

# Choose right carbohydrates and right fats (RCRF) - keys to optimal health

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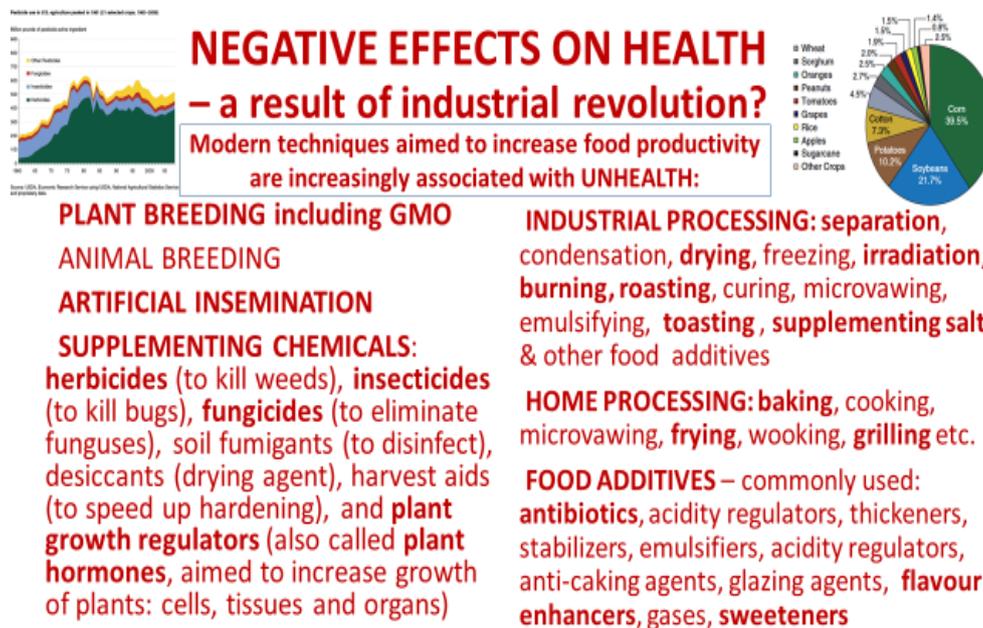
## Industrial processes destroys health-promoting foods

These are my reflections after reading article from Dehghan *et al.* (1). It is increasing well documented that it is Industrial processing: fractionation, separation, condensation, drying, freezing, irradiation, burning, roasting, curing, microwaving, emulsifying, toasting, supplementing food additives but also plant breeding etc. which significantly destroys the nutritional and health-promoting effects of plant foods (*Figure 1*). Foods which have undergone such processes have to large extent lost their nutritional and health-promoting abilities. Such foods are for example Often - unacceptably - rich in calories particularly sugar and sugar-like foods (bread, pasta, pizza, cooked tubers, polished rice etc.) but also, which is often neglected, rich in long-chain triglycerides (LCT) contributed by meat, dairy products but also in increasing amounts of edible/“cooking” oils.

It is also well documented that processed refined carbohydrate products such as sugar and other sugar-like foods are quickly absorbed by the small intestine, and transported by the portal vein to the liver, where they are fast metabolized. Larger consumption of such molecules create a much increased burden to all internal organs, often referred to as postprandial inflammation, a state regularly lasting about 2–3 hours after each meal.

## Raw plant foods - not fats - should be alternative to refined carbohydrates

The scientific world seems often to take for granted that the only available replacement for sugar-rich foods is increased intake of fats especially so called saturated fats - an opinion that I have great difficulties to accept (2,3). The same group of authors choose in another recent study (4) to instead replace refined carbohydrates with to a large extent raw fruits, vegetables, and legumes and found that it significantly reduced major cardiovascular diseases, myocardial infarction, cardiovascular mortality, non-cardiovascular mortality, and total mortality. Fruit intake was associated with lower risk of cardiovascular, non-cardiovascular, and total mortality, and legume intake with reduced non-cardiovascular death and reduced total mortality. Of special interest is their observation that raw vegetable intake was associated with strong effects on health parameters and associated with a very lower risk, much in contrast to intake of vegetables, which after cooking demonstrated much more modest health benefits. Another study, published already in 2007 (5) compared health parameters of raw food eaters and with those of Standard Western (American) food eaters and reported dramatic differences in various health parameters [systolic blood pressure 124 *vs.* 132, diastolic blood pressure 62 *vs.* 79, fasting glucose 85 *vs.* 95, fasting insulin 2.8 *vs.* 5.9, Homa-IR 0.59 *vs.* 1.36, CRP 0.52 *vs.* 2.61 and carotid



**Figure 1** Summary of factors often associated with negative effects on health. The two illustrations in the upper corners are from United States Department of Agriculture - USDA: Economic Research Service using USDA Agricultural Statistic Service and proprietary data.

intima-media thickness (*IMT*) 0.56 vs. 0.74] (*Figure 2*).

