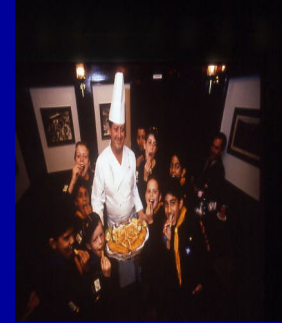


Developments in Oils for Commercial Frying

By

J. Barry Rossell

Outline



- **Oil in Foods**
- **Objectives in developing new frying oils**
- **Problems in developing new frying oils**
- **Oils reviewed**
 - HOSUN
 - NuSun
 - Goodfry
 - Palm Olein
 - Natreon
- **Conclusions**

Oil Absorption



	% Absorption
Frozen Chips	5
Fresh Chips	10
Battered Food (e.g. fish)	15
Battered and Breaded Food	15-20
Potato crisps	35-40
Doughnuts	15-20

The oil you fry becomes part of the food you fry

Objectives



OILS MUST:

- Perform Well During Frying
- Give Good Fried Flavour development
- Be Resistance to Oxidation
 - Flavour Stability During Production and Storage
- Have Acceptable Overall Cost
- Have Good Nutritional Image
 - Low Sat and Trans acids
- Be None GMO

There are, as we know, some good guys in the fat camp: the omega-3s, found in oily fish, that help our brains, and the omega-6 fats in nuts and seeds that are crucial for a healthy complexion. And, of course, there are the polyunsaturated fats in sunflower oil that help to lower cholesterol. The villain has traditionally been saturated fat, found in products such as sausages, pastry, cream and cheese, as too much clogs the arteries and triggers heart disease. But suddenly, there is a new bad fat on the block, which is making saturated fat look almost saintly.

Called trans fat, it occurs naturally in minuscule amounts in dairy foods. However, there is nothing natural about the 3g of these fats that we swallow every day. It is not the cappuccino culture that is causing us to overdose on milk-based trans fats: these supply just 0.5g a day. In fact, the majority of trans fats that we consume come from a man-made source. That source is the margarine-style fats that are widely used in food production.

Here's why. To make butter, milk is churned. Nothing is added, except a little salt. To make margarine, however, food manufacturers must pump hydrogen through vegetable oil to change it from a liquid to a solid at room temperature. It is during this process that trans fats are created.

So what is the big problem with trans fats? Scientific studies have shown that, while saturated fats do their potential damage by raising the levels of LDL cholesterol (which sticks to artery walls and restricts blood flow), trans fats not only do this, but can also lower levels of HDL cholesterol, which protects us from heart disease. Even the Food Standards Agency (FSA), normally pretty conservative when it comes to offering firm nutritional advice, has announced that the evidence suggests that the effects of trans fats are worse than saturated ones. And this raises the none-too-delicious irony that, while we slapped that dreadful axle grease called margarine on our toast, thinking it was good for our heart, it was actually doing more harm to our blood vessels than butter.

Aware of the growing controversy, many of the big boys in the soft-spread sector have been cleaning up their margarine to take out the bad trans fats. The problem now is that we are consuming them by stealth, since the cheap margarines used in food manufacturing are still packed with trans fats. They crop up in the most unlikely places: in Twiglets, for example, the lower-fat snack that is often selected as an alternative to more calorific munchies such as nuts. Yes, nuts have more calories, but at least they have good omega-3 and 6 fats and are trans-fat-free.

Then there are Nutri-Grain and Fruit 'n' Fibre bars, which, judging from their on-pack images and blurb, cannot fail to convey a "healthy" feel to shoppers. And yet they, too, contain trans fats. Not that it says so in the ingredient list. You have to look instead for the words "hydrogenated" or "partially hydrogenated vegetable oils". Next time you are whizzing around your local supermarket, take a cursory glance at the ingredient lists on your food and you might be surprised at what you find. If you would rather be spoon-fed, then take it from me: most biscuits and cakes are packed with the stuff, from Digestives and Rich Tea to cream crackers, sponge puddings and even reduced-fat cakes.

