17 June 2021
MPOC-UKM Seminar 2021

NUTRITIONAL ATTRIBUTES AND FOOD USES OF PALM OIL

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Nutrition Unit
Malaysian Palm Oil Board

Outline

- Introduction
- Current Facts on Saturated Fats
- Current Facts on Trans Fats
- Updates on the Nutritional Properties of Palm Oil
- Food Uses of Palm Oil

Growing World Demand for Oils & Fats

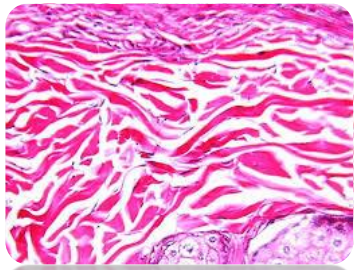
- Growing population 7 billion to ~ 8 billion (2020)
- Increasing per capita consumption 25 kg to 30 kg
- Increasing demand for oils and fats
- Growth in demand for oils and fats – by ~ 2 million each year

Functional Roles of Oils and Fats

- **Enhances palatability and satiety of foods**
- **Acts as a cooking medium**
- **Assists in determining the consistency, texture, mouthfeel**

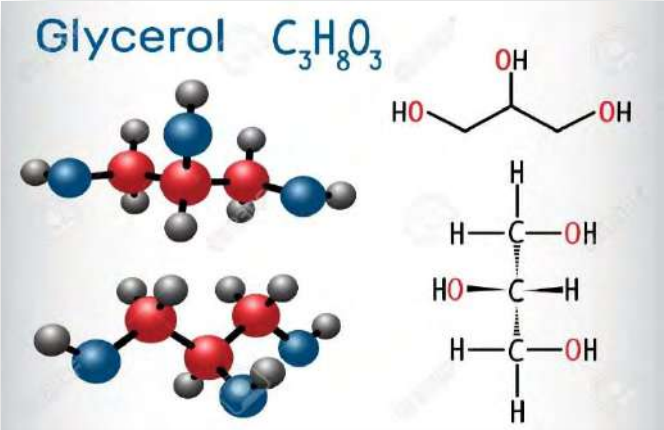
Physiological Roles of Oils and Fats

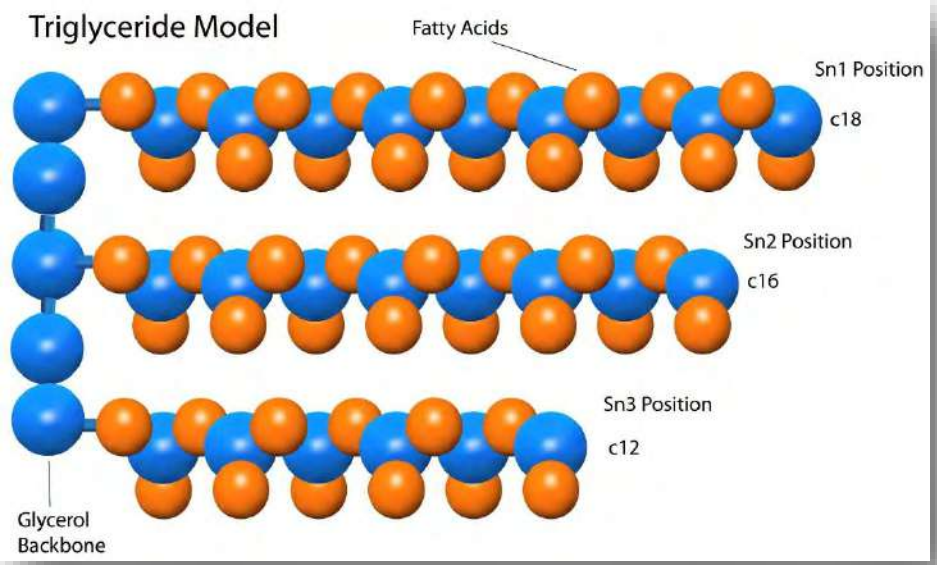
- Macronutrient concentrated source of energy
- Source of essential fatty acids (EFA)
- Carrier for the A,D,E,K vitamins
- Essential for healthy skin and tissues
- Functioning of nerve cells and brain
- Functioning of steroid hormones (to regulate body processes)



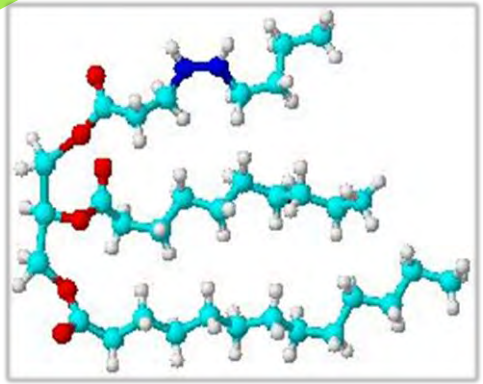
Fats and Oils

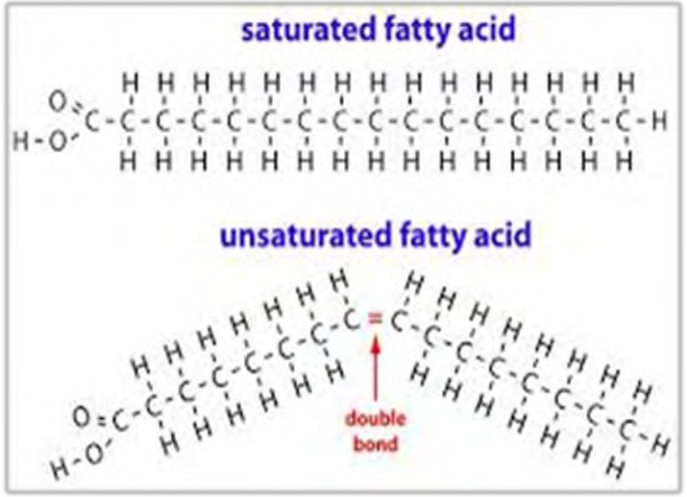
- **Mainly made up of triglycerides**
- **Fatty acids esterified to a glycerol backbone**
- **Fatty acids differ in structure (chain length and bonding)**





Fatty Acids





Saturated fatty acids (SFAs)

No double bonds between the individual carbon atoms of the fatty acid chain

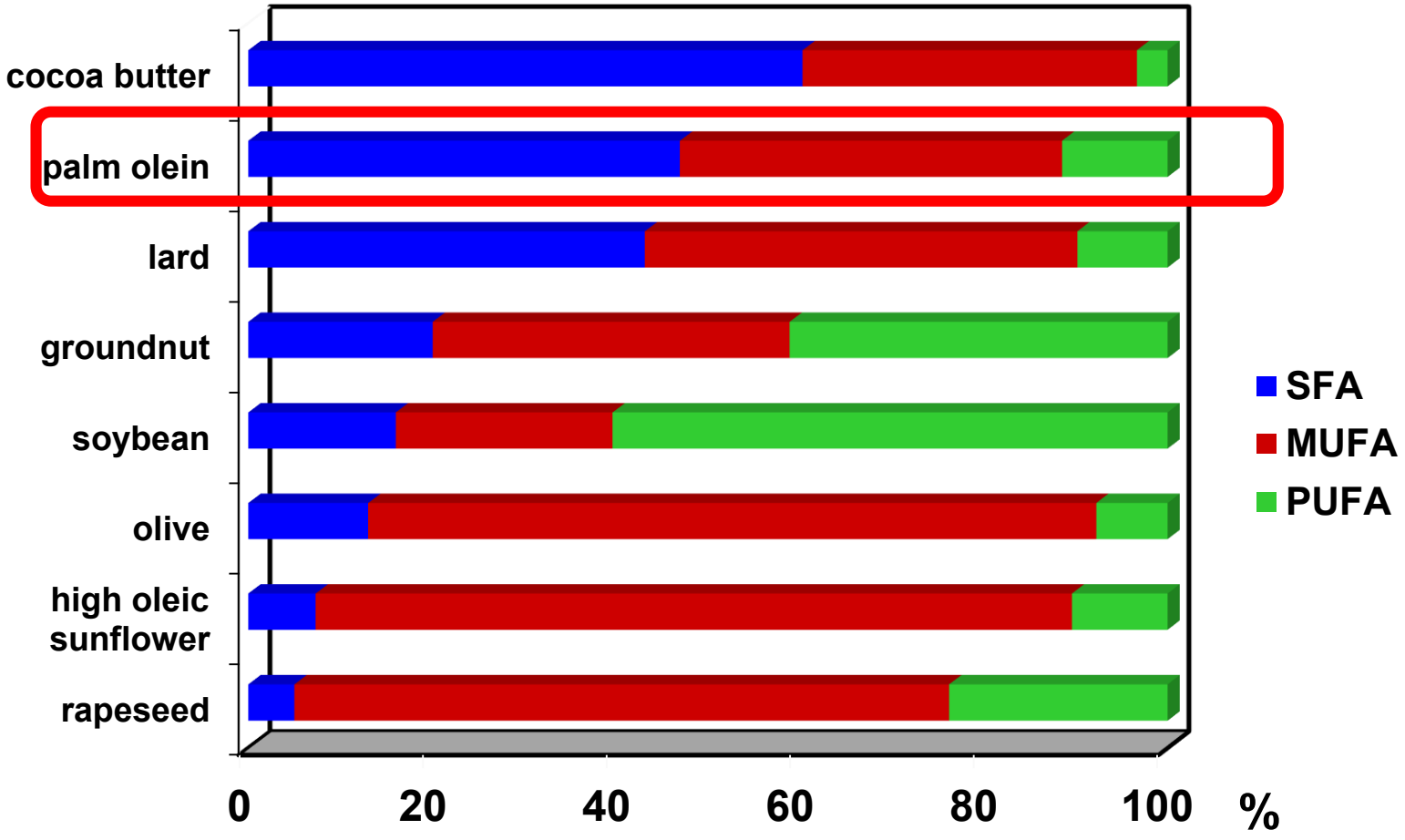
Monounsaturated fatty acids (MUFAs)