### Long-chain fatty acids induces endotoxemia and postprandial inflammation

The body has no possibility to take up long-chain fatty acids directly through the portal vein in order to quickly metabolize these fats. This pathway is restricted to fatty acids with chain length shorter than twelve carbon atoms (3). Long-chained fatty acids, which to about 80% consist in animal fat need to be transported through the thoracic duct. Most of these will remain in the general circulation during 2–3 hours and will be exposed to the endothelium of all blood vessels the body including the carotids and the brain vessels. Such exposure induces short-term inflammation - postprandial inflammation and long-term intimal calcifications constitution strong risk factors for heart disease but also other chronic diseases including Alzheimer's and type 2 diabetes.

Among the negative consequences associated with elevated postprandial glucose and insulin are:

- (I) Increased content of endotoxin in blood (said to be equivalent to smoking three cigarettes) (3,4);
- (II) Cascades of inflammatory and oxidative stress (5);
- (III) Release of tumour necrosis factor- $\alpha$ , a key

proinflammatory cytokine (4);

(IV) Increased numbers of activated leukocytes (6);

(V) Increased inflammatory reaction, significantly potentiated by simultaneous intake of sugar (5) (*Figure 3*).

### Medium-chain fatty acids inhibits postprandial inflammation

Medium-chain triglycerides, or MCTs, are saturated fats containing 8 to 12 carbons. The three MCTs - capric acid, caprylic acid and lauric acid - are naturally found in a variety of animal and vegetable fats, but, regrettably, few sources contain significant amounts. Coconut oil and palm kernel oil are the top sources of MCTs. Both have about 11 grams of saturated fat in 1 tablespoon of oil. Out of the total saturated fat, you will get 7.4 grams of MCTs from a tablespoon of palm kernel oil and 7.9 grams from coconut oil. MCTs are known to possess several important health effects - including general anti-inflammatory abilities. It is important to know that MCTs are very low in energy and quickly metabolized in the body - leaving no residuals. These properties have made MCT favorite tools in control of weight - particularly controlling abdominal obesity. A recent prospective double-blind randomized dietary

## ADVANTAGES OF RAW FOOD VEGAN DIET

Fontana L et al. *Rejuvenation Res.* 2007;10:225-234

Consuming a low-calorie low-protein vegan diet, composed of unprocessed and uncooked plant derived foods



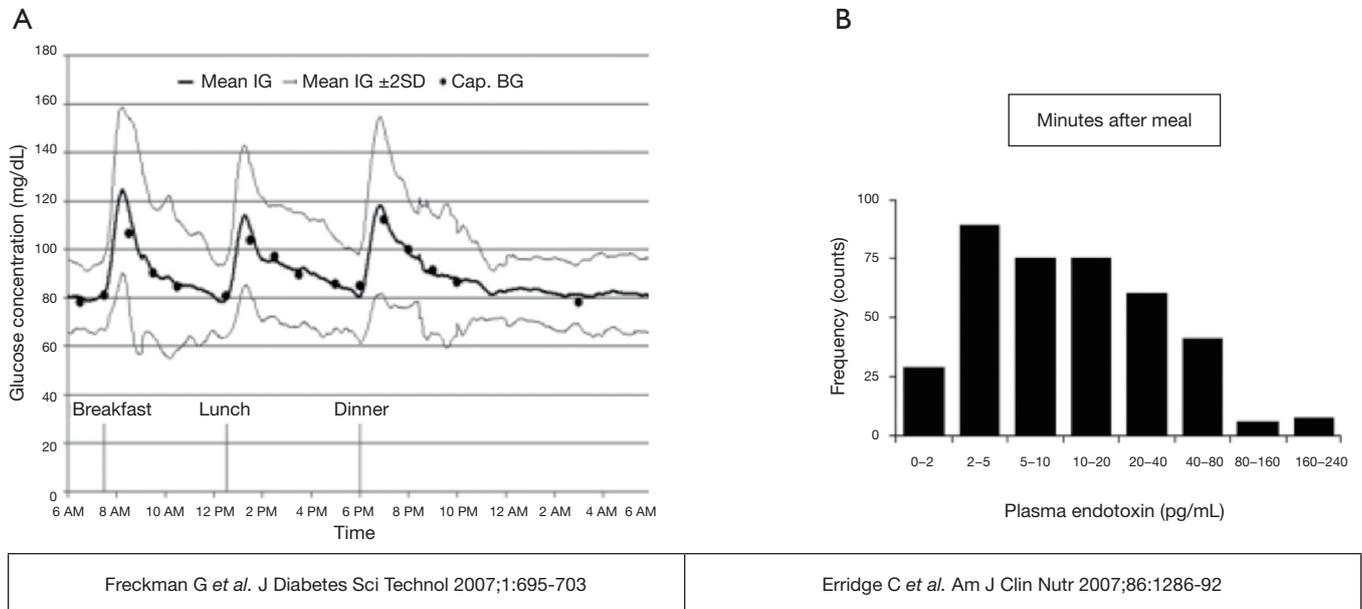
Recruited from The St. Louis Vegetarian Society and a Raw Food online magazine (*Raw Food News*, [www.rawfoods.newsmagazine.com](http://www.rawfoods.newsmagazine.com)).