You seem only to be safe on the biscuit front with those produced by our heir to the throne. HRH's Duchy Original biscuits are trans-fat-free, because he insists on using butter in the recipes. Other organic brands, such as Seeds of Change, make cereal bars that are also free of trans fats, as are Village Bakery and Nairn's outcakes, which actually flash up on the pack their "no hydrogenated fat" credentials. In other sectors of the supermarket, you will find trans fats in more unexpected places. They are in Linda McCartney's sausages, for example, but, oddly enough, not in Mr Brain's Pork Faggots.

So what are we supposed to do? The bottom line, according to the FSA, is that we should cut back on foods that contain trans fats. Sound advice, but, frankly, wishy-washy compared to the American Institute of Medicine, a government advisory body that says that only a zero-tolerance policy is good enough. In other words, cut them out completely. The American government has responded by announcing that, by January 2006, food and drink will by law have to flag up on packaging the amount of trans fats they contain, so shoppers will be able to avoid them.

These are interesting steps, but removing trans fats from your diet means thinking twice before you tuck into lots of processed foods. It means searching out the word "hydrogenated" on all packaging, and seriously questioning the wisdom of ploughing your way through a takeaway, the trans-fat composition of which you have not the faintest notion. These are steps that scientists such as Dr Walter Willett, a professor at the Harvard School of Public Health, would applaud, and not just for the health of our hearts. He believes that trans fats make our arteries more rigid, and links them to the development of age-onset diabetes.

Those working in the area of the brain would also give three hearty cheers to anyone able to rid their diet of these pernicious fats, since experts fear that an onslaught also damages the health of this vital organ. While good fats, like omega-3s, help to send messages between the junctions of nerve cells in the brain, trans fats seem to get into these junctions and, once there, block nerve transmissions. They are squatting in brain cells, in effect, and disrupting the normal messaging services. Some scientists link this to the increased problems that we are seeing with dyslexia and hyperactivity in children.

My advice? Use the brain cells that you do have left and start making some smart choices on the fat front. There are plenty of naturally low- and trans-fat-free foods around: lean meat, fish, chicken, fresh vegetables and fruit, and 100% whole-grain breakfast cereals, such as muesli and Shredded Wheat. And, of course, those royal biscuits, should you fancy a treat. ■

"TRANS FATS ARE SQUATTING IN BRAIN CELLS, DISRUPTING THE NORMAL MESSAGING SERVICES"

says **Amanda Ursell**

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Sunday Times – 21st December 2003... "by Jan. 2006 food and drink will by [USA] law have to flag up ... the amount of trans fats so that shoppers can avoid them"

Problems



- **Foam Formation**
- **Viscosity Increase**
 - Increases oil pick-up, and thus cost
- **Colour Darkening**
- **Flavour Deterioration**
- **Oxidation**
 - Metals in food, esp. 16.5 mg/Kg Iron in breadcrumbs
- **Minimise Waste Oil Discard**

Metals in Oil



Concentration of metal which reduces shelf life to 50% (Swern, 1982)

Copper	0.5 mg/kg (but 0.02 mg/kg Cu is limit for preservation of margarine flavour (Swern 1982))
Iron	0.6
Manganese	0.6
Chromium	1.2
Nickel	2.2
Vanadium	3.0
Zinc	19.6
Aluminium	50.0

Oils based on Sunflower



HOSUN



	Regular Sunflower	Hydrog. Sun Oil	High Oleic (HOSUN)
Iodine Value	110-143	Ca. 110	78-89
Slip M.Pt. °C	-18 to -16	25 Max	Liquid
C16	5-8	7	3-4
C18:0	3-6.5	6	3-6
C18:1	14-40	76	77-91
C18:2	50-57	10	2-12
<i>trans</i>	< 4.0	Ca.20	< 4.0

Evaluations



- **Regular Sunflowerseed Oil**
 - low resistance to oxidation,
 - flavour deterioration
 - Free from *trans* & GMO
- **Hydrog. Sunflowerseed Oil**
 - no longer has good nutritional image (High *Trans*)
- **HOSUN**
 - Better resistance to oxidation,
 - Free from both *trans* & GMO
 - Fair nutritional image, but **zero** C18:3 (important for retina)
 - Does **not** give good Fried Food Flavour