One double bond in the fatty acid chain and all of the remainder of the carbon atoms in the chain are single-bonded

Polyunsaturated fatty acids (PUFAs)

Contain more than one double bond in their carbon chain

TOTAL FATTY ACID COMPOSITION OF OILS & FATS



Current Views on Saturated Fats

Current Recommendation for Saturated Fats

Limit energy intake from total fats and shift fats consumption *away from saturated fats to unsaturated fats*

SFA should be replaced with PUFA (n-3 and n-6) in the diet and the total intake of SFA not exceed 10% en.

Joint FAO/WHO Expert Consultation on Fats and Fatty Acids in Human Nutrition 2010

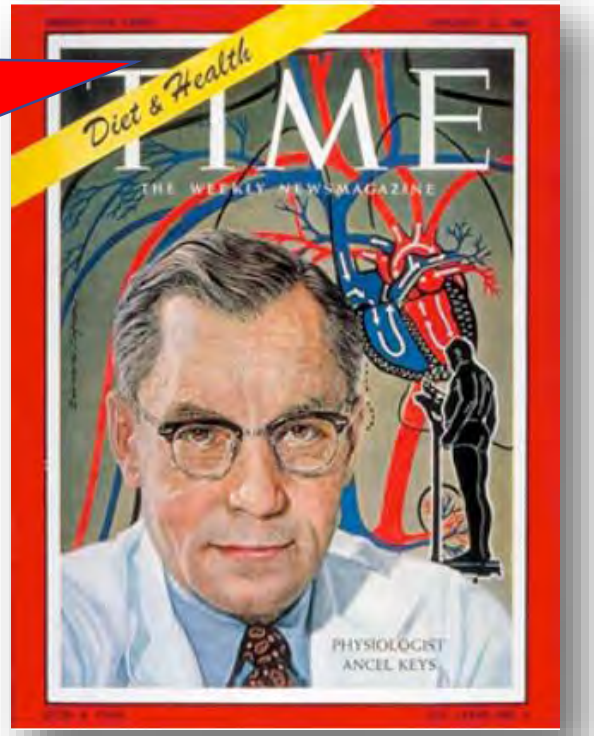
The concept of eating healthy has become synonymous with avoiding dietary fat, especially saturated fats

EVOLVING VIEWS ON SATURATED FATS

Saturated Fat: Impact on Health

- In the late 1950s, Ance[illegible] ulated that:
  - *"Fats cause[illegible]*
  - *"Satur[illegible]ls"*
- Often ref[illegible]or diet-hea[illegible]
  - *Widely[illegible]*
  - *Most peopl[illegible]e ju[illegible] granted that[illegible]is is TRUE*
- Current evidence shows otherwise

Is this still valid ?



Systematic Reviews and Meta-Analysis on Saturated Fat and CHD

Skeaff 2009

- Numerous clinical studies have shown that saturated fatty acid intake does not increase cardiovascular heart disease event and death

Siri Tarino et al., 2010

- There is NO significant evidence for concluding that dietary saturated fat is associated with increased risk of CVD or CHD

Astrup *et al.*, 2011

- No association between intakes of SFA and CVD. There is insufficient evidence to judge the effect on CVD risk on replacing SFA with MUFA

Systematic Reviews and Meta-Analysis on Saturated Fat and CHD

Mozaffarian 2011

- Modern nutritional evidence simply does not support a major effect of saturated fat on CHD risk

Chowdhury *et al.* 2014

- Current evidence does not clearly support current dietary guidelines for high consumption of polyunsaturated fatty acids and low consumption of total saturated fats

de Souza *et al.* 2015

- Found no association between saturated fats and health outcomes related to all cause mortality, CVD, CHD, stroke and type 2 diabetes.

Dehghan *et al.* (2017)

Associations of fats and carbohydrate intake with cardiovascular disease and mortality in 18 countries from five continents (PURE): a prospective cohort study

Mahshid Dehghan, Andrew Mente, Xiaohe Zhang, Sumathi Swaminathan, Wei Li, Viswanathan Mohan, Romaina Iqbal, Rajesh Kumar, Edelweiss Wentzel-Viljoen, Annika Rosengren, Leela Itty Amma, Alvaro Avezum, Jephat Chifamba, Rafael Diaz, Rasha Khatib, Scott Lear, Patricio Lopez-Jaramillo, Xiaoyun Liu, Rajeev Gupta, Noushin Mohammadifard, Nan Gao, Aytekin Oguz, Anis Safura Ramli, Pamela Seron, Yi Sun, Andrzej Szuba, Lungiswa Tsolekile, Andreas Wielgosz, Rita Yusuf, Afzal Hussein Yusufali, Koon K Teo, Sumathy Rangarajan, Gilles Dagenais, Shrikant I Bangdiwala, Shofiqul Islam, Sonia S Anand, Salim Yusuf, on behalf of the Prospective Urban Rural Epidemiology (PURE) study investigators*

A prospective cohort study from 18 countries in five continents reported in Lancet, Nov 2017

- that saturated fat consumption shows no association with cardiovascular disease, myocardial infarction, or cardiovascular disease mortality,
- saturated fat had an inverse association with stroke.
- there is an association between high carbohydrate intake and mortality especially in countries where the intakes of carbohydrates are particularly high.

Gershuni *et al.* (August 2018)

Current Nutrition Reports
https://doi.org/10.1007/s13668-018-0238-x

GASTROENTEROLOGY, CRITICAL CARE, AND LIFESTYLE MEDICINE (SA MCCLAVE, SECTION EDITOR)

CrossMark

Saturated Fat: Part of a Healthy Diet

Victoria M. Gershuni[1,2]

© Springer Science+Business Media, LLC, part of Springer Nature 2018

Abstract
Purpose of Review Despite the American public following recommendations to decrease absolute dietary fat intake and specifically decrease saturated fat intake, we have seen a dramatic rise over the past 40 years in the rates of non-communicable diseases

- No consistent benefit from the reduction of dietary saturated fats to CVD mortality
- Saturated fat has been shown in some cases to have an inverse relationship with obesity-related type 2 diabetes
- Clarify dietary guidelines to recognize that dietary saturated fat is not the villain we once thought it was (best interest of public)

Big fat controversy: changing opinions about saturated fats

Laura Cassiday

- **Nutritionists have long vilified saturated fat for its propensity to raise LDL ("bad") cholesterol levels in the blood.**
- **Although initial epidemiological studies associated saturated fat intake with heart disease risk, subsequent studies have failed to confirm the link.**
- **Saturated fat raises HDL ("good") cholesterol levels, perhaps ameliorating its effects on LDL cholesterol.**
- **An unintended consequence of a low-fat diet may be increased carbohydrate intake, which could actually raise heart disease risk compared with a higher-fat diet.**

In the early hours of September 24, 1955, US President Dwight D. Eisenhower suffered a massive heart attack. The popular president and war hero was visiting in-laws in Denver, Colorado, where he had enjoyed 27 holes of golf before retiring early that evening with what he thought was indigestion. Although Eisenhower recovered and went on to win a second term in office, his sudden incapacitation heightened public awareness of the growing epidemic of cardiovascular disease. Once a rare ailment, by the 1950s heart disease had become the leading cause of death in the United States. What diet, lifestyle, or other factors were responsible for this dramatic change? People were looking for a scapegoat, and nutritional scientists were soon to provide one.