	Low-calorie low-protein vegan diet group (n = 21)	Endurance runner group (n = 21)	Western diet group (n = 21)	p value
SBP (mm Hg)	104 ± 15 <sup>a,c</sup>	122 ± 13	132 ± 14	0.0001
DBP (mm Hg)	62 ± 11 <sup>b,c</sup>	72 ± 9 <sup>f</sup>	79 ± 8	0.0001
Fasting glucose (mg/dL)	85 ± 7 <sup>c</sup>	88 ± 6 <sup>f</sup>	95 ± 6	0.0001
Fasting insulin (μU/mL)*	2.8 ± 2 <sup>b</sup>	2.1 ± 2 <sup>d</sup>	5.9 ± 4	0.0001
HOMA-IR	0.59 ± 0.43 <sup>c</sup>	0.45 ± 0.38 <sup>d</sup>	1.36 ± 0.83	0.0001
hsCRP (mg/L)*	0.52 ± 0.6 <sup>e</sup>	0.75 ± 0.9 <sup>e</sup>	2.61 ± 3.3	0.003
Carotid artery IMT (mm)	0.56 ± 0.1 <sup>c</sup>	0.63 ± 0.1 <sup>e</sup>	0.74 ± 0.1	0.0001

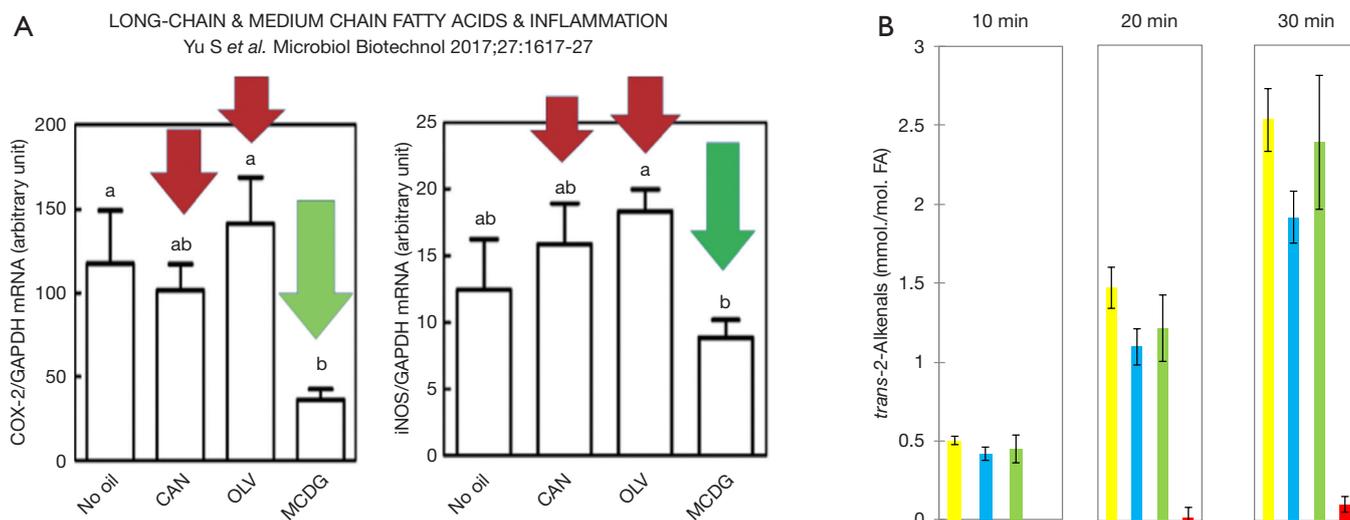
SBP=Systolic blood pressure, DBP=Diastolic blood pressure, HOMO-IR=homeostatic model assessment - a method used to quantify insulin resistance and beta-cell function, hsCRP=high sensitive c-reactive protein - indicator of inflammation

