



International Association
of Rice Bran Oil

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Healthy Fatty Acids and Bioactive Compounds in Rice Bran Oil: a Comparison with Leading Counterparts and Emerging Dietary Sources

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Plant-derived oils present varying features in terms of nutritive or health-promoting value

Fatty acid profiles

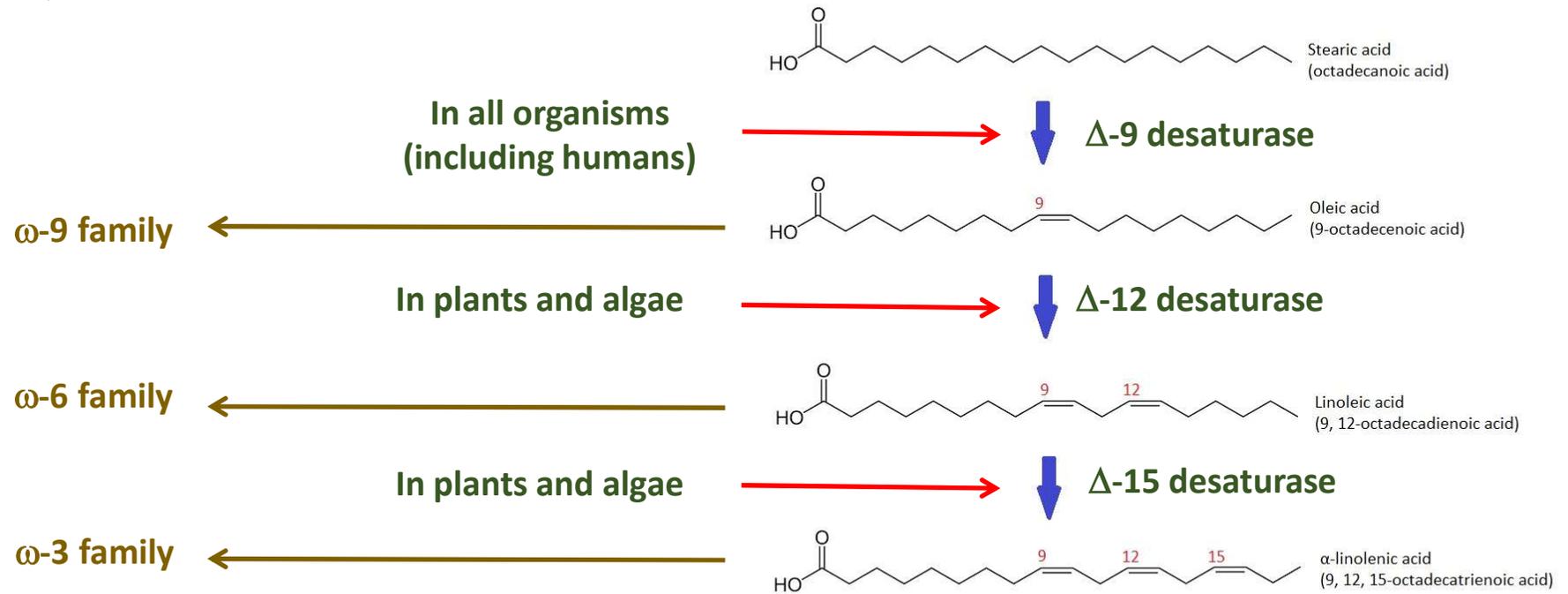
- **SFA / MUFA / PUFA**
- **Omega 3-6-9 families**
- **Cis and trans isomers**
- **Conjugated isomers**

Bioactive phytochemicals

- **Liposoluble vitamins**
- **Carotenoids**
- **Sterols**
- **Phenolic compounds**

A huge diversity of fatty acids can be found in plant-derived oils

- saturated FA ← Mainly C16:0 and C18:0 but also C12:0 and C14:0, etc
- unsaturated FA
 - monounsaturated FA ← Mainly C16:1 n-7 and C18:1 n-9
 - polyunsaturated FA