Researchers were already beginning to implicate dietary fats, particularly saturated fats, in cardiovascular disease. The logic went like this: Saturated fats such as those found in butter,

Are refined carbohydrates worse than saturated fats?

Hu 2010 AJCN

The American Journal of CLINICAL NUTRITION

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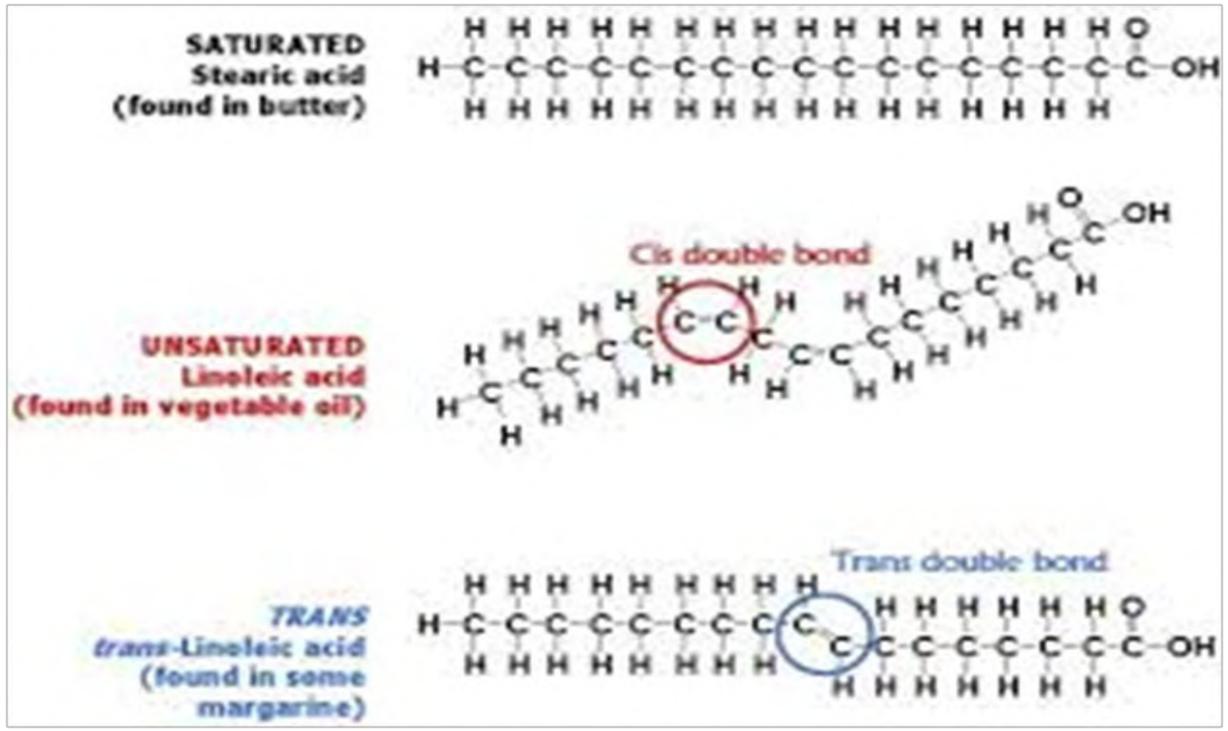
Intake of carbohydrates compared with intake of saturated fatty acids and risk of myocardial infarction: importance of the glycemic index[1,2,3]

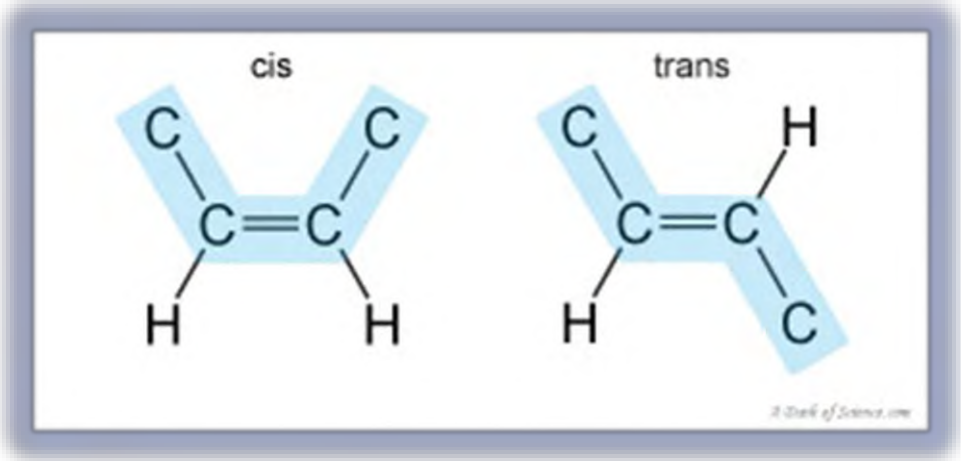
Marianne U Jakobsen, Claus Dethlefsen, Albert M Joensen, Jakob Stegger, Anne Tjønneland, Erik B Schmidt, and Kim Overvad

- Substitution of 5% en carbohydrate with high glycemic index values for SFA increased 33% risk of myocardial infarction
- More research is needed to clarify the role of SFA in comparison with specific forms of carbohydrates on CHD risk

Current View on Trans Fats

Trans Fatty Acids





Hydrogenation

Liquid

Hydrogenation

Solid

Hydrogenation

Liquid

Hydrogenation

Trans Fatty Acid

Solid

Current Facts on Trans Fats

WHO/FAO	TFA's should be limited to < 1% of total daily en in human diet
FDA	Labeling of 0.5g TFA/serving on packaged foods
EU / North America	Put a limit on TFA 2% max in dietary oils/fats
WHO (Scientific Update)	Each 2%en replacement of TFA with SFA, MUFA and PUFA would lower CHD risk by 17%