**Figure 2** Advantages on raw food vegan diet (5). Reprinted with permission from *Rejuvenation Research* Volume 10, Issue 2, 2006, rej.2006.0529, published by Mary Ann Liebert, Inc., New Rochelle, NY.

### POSTPRANDIAL INFLAMMATION - ASSOCIATION TO SUGAR & FAT INTAKE



**Figure 3** Postprandial inflammation associated with intake of three meals a day (7) and the height and length of the associated endotoxemia (8).



**Figure 4** Comparison of inflammation inducing effects of raw (A) (15) and heated (B) medium- and long-chained fatty acids. (B) Mean  $\pm$  SEM concentrations of toxic aldehydic lipid oxidation products [mmol./mol. fatty acid (FA)] generated in culinary oils when heated according to laboratory-simulated shallow frying episodes at 180 °C: trans-2-alkenals. Different letters indicate significant differences between groups within the panel ( $P < 0.05$ ). Colour codes: sunflower oil (yellow); corn oil (blue); extra virgin olive oil (green); coconut oil (red).

intervention study (9) reports that MCT-rich diet alters the plasma lipidome and seems to benefit cardiac function and fasting insulin levels in humans with type 2 diabetes - effects not obtained by long-chain fatty acids - LCT. Diets rich in MCTs, but not in LCTs, decrease several plasma sphingolipids, ceramide, and acylcarnitines, which are implicated in diabetic cardiomyopathy, and decreases in these sphingolipids correlate well with improved fasting insulins (10,11).

Coconut and palm oils which were the major sources of dietary fats for centuries in most of African, Asian, and South American countries and remain so in rural areas while it to large extent have been replaced by edible oils such as olive oil, canola oil and sunflower oil, particularly in North America and Europe. As MCTs are all saturated, they were, without any support of studies branded as unhealthy highly saturated fats and it is only in recent years that the MCTs are receiving its recognition for all its health-promoting properties.

The 18 countries and five continents study is focusing on food consumed mainly in rural areas to a large extent in Asia and South America. It is unfortunate that the study do not report which fats are dominating in the foods eaten in the various rural areas of the countries studies - and also that the pattern of fatty acids have been analysed in this study. Intake of fat and amounts type of fats consumed varies to a large extent between countries and continents.

It is regrettable that the food habits are not reported in an important study like this. I have been in contact with one the authors who informs that this is planned to be the next step in this series of most interesting studies.

### Western diet rich in cytotoxic and genotoxic lipid oxidation products (LOPs)

A very high percentage of humans continuously consume cytotoxic and genotoxic LOPs present in fried foods available in Western diets, and the possibility that the regular ingestion of such toxins may contribute to chronic, non-communicable human diseases has recently attracted a considerable level of public health research interest (12,13). Notably, polyunsaturated fatty acids (PUFAs) present in edible oils oxidatively degrade when exposed to high temperature frying practices, and generate very high levels of such health-threatening LOPs: PUFAs are much more readily peroxidised at standard frying temperatures than monounsaturated fatty acids (MUFAs), whereas saturated fatty acids (SFAs) are very highly resistant to this process (14) (Figure 4).

A recent study supports observations that long-chain fatty acids - not only those in cow och pig fat - but also those in various edible oils, increasing consumed particularly in the Western world have, compared to medium-chain fatty acids strong ability to induce inflammation and disease (15) and

especially so when heated up.

Biology is more complex than often assumed. It is said to exist about 250,000 different fats in Nature. Much support that almost all have different biology and create different reactions when exposed the human body. It is time to stop “lumping together” them in studies. This is extremely necessary in future research if progress shall be made.

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### Footnote

*Conflicts of Interest:* The author has no conflicts of interest to declare.

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