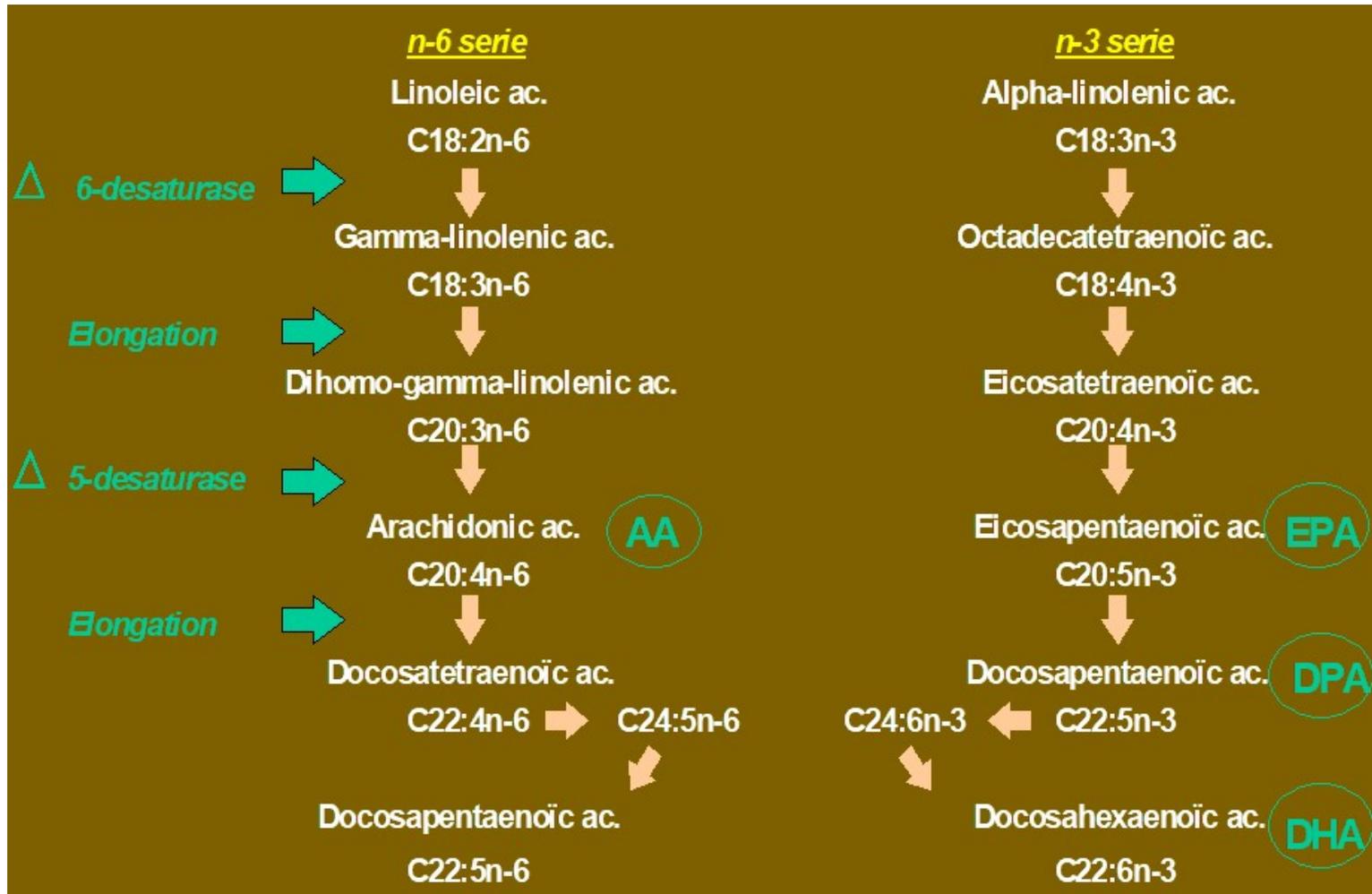
Linoleic acid and α -linolenic acid are called essential for humans

Animal cells use several enzymes for the anabolic processing of C18:2 n-6 and C18:3 n-3

Some C20 and C22 fatty acids are of utmost importance for human health

Competition due to the use of the same enzymes for both pathways

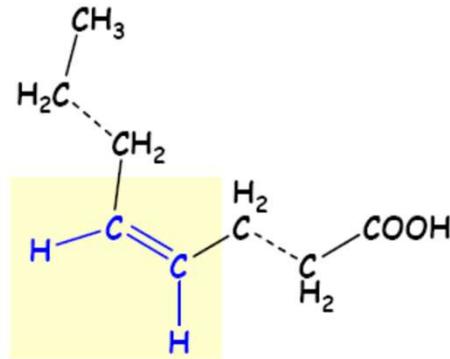
Necessary balance in the dietary intakes of n-6 and n-3 precursors