DETRIMENTAL EFFECTS OF TRANS FAT

Fats and fatty acids in human nutrition

Report of an expert consultation

FAO FOOD AND NUTRITION PAPER

91

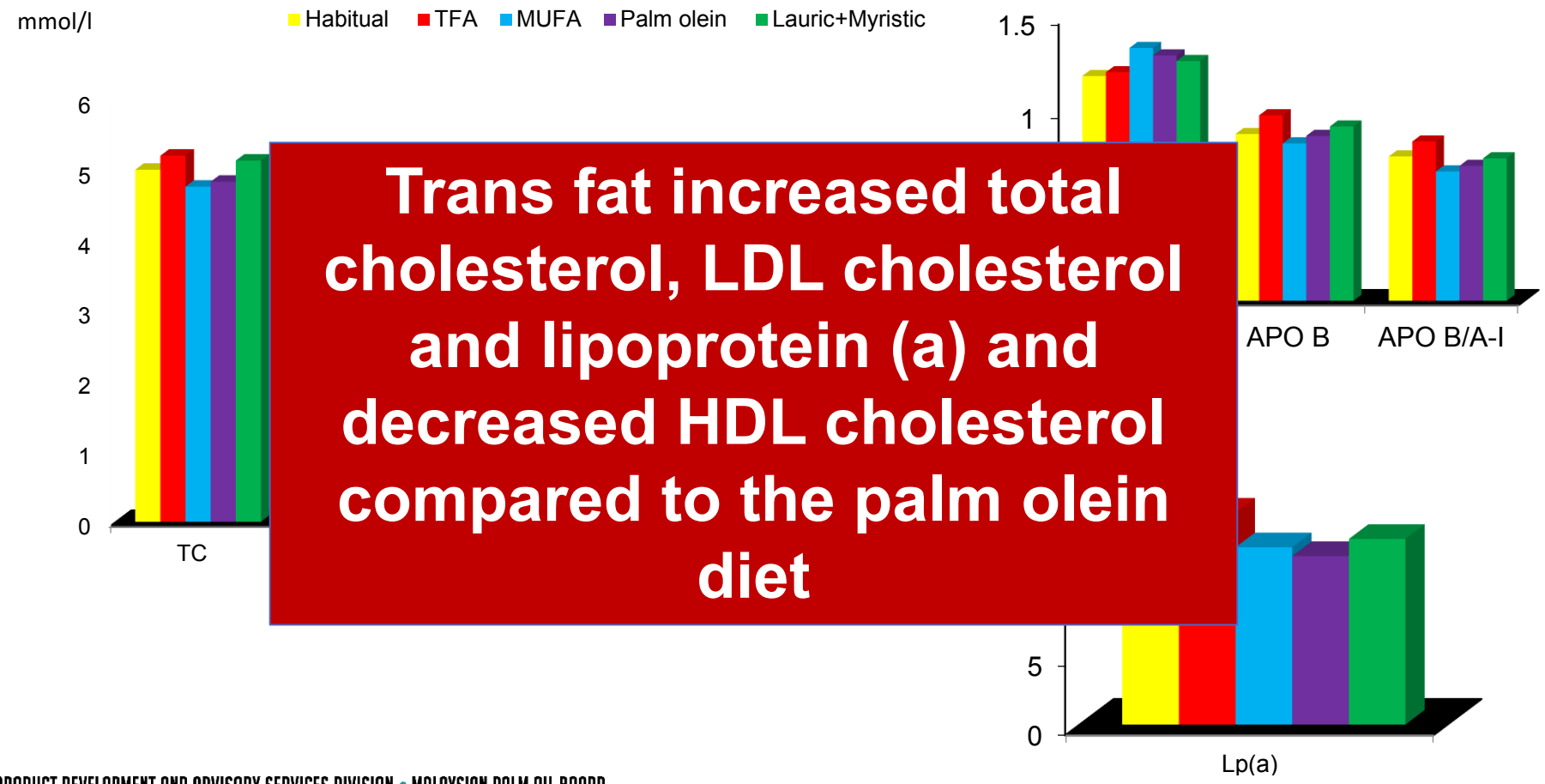
There is convincing evidence that trans fatty acids from commercial partially-hydrogenated vegetable oil increase CHD risk factors and CHD events, more so than thought previously.

There also is probable evidence of an increased risk of fatal CHD and sudden cardiac death in addition to an increased risk of metabolic syndrome components and diabetes.

……. This could well lead to the need to remove partially hydrogenated fats and oils from the human food supply.

USFDA has withdrawn the GRAS status for PHVO effective 16 June (3 year phase out).

Palm Oil *vs.* Trans Fats

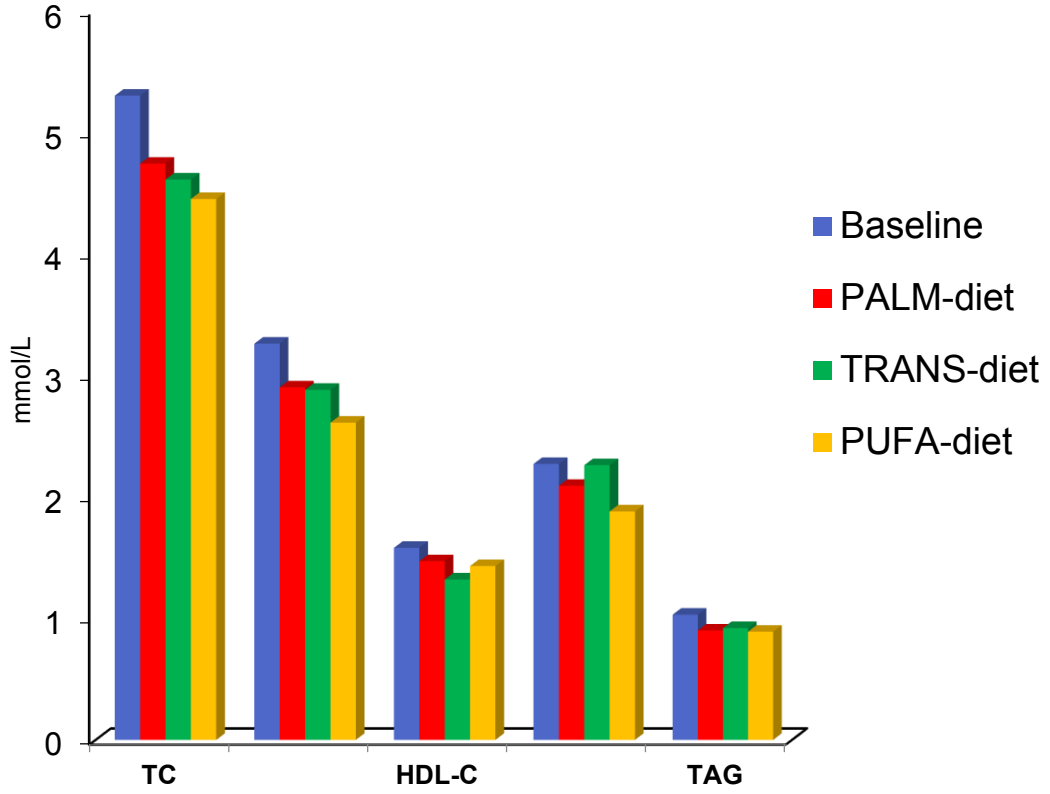


Trans fat increased total cholesterol, LDL cholesterol and lipoprotein (a) and decreased HDL cholesterol compared to the palm olein diet