NuSun



	Regular Sunflower	High Oleic (HOSUN)	Mid Oleic NuSun
Iodine Value	110-143	78-89	Ca. 100
Slip M.Pt. °C	-18 to -16	Liquid	Liquid
C16	6-7	3-4	}
C18:0	3-6.5	3-6	} Ca. 8
C18:1	14-40	77-91	Ca. 65
C18:2	50-57	2-12	Ca. 25
<i>trans</i>	< 4.0	< 4.0	Trace

NuSun Evaluation



- **Better Resistance to oxidation than Regular Sun Oil**
- **Free from both *Trans*, and GMO**
- **Better Fried Food Flavour than HOSUN**
- **Developed 25% polar material after 30 hours frying**
- **Zero C18:3 gives no nutritional benefit to nervous system or retina**

Goodfry



HOSUN + sesame and rice bran oils

Iodine Value	86
Slip M.Pt. °C	Liquid
C16	4.5
C18:0	4
C18:1	79
C18:2	12
<i>Trans</i>	<4

Goodfry Evaluation



- Sesame and Rice bran oils add sufficient C18:2 for fried flavour development
- Natural antioxidants from Sesame and Rice bran oils stabilise blend
- High price of HOSUN is not reduced by cost of specially processed additives
- Poor availability of low acidity Rice bran
- Trivial amount (<0.1%) of C18:3 gives no nutritional benefit to nervous system or retina
- Free from both *trans* and GMO
- Death of inventor has inhibited further development

PALM BASED OILS

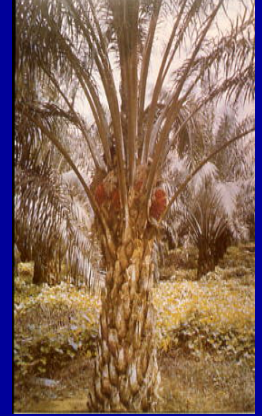


Palm Oleins



	Palm Oil	P.Olein	P.Super Olein
Iodine Value	50 - 55	56 - 60	60.1- 67.5
Slip M.Pt. °C	33 - 40	19 - 24	13 - 17
C16	43 - 46	37 - 43	30 - 37
C18:0	4 - 5.5	4 - 5	3 - 4
C18:1	37 - 41	40 - 45	43 - 50
C18:2	9 - 12	10 - 13	11 - 15
Trans	<4	<4	<4

Palm Olein Evaluation



- Very good frying performance
- Better fluidity than whole oil - still sets up
- Lower Sat Acid than whole oil – but still high
- Colour darkening can be a problem
- Double fractionation gives a low yield
- 0.2-0.6% C18:3 beneficial to retina
- Free from both *trans* and GMO

