
<td>2010 (n=25)</td>
<td>158 (24–450)</td>
<td>1087 (290–1480)</td>
</tr>
<tr>
<td>2012 (n=28)</td>
<td>175 (24–506)</td>
<td>1184 (254–1620)</td>
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Eating out: Mandatory menu board labelling of fast food products by Elizabeth Dunford

Over 1 billion meals and takeaways are served by approximately 17,000 fast food chains and take-away food outlets in Australia each year\(^1\). The average Australian eats out four times a week\(^2\) and one quarter of household food purchase expenditure in New Zealand is on food from restaurants and ready-to-eat outlets\(^3\).

Fast food may be more energy dense, higher in saturated fat and sodium, lower in micronutrients, and eaten in larger portions relative to other foods\(^4\). Australian research shows that fast food menu items vary greatly in energy and nutrient content (Table 1, page 2, and Figure 1, below)\(^5,6\). Burgers may provide from 979kJ (11% Recommended Dietary Intakes; RDI) per serve up to 4876kJ (56% RDI) per serve. Even some sandwich menu items may be up to four times higher in energy than others, providing between 570kJ (7% RDI) and 2167kJ (25% RDI) per serve. A recent New Zealand study reported that less than 25% of menu items in fast food restaurants can be classified as ‘healthier’ options, and less than 1% of nutrition information is available at the point-of-purchase\(^7\).

National Heart Foundation research has shown that, although 60% of consumers are concerned about the healthiness of fast food, most have trouble identifying healthier choices\(^2\). To address this, since February 2012 the NSW Government has required all fast food chain outlets with twenty or more locations in NSW, or fifty or more nationally, to provide kilojoule information on menu boards. The accompanying 8700 campaign further aims to educate consumers that the average person consumes 8700kJ each day; the energy content of products at fast food outlets can then be compared and choices can be made within this context.

Labelling information on other nutrients that have been linked to chronic disease may also be needed to assist consumers to make healthier choices. Specifically, it would be useful to see the saturated fat and sodium content of fast foods made available. However, it is yet to be seen whether even the initial step in kilojoule labelling will make a difference to consumer behaviour; recent Australian evidence suggests that consumers do not purchase products marketed as ‘healthier menu options’\(^8\).

While mandatory kilojoule menu board labelling teamed with education is an important first step in the attempt to make healthier choices easier for consumers, it is essential that robust evaluation is conducted to determine the effect on both consumer knowledge and consumer purchasing behaviour. If evaluation shows that mandatory kilojoule labelling on menu boards helps change consumer purchasing behaviour in some Australian states, then it may be worthwhile extending this throughout Australia and also in New Zealand.

FIGURE 1: PROPORTIONS OF FAST FOOD CATEGORIES MEETING BENCHMARK CLASSIFICATIONS FOR SATURATED FAT AND SODIUM\(^(5)\)

Notes: ‘Sides’ includes fries, potato and gravy, onion rings and garlic bread. Classification criteria for low, medium and high were based on those from the United Kingdom Food Standards Agency\(^6\).

References
6. The George Institute, unpublished data.
The population of Australia and New Zealand is ageing, and the demand for places in residential aged care facilities (RACFs) is increasing. Currently, there are over 250,000 residents in approximately 3700 homes in Australia and New Zealand\(^1,2\). Many older people have multiple medical problems, increased nutrient requirements, special dietary needs, and poor appetites, meaning that it can be difficult to achieve adequate nutrient intake.

Studies have reported the rate of malnutrition among residents in Residential Aged Care Facilities can be as high as 50\(\%\)\(^3-5\).

It is essential that RACFs have processes for identifying residents who are at risk of malnutrition, and strategies in place to improve nutritional intake. Good menu planning is fundamental to ensuring that a nutritionally appropriate diet can be provided and can meet the needs of an increasingly frail and vulnerable population. Providing a meal service that meets residents’ nutritional requirements whilst offering food that they enjoy and is within budgetary constraints is a complex and challenging task.