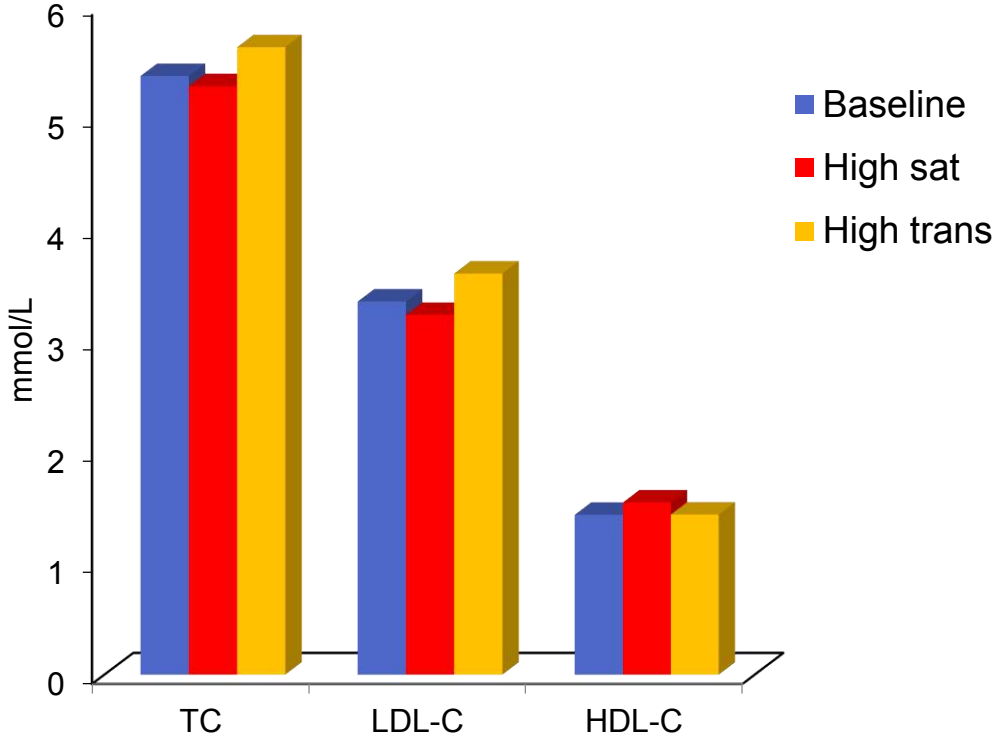
Sundram et al. 1997 J Nutr

Palm Oil *vs.* Trans Fats

Palm olein diet increased HDL cholesterol compared to trans fats diet



Trans fat diet depressed HDL cholesterol levels



Muller et al. 1998 BJN

Trans fats increased inflammatory markers

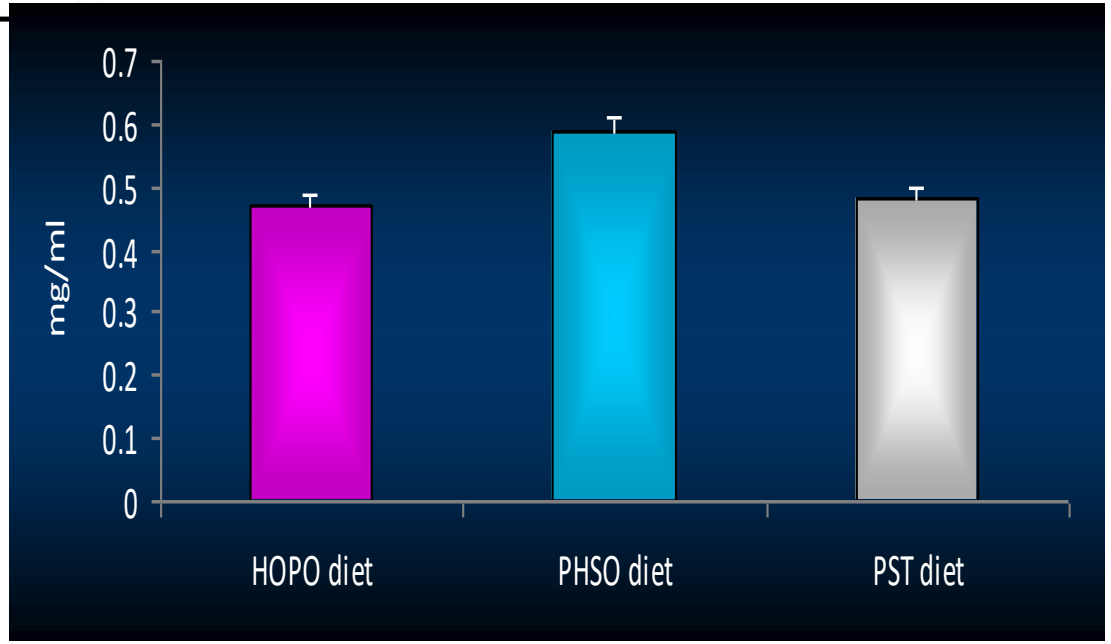
Lipids (2010) 45:385–392
DOI 10.1007/s11745-010-3416-1

ORIGINAL ARTICLE

Effects of Partially Hydrogenated, Semi-Saturated, and High Oleate Vegetable Oils on Inflammatory Markers and Lipids

Kim-Tiu Teng · Phooi-Tee Voon · Hwee-Ming Cheng · Kalanithi Nesaretnam

Received: 19 January 2010 / Accepted: 12 April 2010 / Published online: 1 May 2010
© AOCS 2010



High oleic palm olein & palm stearin ↓ hsCRP levels compared to partially hydrogenated soybean oil

The consumption of TFA provides no nutritional benefit and has considerable potential for harm

In promoting the removal of TFA, particular attention must be given to their replacement; this is a challenge for the food industry

Palm oil is a natural substitute for TFA

Nutrient Content of Palm Oil

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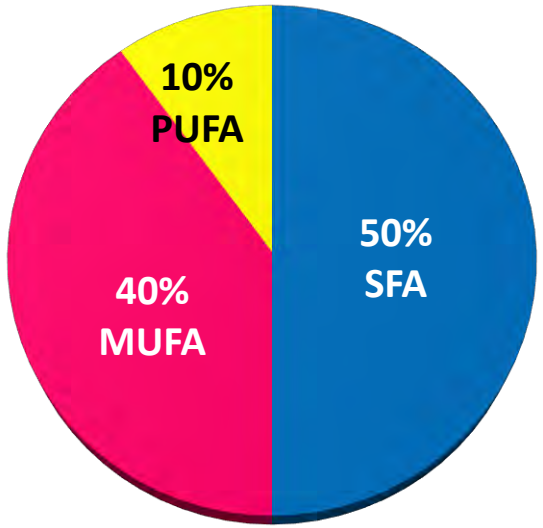


13.6 g fat and
120 calories

1 tablespoon palm oil (13g)

2.17 mg vitamin E
533 µg RE of Carotenes
Other phytonutrients

« Previous

Atherosclerosis
Volume 90, Issue 1 , Pages 91-93, September 1991

A palm oil-enriched diet lowers serum lipoprotein(a) in normocholesterolemic volunteers

G. Hornstra, A.C. van Houwelingen, A.D.M. Kester, K. Sundram

Received 10 May 1991; received in revised form 13 June 1991; accepted 17 June 1991.

Palm oil is beneficial in lowering lipoprotein(a) which is associated with cardiovascular disease

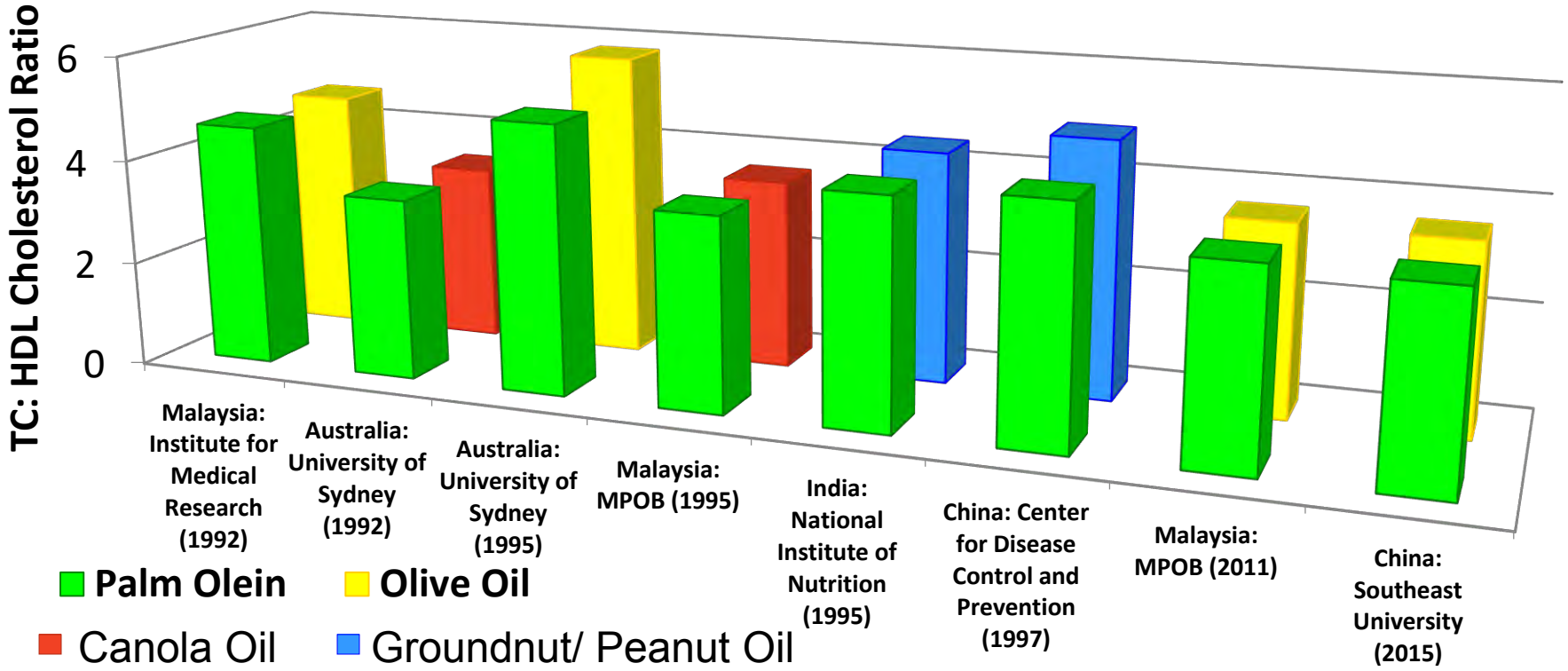
Palm oil and olive have similar effects on blood lipids

=

Numerous human studies comparing the health effects of palm olein and olive oil have shown that palm olein and olive oil have similar beneficial effects on blood cholesterol