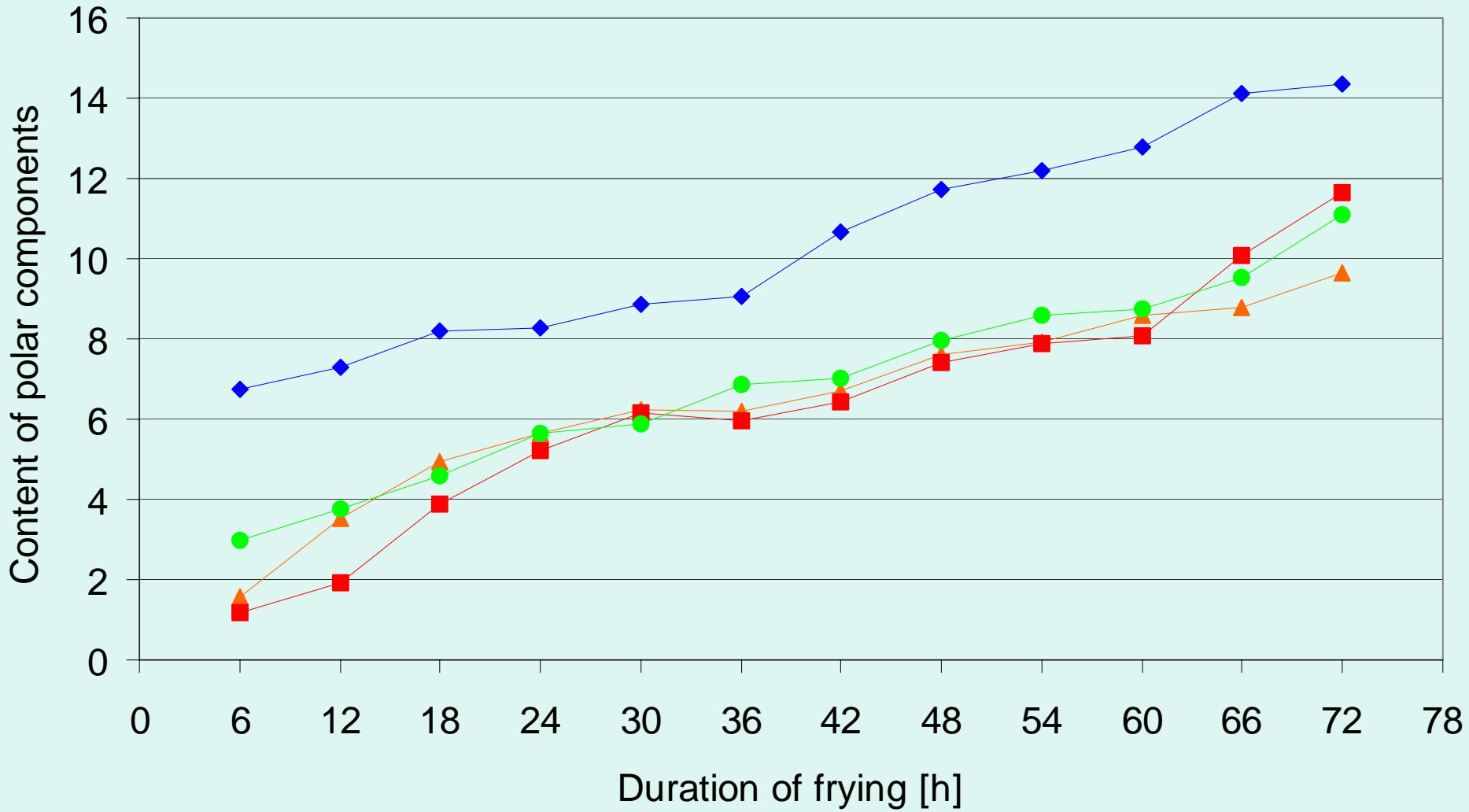


Rape based oils



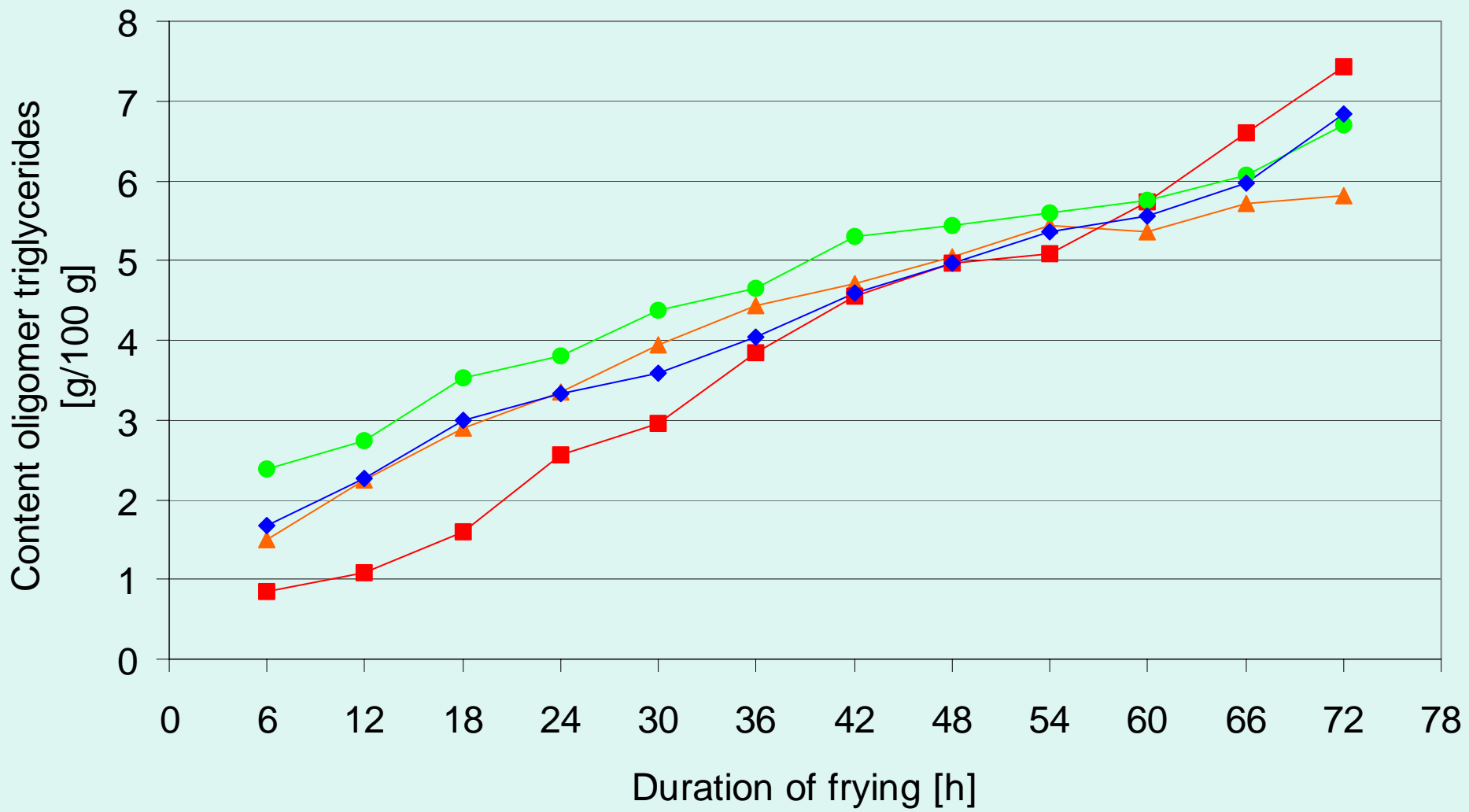
	Regular Rape	Hydrog. Rape	Natreon
Iodine Value	110-126	86	95.8
Slip M.Pt. °C	-20	25 max	Liquid
Sats	4-9	7.5	5
C18:1	52-65	81	73
C18:2	17-25	9	15
C18:3	6-14	2 max	3
Trans	<4	Ca. 20	<5

▲ Natreon ■ partially hydrogenated rapeseed oil ● HO-sunflower oil ◆ Palmolein



Polar components during frying at 175

▲ Natreon ■ partially hydrogenated rapeseed oil ● HO-sunflower oil ◆ Palmolein



Development of Oligomers during frying at 175C

Rape Oils Evaluation



- Regular Rape - 6-14% C18:3 – unstable
- Hydrog. Rape - Ca. 20% *Trans-unacceptable*
- Natreon
 - *Lower IV*
 - *Very low trans and low Sat acid contents*
 - *High Oleic acid content*
 - *Best ratio of C18:2/C18:3 viz. in recommended range 4:1 to 10:1*
 - *Sufficient C18:2 for Fried Food Flavour*
 - *Free from GMO*
 - *Low increase of Polar Components during frying*
 - *Low increase in Oligomers during frying*
 - *Can be grown in temperate zones e.g. Europe*

Conclusions



- **NuSun, Goodfry and Natreon appear superior to other oils due to:**
 - Dietary image (low sat, low *trans*)
 - Freedom from GMO's
 - Good frying performance
- **Natreon also has**
 - Lower viscosity increase
 - Best ratio of C18:2/C18:3
 - Less prone to colour darkening
 - Can be grown in temperate zones

Fish Fryer of the Year

