

# Reviewing high oleic vegetable oil substitutions

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*The role of edible fats and oils in health and disease continues to evolve as further knowledge is gained about the relation between dietary fats and fatty acids (FAs) and chronic diseases, particularly coronary heart disease (CHD). For instance, in response to early public health recommendations to move away from animal fats and tropical oils to reduce CHD risk, the food industry adopted the use of partially hydrogenated vegetable oils (PHVOs) to achieve the same functional characteristics provided by animal fats in food products.*

PHVOs and the trans-FA (TFA) components produced by partial hydrogenation of liquid vegetable oils appeared to be a suitable alternative because of their ability to replace animal fats high in saturated fat while providing adequate functionality for a wide range of product applications, increased flavour stability and shelf life, resistance to oxidation, lower cost, and consistent availability.

However, based on evidence from numerous clinical and prospective cohort studies it is now recognised that the consumption of TFAs, in amounts achievable in Western diets, adversely affects CHD risk factors and is associated with a higher risk of CHD.

## Dietary guidelines

Current United States (US) government dietary guidelines recommend keeping TFA consumption as low as possible by limiting the intake of foods that contain TFAs and by limiting other solid fats. In addition, since 2006, food manufacturers are required to state the quantity of TFAs per serving on the nutrition facts panel of all packaged food labels. As a result, many food products were reformulated to contain lower amounts of TFAs and have led to substantial reductions in TFA intake.

Many ingredient alternatives are available to replace PHVOs in oil-based food products. In general, most edible fats and oils are used in three areas of food product applications: salad and cooking oils, solid fats (e.g. margarines and shortenings), and frying oils. Salad

and cooking oils is the largest category, accounting for 65% of the total fats and oils consumed in the US.

The need for TFA alternatives in this category is low, because most of these products contain little or no TFAs and typically include oils rich in polyunsaturated fatty acids (PUFAs) and monounsaturated fatty acids (MUFAs) such as soya bean oil (SBO), maize oil, canola oil, and others.

In contrast, solid-fat products that contain PHVOs such as margarines and shortenings present greater product challenges. These include management of functional properties such as melting point, lubricity, moisture barrier, and creaming ability to produce a product low in TFAs with parity performance to its PHVO counterpart.



### Fats and oils in food preparation

To minimise TFAs while meeting functional and stability requirements many of the current approaches have typically used oil blends that contain small proportions of saturated fats high in palmitic acid (e.g. palm and palm fractions) and a high proportion of high oleic acid (HO) oils or oils moderately high in linoleic acid (LA) and alpha-linolenic acid (ALA).

Frying fats and shortenings used in restaurants for preparing deep-fried foods and for commercial frying of packaged foods such as snacking chips, represent a large source of PHVOs and are known to contain relatively high amounts of TFAs.

Alternative oils with increased amounts of oleic acid (50–65%), decreased amounts of LA (20–30%), and low amounts of ALA (<3%) have proven effective replacements for PHVOs. This is because they can withstand the high temperatures of commercial frying, provide relatively long fry-life, and are resistant to producing off flavours because of thermal deterioration and oxidative processes.

The replacement of PHVO frying fats with alternative oils was examined in a FA-analysis of 327 fast-food items by Health Canada, which suggested that products achieving a goal of  $\leq 5\%$  TFAs was accomplished by using predominantly HO vegetable oils. Examples of these oils (>70% oleic acid) include olive oil, HO sunflower oil, HO safflower oil, and newer trait-enhanced oils such as HO canola oil, and HO soya bean oil (H-OSBO).

### Traditional use of soya bean oil

SBO is the most consumed edible oil in the US because of its availability, cost, and versatility in food product applications. In 2004, of the 12,3 billion kg of edible oils used in the US, SBO accounted for 7,9 billion kg (67%). SBO is high in LA and ALA.