Ng et al. 1992; Choudhury et al. 1995; Voon et al. 2011

HUMAN STUDIES : PALM OLEIN VS UNSATURATED OILS



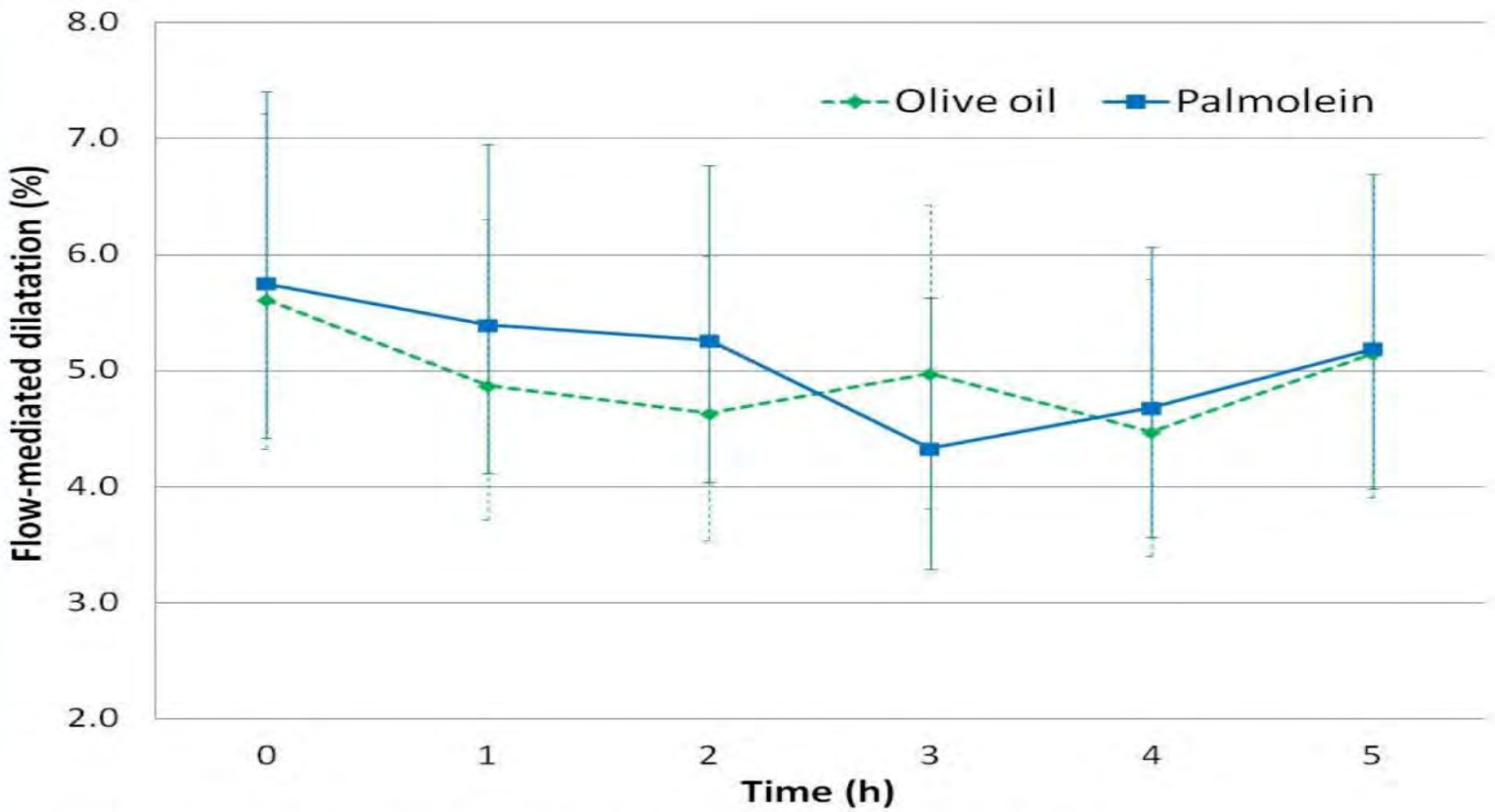
CONCLUSION: Palm olein behaves more like a monounsaturated oil in its effects on cholesterol levels, although it contains saturated fatty acids

REFERENCES:

1. Ng et al. 1992 *Am J Coll Nutr*
2. Truswell AS et al. 1992 *Nutr. Res.*
3. Choudhury et al. 1995 *AJCN*
4. Sundram et al. 1995 *Nutr. Biochem.*
5. Ghafoorunissa et al. 1995 *Lipids*
6. Zhang et al. 1997 *Asia Pacific J Clin Nutr*
7. Voon et al. 2011 *AJCN*
8. *MPOB Unpublished Data 2015*

PALM OLEIN VS MUFA OILS

Study by the Commonwealth Scientific and Industrial Research Organization (CSIRO) Australia



Meal, $P = 0.8$; Time, $P = 0.48$; **meal x time interaction, $P = 0.69$**

Stonehouse *et al.* 2015 Atherosclerosis

PALM OIL/ OLEIN VS UNSATURATED OILS

Palm

=

Sunflower

Olive

Rapeseed

Peanut

LATEST PUBLICATION: MAY 2019

Intake of Palm Olein and Lipid Status in Healthy Adults: A Meta-Analysis

Phooi Tee Voon ✉, Sin Tien Lee, Tony Kock Wai Ng, Yen Teng Ng, Xiou Shuang Yong,

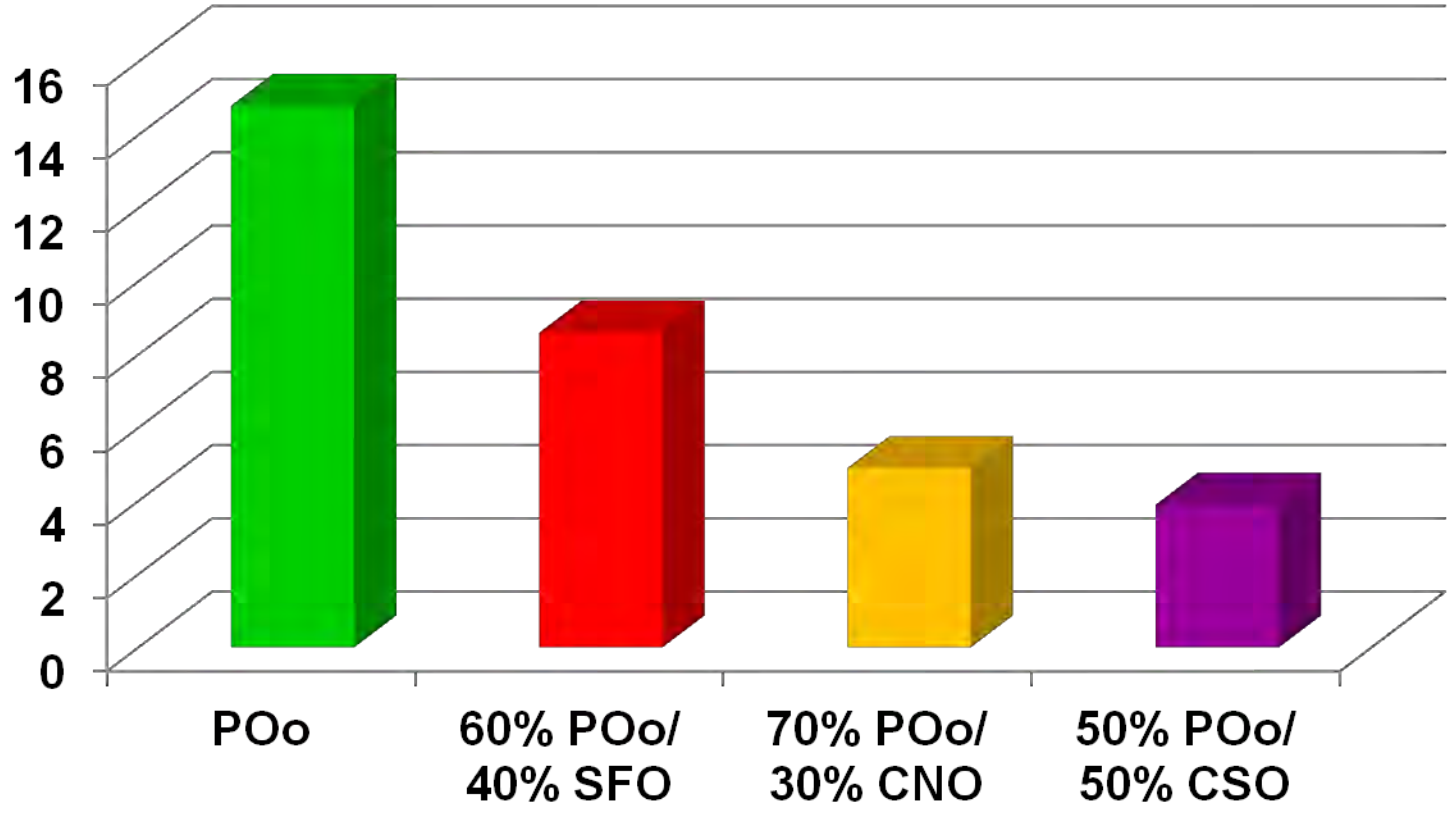
There are no significant differences in the effects of palm olein intake on lipoprotein biomarkers compared with other dietary oils.