RACF accreditation standards in both countries are in place and include nutrition and hydration standards\(^6,7\). However, these are very general and outcome based; standards addressing actual menu planning are limited or non-existent. Currently, in Australia and New Zealand there are no national nutrition and menu planning standards for RACFs. There are some guidelines for hospital catering and menu planning\(^8,9,10\), but few include any reference to aged care and may not be relevant for use with frail, elderly residents. Some were designed as recipe specifications for catering organisations to ensure that dishes have a minimum nutrient profile. The Australian National Health and Medical Research Council\(^11\) and the New Zealand Ministry of Health\(^12\) have both developed guidelines for the nutrition needs of the elderly, but they are primarily intended for the healthy elderly person living in the community.

In October 2011, the Dietitians Association of Australia (DAA) contracted Associate Professor Peter Williams (Fellow of DAA) to conduct a scoping project to review literature and documentation relevant to nutrition and menu planning standards in Australia and New Zealand. All known Australian and New Zealand nutrition or menu standards, guidelines or checklists were reviewed for their applicability for use in the aged care sector. Key standards from the USA and UK were also compared. Thirty-four stakeholders were consulted, including dietitians working in aged care, service providers, government, regulators and advocacy groups.

The majority (70\%) of stakeholder respondents (including all 12 dietitians interviewed) agreed that there was a need for national menu planning standards or guidelines. Only three respondents, all of whom were responsible for managing RACFs, believed that the sector is already over-regulated and that mandatory standards were not warranted. However, government representatives in both Australia and New Zealand who are involved in management or auditing of RACFs did comment that best practice guidelines with regard to menu planning would be welcome, but that an overly prescriptive approach (e.g. specific amounts of nutrients for certain meals or foods) was not helpful. All agreed that guidelines should be practical and flexible. Key recommendations from the scoping project were provided to DAA in February 2012 (see Figure 2)\(^13\).

**FIGURE 2: KEY RECOMMENDATIONS FROM THE SCOPING PROJECT: DEVELOPMENT OF NUTRITION AND MENU PLANNING STANDARDS FOR RESIDENTIAL AGED CARE FACILITIES IN AUSTRALIA AND NEW ZEALAND**\(^13\)

- Aged care specific menu planning guidelines should be developed.
- Guidelines should not be mandatory, but should provide a Best Practice approach.
- Guidelines should be simply and clearly written, practical and easily understood by non-dietitians.
- Development of guidelines should involve dietitians in Australia and New Zealand, as well as representatives of the Institute of Hospitality in Health Care, major companies providing food services to RACFs, the Aged Care Standards and Accreditation Agency, and peak bodies such as the Aged Care Associations of Australia and New Zealand.
The scoping report identified a number of tools and resources that dietitians currently use to assess the nutritional adequacy of menus. The Best Practice Food and Nutrition Manual for Aged Care Facilities (developed by dietitians at the NSW Central Coast Area Health Service) and the New Zealand Menu Audit Tool for Aged Care Facilities, developed by Dietitians New Zealand (Dietitians NZ), were identified in the scoping project as the most commonly used and useful.

In practice, dietitians, food service managers, and care staff use a combination of the available guidelines, along with their own experience and input from a variety of sources (including the resident and their families) to plan menus for RACFs.

**There are a number of challenges for RACFs in the implementation of menu planning guidelines, including financial limitations and the skills needed to translate the guidelines into practical food choices.**

The scoping report also identified possible barriers to implementing menu planning guidelines. These included industry resistance and lack of support for guidelines, the perception that guidelines will increase food costs, and that the guidelines do not address the training needs for cooks and chefs working in the RACF’s.

Dietitians have unique skills to assist facilities in menu planning to meet nutrition requirements for different populations. Dietitians in Australia and New Zealand are specifically trained in food service management and there are many dietitians who have developed expertise in this area. It is important that RACFs seek advice from dietitians with experience in the aged care setting. The DAA, in conjunction with Dietitians NZ, is well-placed to lead the development of a statement of best practice guidelines for menus and nutrition care in residential aged care facilities, to support the work of dietitians consulting in this area.

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Ms Liz Beaglehole is a New Zealand Registered Dietitian and Consultant Dietitian, Aged Care

References


**KEY POINTS**

- There are no comprehensive national aged care-specific menu planning guidelines in Australia and New Zealand.
- A scoping project has been conducted on behalf of the Dietitians Association of Australia to review literature and documentation relevant to nutrition and menu planning standards in Australia and New Zealand.
- The Dietitians Association of Australia and Dietitians New Zealand are well placed to lead the development of a statement of best practice guidelines for menus and nutrition care in residential aged care facilities.
Creating a sustainable future will require fundamental changes in attitude and behaviour across society. In November 2011, Unilever published the ‘Five Levers for Change’ (Figure 3), a behaviour change model which is used by the business to encourage sustainable changes in consumer living habits(1).