Therefore, for use in baking and frying, shortenings in which high heat stability is required, SBO was traditionally partially hydrogenated to produce stable solid or semisolid fats. In 2006, an estimated 41% of the total SBO used in edible products was partially hydrogenated. This accounted for nearly 82% of the 3,45 billion kg of baking and frying shortenings produced in

the US, and considerable amounts used in production of margarines – particularly the hard-stick variety.

Yet, because of US and Canadian regulatory requirements for mandatory labelling of trans fats on packaged foods and mounting consumer concerns about the health effects of TFAs, the food industry has been reducing or eliminating TFAs in its products.

### Move to high oleic oil

Between 2007 and 2011, 66% of identified brand-name products in US supermarkets that contained  $\geq 0,5\text{g}$  TFAs per serving had reduced its content to  $< 0,5\text{ g}$  per serving. Although SBO continues to be the dominant edible oil in the US market, in 2011–2012 it accounted for 50% of the disappearance of all edible fats and oils used, down from 65% a decade earlier.

The market trend away from SBO and SBO-derived hydrogenated ingredients has made development and expanded production of H-OSBO a compelling alternative because of its high heat and oxidative stability for use in both high temperature and ambient temperature food applications, and because of potential cost advantages due to the economy of scale of US soya bean production.

Because H-OSBO requires no hydrogenation to be used in many processed food applications, including deep frying and baking, its use in processed food products provides opportunities for consumers to reduce their intake of TFAs. Large-scale substitution of SBO with H-OSBO could affect the intake of other FAs, including the essential FA and ALA.

The ALA content of H-OSBO is 2,5–3,0% compared to 7% for SBO. However, SBO is hydrogenated for use in many food applications which reduces its ALA content. Therefore, the FA content of foods produced from H-OSBO and partially hydrogenated SBO (PHSBO) will differ primarily in the amounts of TFAs and not ALA content.

### Dietary effect impact studies

In a study that estimated the impact of substituting low ALA-SBO, a SBO variety that contains only 2,4% ALA, for PHSBO

in several food categories, dietary TFA intake was reduced by 45%, whereas no reduction was found in ALA intake. Because the levels of ALA in low ALA-SBO and H-OSBO are similar, the dietary effect of substituting H-OSBO for PHSBO on ALA intake would be expected to be similar to that estimated for low ALA-SBO.

In the only randomised controlled trial, to our knowledge, that compared the effects on blood lipids of a diet high in H-OSBO with a diet with an isocaloric amount of SBO (high PUFAs), no substantial differences were observed in any of the lipid biomarkers, suggesting that MUFAs and PUFAs are interchangeable for their effects on blood lipids.

Both diets were effective in substantially lowering LDL cholesterol, apolipoprotein B, and the ratio of total cholesterol (TC) to HDL cholesterol compared with a diet that contained TFAs from PHSBO.

Previous reviews that assessed the clinical evidence on the effects of MUFAs on traditional cardiovascular disease risk factors concluded that the MUFA class of FAs favourably affects plasma lipids and lipoproteins when substituting for SFAs or carbohydrate-containing diets.

In a meta-analysis of 13 RCTs that estimated the change in CHD risk when TFA-containing diets are substituted with unsaturated FA containing vegetable oils, replacing 7,5% of energy from PHVOs with an equivalent amount of HO- or PUFA-containing vegetable oils resulted in risk reductions of 9,2% and 8,8%, respectively.

### Clarity is still needed

Although these studies indicate that replacing saturated fats or PHVOs with high MUFA-containing vegetable oils has a favourable effect on CHD risk, there is a need for additional clarity. Given the predicted increased presence of H-OSBO in the US diet, there is a need to understand the quantitative and qualitative impact of HO oils on CVD risk compared with other fats and oils in the diet. ●

The complete research piece can be read in *Advances in Nutrition: An International Review Journal*. Visit [www.advances.nutrition.org](http://www.advances.nutrition.org) for more information.