Dietary palm olein was found to have effects comparable to those of other unsaturated dietary oils (monounsaturated fatty acid- and polyunsaturated fatty acid-rich oils) but differed from that of saturated fatty acid-rich oils with respect to the serum lipid profile in healthy adults.

OXIDATIVE STABILITY OF PALM OIL

OXIDATIVE STABILITY OF COOKING OILS

Stability of oils after 56 hours of frying



POo: Palm Olein
SFO: Sunflower Oil
CNO: Canola Oil
CSO: Cottonseed Oil

A.H. Ahmad Tarmizi & R. Ismail (2014)
Food Science & Nutrition

MPOB

Journal of Oil Palm Research Vol.30 (4) December 2018 p. 635-641
DOI: https://doi.org/10.21894/jopr.2018.0051

OXIDATIVE CHANGES IN REPEATEDLY HEATED VEGETABLE OILS

TAN PEI YEE*; RADHIKA LOGANATHAN* and TENG KIM TIU*

ABSTRACT

Palm olein was shown to have greater oxidative stability against thermal oxidation compared to corn oil and soybean oil

Consequently, PV, FFA and AV value of the oil samples increased according to their unsaturation level: POo < SBO < CNO. Therefore, POo was shown to have the greatest oxidative stability against thermal oxidation, followed by CNO and SBO.

nutrients

MDPI

Article

Effect of Consumption Heated Oils with or without Dietary Cholesterol on the Development of Atherosclerosis

Che Anishas Che Idris [1], Kalyana Sundram [2] and Ahmad Faizal Abdull Razis [3,4,5,*]

Received: 1 October 2018; Accepted: 13 October 2018; Published: 17 October 2018

check for updates

Abstract: Heating oils and fats for a considerable length of time results in chemical reactions, leading to the aggravation of a free radical processes, which ultimately contributes to atherosclerosis. Our study focused on elucidating the effect of feeding heated oils with or without dietary cholesterol

suggest that heated palm oil confers protection against the onset of atherosclerosis compared to heated polyunsaturated oils in a rabbit model.

Heated palm oil confers protection against the onset of atherosclerosis compared to heated polyunsaturated oils in a rabbit model

PHYTONUTRIENTS IN PALM OIL

Phytonutrients in Palm Oil

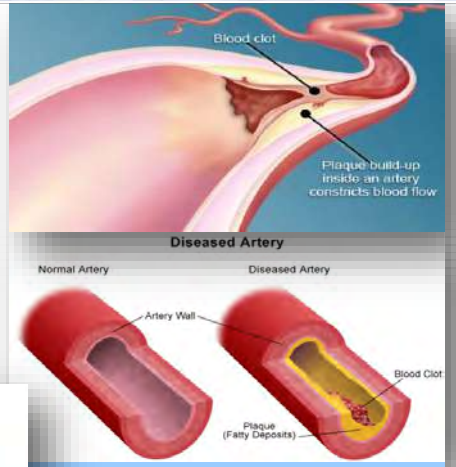
Phytonutrients	Concentration (ppm)
Vitamin E (tocotrienols, tocopherols)	600-1000
Carotenoids (α-carotene, β-carotene, lycopene, phytoene)	500-700
Phytosterol (Sitosterol, stigmasterol, campesterol)	300-620
Squalene	250-540
Lecithin (Phospholipids)	20-100
Co-enzyme Q10 / Ubiquinones	10-80
Polyphenols (phenolic acids, flavonoids)	40-70

Choo *et.al.*, 2008

Tocotrienols: **Beneficial Effects**

Neuroprotection
(Sen et al.,1999)

Radioprotection



Cardiovascular prevention
(Das et al., 2008)

Antioxidant
(Theriault et al.,1999)

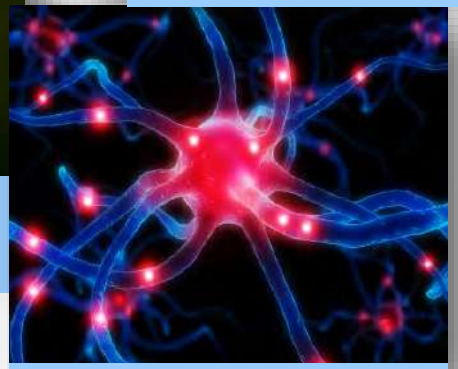
Immune booster
(Radhakrishnan et al., 2013, 2014)

Cancer prevention
(Yap et al., 2008; Selvaduray et al., 2008)

Anti-inflammation
(Yam et al., 2009

Bone protection

Skin protection



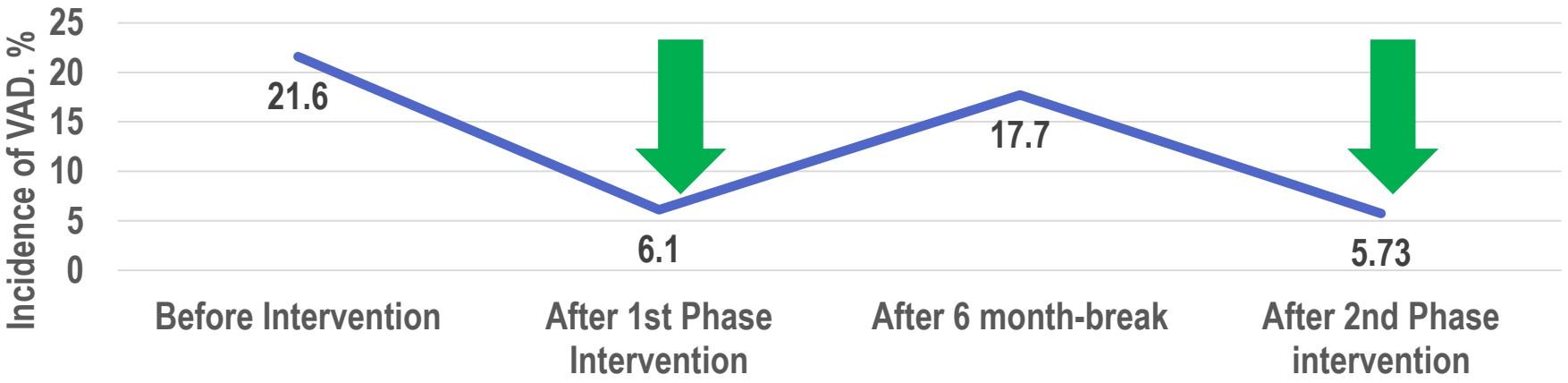
Hormone regulator

Health Promoting Properties of Palm Carotenes

Carotenoids
➢ Pro-vitamin A activity
➢ Prevention of cardiovascular diseases
➢ Immuno-enhancement
➢ Prevention of macular degeneration
➢ Decrease risk of cataract formation
➢ Inhibition of cancer

Study of Red Palm Oil in Gansu Province, Lanzhou, China

Red Palm Oil Biscuit



Incidence of vitamin A deficiency (VAD) before and after the vitamin A intervention