The Five Levers for Change offers a coherent approach to thinking about behaviour change and putting it into practice. The model has been used overseas to successfully change laundry, handwashing and tooth brushing behaviours(1), however it could also be applied to nutrition behaviours.

The Five Levers include:

• Make it understood – raises awareness and encourages acceptance; being aware of the behaviour and its relevance. In India, Indonesia, Pakistan and Bangladesh ultra-violet light demonstrations have shown children that germs are left behind on their hands when they wash with water alone. Hands washed again with Lifebuoy® soap were shown as germ-free under the same ultra-violet light.

• Make it easy – establishes convenience and confidence; how this fits into day-to-day life, knowing what to do and feeling confident doing it. In many parts of the world where water is scarce, laundry is washed by hand. Live demonstration events and product samples (Comfort One Rinse® fabric conditioner) have helped to show convenience in terms of saving time and water, and built confidence that the new way of rinsing (with one instead of three buckets of water) was enough to remove all residues.

• Make it desirable – is about self and society; how this fits in with aspirational self-image and relating to others. Eating lower sodium products may establish healthier nutrition practices for the whole family, thus motivating the purchaser.

• Make it rewarding – demonstrates the proof and payoff; knowing the behaviour is being done correctly and getting some reward for it. A campaign for Suave® (US hair care brand), showed families that by turning off the shower while lathering hair they could save up to $150 a year on utility bills and have a positive impact on the environment by cutting hot water use.

• Make it a habit – is about reinforcing and reminding; helping people to maintain the behaviour change. Lifebuoy® soap’s handwashing campaign reinforced children’s behaviour change through a daily sticker chart, and encouraged children to participate in activities designed to deliver the handwashing message in an engaging and memorable way (e.g. comic books, and songs).

Consumer behaviour change is a challenge, with no easy solution. Unilever has achieved some success with using this Five Levers for Change methodology(1). Sharing the model may benefit others by increasing the likelihood of positive results from behaviour change programs(1). Note: The most effective application includes all the Levers, however they do not need to be applied in sequential order(1).

Katherine Tocchini is Nutrition & Health Manager (Spreads) at Unilever Australasia. The Five Levers of Change was one of the highlights at Unilever’s Behaviour Change for Better Health Symposium held in The Netherlands in June 2012.

*This article has been completed with the assistance of the Editor.

Editor’s note: readers may be interested in accessing the youtube recording on the Five Levers for Change at http://www.youtube.com/watch?v=jEaGM8kDac4.

References
Food miles: From paddock to plate by Corey Watts

When humans started trading foods over large distances we embarked on a transformation: from ‘ecosystem people’ dependent on only what our local environment yielded, to ‘biosphere people’ sourcing much of our food from far afield. The freedom to choose a huge variety of different foods from all over the world, largely unimpeded by seasonality, comes with consequences.

Putting a meal on the table today is a process inextricably linked to fossil fuels. This age of climate change requires us to examine the sustainability of the whole food chain, with food miles an important dimension.

The term ‘food miles’ was coined by British researchers in the early 1990s, and has been the subject of debate and discussion since. In essence, it refers to the fossil energy or fuel used to shift food, from paddock to plate (and even to the tip). Most items on an ordinary supermarket shelf have travelled incredible distances. Gaballa and Abraham(1) found that ingredients in a typical Melbournian’s weekly shopping basket (excluding packaging) had travelled the equivalent of two round-the-world trips, or three times the length of the Australian coastline. The carbon pollution produced would be equivalent to that produced by almost 3,000 cars for a year.

However, there is more to the carbon footprint of food than distance travelled. Some modes of transport, like rail and shipping, are generally less carbon-intensive than aeroplanes and long-haul trucking. How food is produced can be equally, if not more, important than ‘food miles’. For example, the biggest impact from a packet of corn chips is the packaging and processing(2). Some foods simply have a bigger carbon footprint than others: red meat and dairy products, derived from ruminant animals produce methane, a potent greenhouse gas. Worldwide, emissions from livestock are increasing with escalating demand, although differences in diet, breeding and environmental conditions can result in profound differences in the impact of one beef business compared with another.

Sixty per cent of food grown in Australia is exported. Research by the World-Wide Fund for Nature shows that Australia has a higher ecological footprint than the global average and many other countries including Japan, Italy and the UK(3).

Food can make up a large proportion of our overall impact on the environment, so we – producers, hauliers, processors, retailers, consumers – can make a difference in the value chain through producing less waste and pollution. Unfortunately, there are no hard and fast rules for eating sustainability, and it certainly is not as simple as sourcing only within a hundred miles of your home. Australians today enjoy the benefits of a wonderful multicultural smorgasbord. The good news is that a healthy diet – mostly plants, mostly unprocessed, not too much – often goes hand-in-hand with sustainability. However, leadership from government and food industry is essential.

Mr Corey Watts is Regional Projects Manager at The Climate Institute, Melbourne.

References
In contrast, it has been suggested that fructose may have particularly adverse effects on total and visceral fat mass and insulin resistance[17]. However, much of the clinical research has used very high fructose loads, and similar effects may be observed with hyper-caloric high-fat or high-glucose diets, suggesting that excess energy may be the main contributor to the development of MetS[18]. The importance of fructose specifically, at dietary-relevant intakes, is currently an area of considerable debate.

Higher glycaemic index (GI)/glycaemic load (GL) diets may increase the risk of CHD[19-21], particularly in the overweight[19,20], and type 2 diabetes[22]. Lower GI/GL diets may achieve positive outcomes on health markers, however it is difficult to differentiate the effects of fibre, carbohydrate type, energy density and weight.

**EFFECTS OF FATTY ACIDS**
A discussion of the effects of different dietary fats along with CHO is warranted since a reduction in dietary CHO may result in a concomitant increase in dietary fat and vice versa. Saturated fats (SFAs) have traditionally been targeted in MetS and CVD risk reduction.

Results from a pooled analysis of eleven cohort studies have suggested that replacing SFAs with polyunsaturated fats (PUFAs) rather than monounsaturated fats (MUFAs) or CHO prevents coronary heart disease over a wide range of intakes[23].

Another meta-analysis of eight randomised controlled studies predicted that the effect of replacing SFA with PUFA resulted in 10% CHD risk reduction for each 5% energy of increased PUFA (RR = 0.90, 95% CI = 0.83–0.97)[24].

The different SFA in the diet can have varying effects on cholesterol and possible CVD risk. For example, meta-analysis data has shown that stearic acid (found in foods like meat and dairy) increases LDL and HDL cholesterol less than the other SFAs[25]. Whilst many studies focus on the effect on cholesterol to indicate CVD risk, dietary manipulation may also have effects on other important CVD risk factors. A five week randomised controlled trial replacing 8% of fats with specific fatty acids with various SFA and trans-MUFA in the diets of 50 men had differing adverse effects on fibrinogen, the inflammatory markers CRP and interleukin-6 (IL-6), and the vascular function marker E-selectin[26].

SFA and trans fats appear to promote insulin resistance whereas cis-unsaturated fatty acids increase insulin sensitivity[27,28]. Longer term research on insulin sensitivity has demonstrated improved insulin sensitivity when SFA is replaced by MUFA in healthy individuals[29], however no benefit on insulin sensitivity of a diet rich in MUFA, PUFA or ‘complex’ carbohydrates compared to SFA was found in a long-term study of 417 persons with metabolic syndrome[30]. In an acute meal based study, with three meals high in either SFA, MUFA or PUFA, replacing SFA with PUFA had a beneficial effect on postprandial insulin sensitivity, possibly through lower uptake of lipids in skeletal muscle, thereby protecting against the development of insulin resistance[31]. MUFAs has also been shown to be superior to SFA in buffering 8 cell hyperactivity and insulin intolerance post-prandially, in persons with high fasting triglyceride concentrations[32].

**CONCLUSION**
Studies examining the effect of dietary CHO and fat on MetS and CVD are complex and must be seen in the context of a total eating pattern. Issues of dietary compliance and the dominance of energy deficit impact the interpretation of study results. Current evidence indicates that diets rich in plant foods that include PUFAs fats at the expense of SFA may beneficially affect components of MetS and CVD.

**References**