Confirms the effects of red palm oil in reducing %VAD

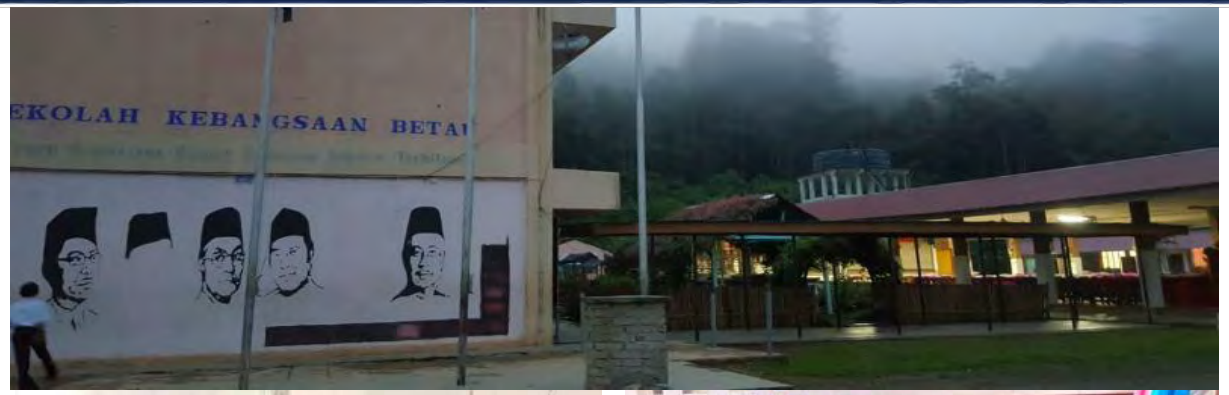
1ST Phase (May – Nov 2015)

2,000 children at schools in Gansu

2nd Phase (Apr – Oct 2016)

The second phase involved 300 children at schools in Gansu

Red Palm Oil Intervention Study in Malaysia

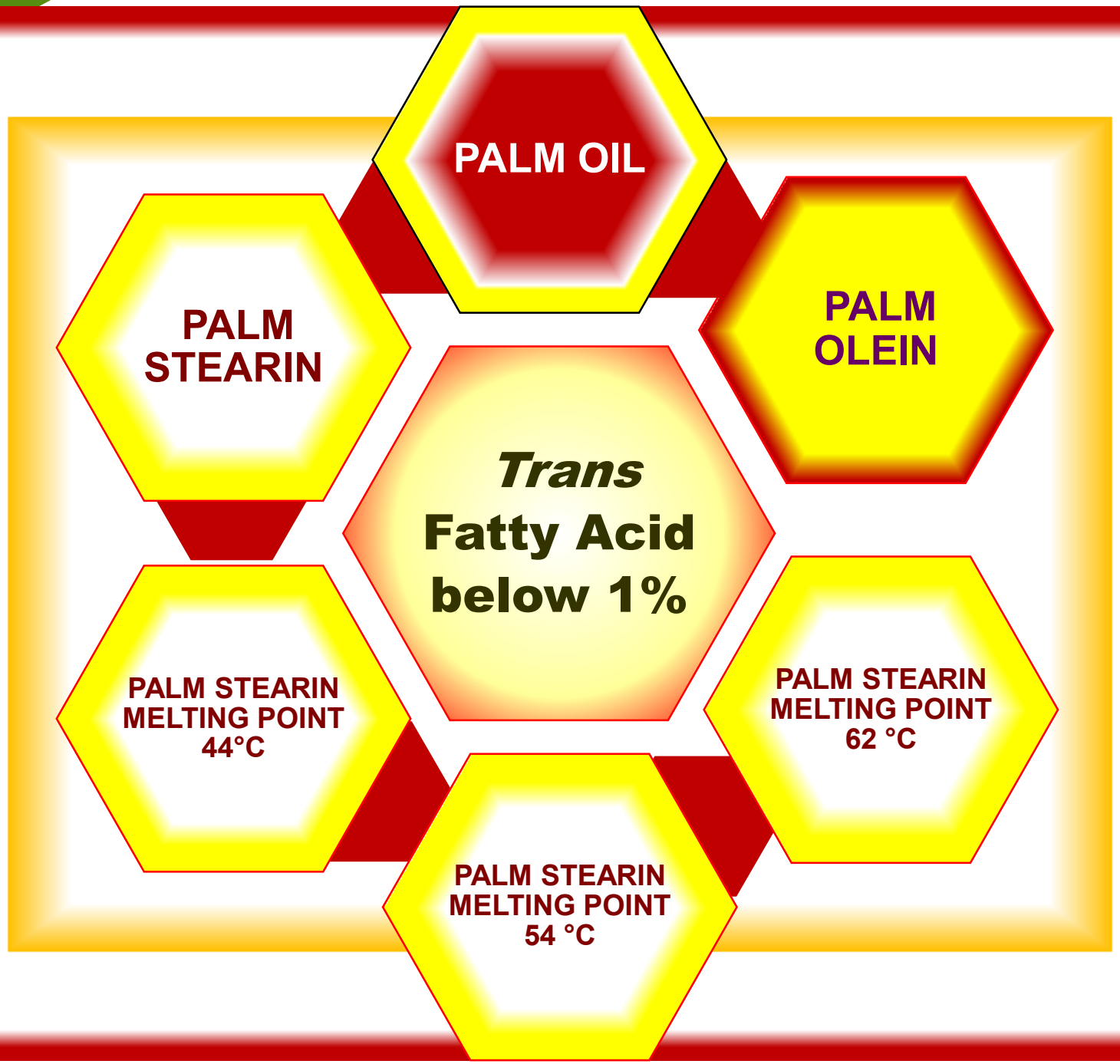


FOOD USES OF PALM OIL

How is Palm Oil Versatile ?

We Have Numerous Advantages to Support the Food Industry

1. Two Types of Oils from One Fruit
2. Fractions of Palm Oil and Palm Kernel Oil
3. *Trans* Fatty Acid Free


PALM OIL
PALM STEARIN
PALM OLEIN
Trans Fatty Acid below 1%
PALM STEARIN MELTING POINT 44°C
PALM STEARIN MELTING POINT 62 °C
PALM STEARIN MELTING POINT 54 °C

ADVANCEMENTS IN PALM OIL FRACTIONATION PROCESSES HAVE ENABLED PALM OIL AND ITS FRACTIONS TO CONQUER A WIDE RANGE OF APPLICATIONS IN THE FOOD SEGMENT.

THE FUNCTION AND SUGGESTS OF FATS AND OILS IN FOOD PRODUCTS

	High Melting Point Fats	Medium Melting Point Fats	Low Melting Point Liquid Oils
Function	Acts as the backbone structure	Acts as the/ main body	Used as modifiers to obtain the required melting point
Suggested palm fractions	Palm Stearin (hard) SMP above 50 ºC	Palm Oil Palm Soft Stearin SMP below 45 ºC Palm Mid Fraction Soft Palm Kernel Oil Palm Kernel Stearin	Palm Olein Palm Kernel Olein (Other oils Soybean Oil Sunflower Oil Canola Oil Rice Bran Oil)

Teng Kim Tiu, Sivaruby Kanagaratnam and Kalanithi Nesaratnam (2014) *Trans* Fats Replacement Solutions in Malaysia in Trans Fats Replacement Solutions Urbana, Illinios AOCS Press: 385-398.

COOKING AND DRESSING OIL

ROLE OF SOLID FATS IN BAKERY PRODUCTS

SOLID FATS PROVIDE THE CRUCIAL CHARACTERISTICS SUCH AS :

- Structure
- Texture
- Firmness

FATS IN BAKERY PRODUCTS

Shortening and Margarine for Cookies, Cream Filling and Spread

CONFECTIONERY FATS

CONFECTIONERY FATS FOR SPREADS AND CHOCOLATES

DAIRY FAT REPLACERS

Ice Creams

Sweetened Creamer Fats

Creamer Fats

Vegetable Ghee Vanaspati

ANIMAL FAT REPLACERS : MEAT SAUSAGES

Meat Sausages

Canned Food

Meat Patties

Seasoning Cubes

INFANT FORMULATION: HUMAN BREAST MILK FAT

INTERESTERED PALM STEARIN IV 10 to produce TAG of OPO

BUN
Patties
Margarine
mayonnaise

Take Home Messages

- Opinion on saturated fats is **changing**
- There is increasing evidence to show that there is **no association** between **saturated fat** intake and **CVD**
- Say **No** to **trans** fats
- **Palm oil** is the best **substitute** for trans fat
- Palm oil is **nutritious** and is rich in **phytonutrients**
- Good oxidative **stability**
- Good functional properties and is **versatile**
- Palm oil has **numerous** food uses
- Non GMO

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THANK YOU

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