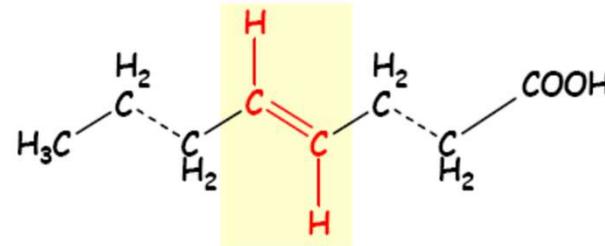
Plant-derived oils may contain unconventional fatty acids

➤ trans fatty acids

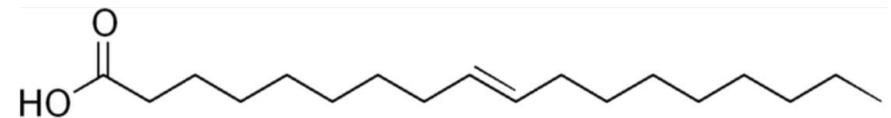
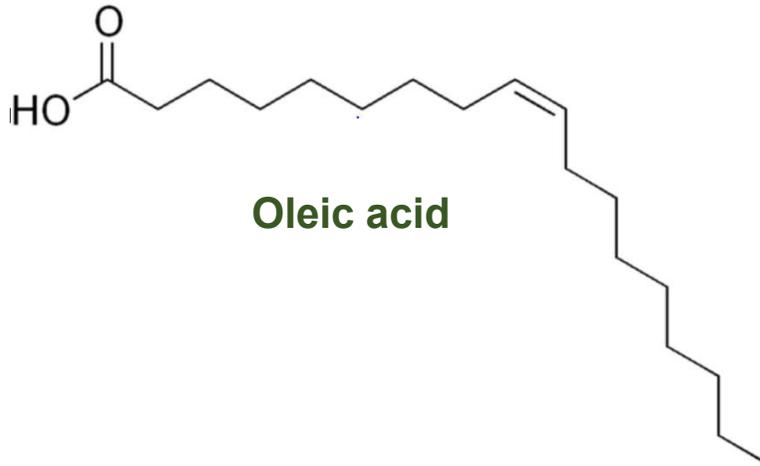
Due to refining



configuration *cis*



configuration *trans*



Elaidic acid

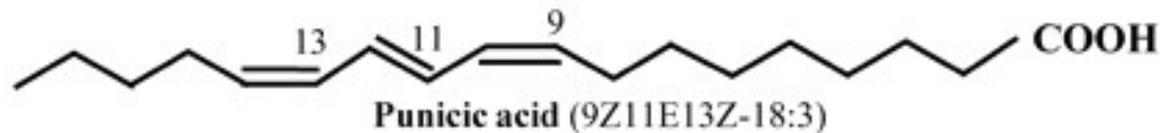
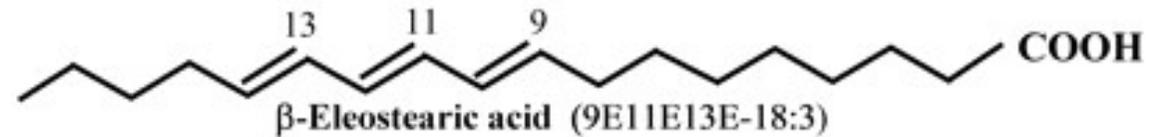
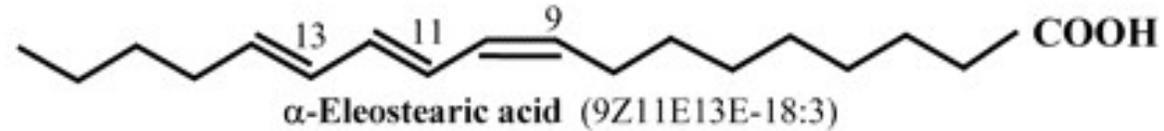
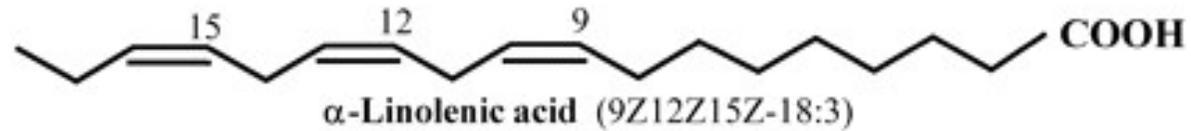
Plant-derived oils may contain unconventional fatty acids

➤ conjugated linolenic acids

Major fatty acids
in these products

Only a few plants
contain CLnA

CLnA present
a health potential



Culinary oils and fats

show extremely diverse fatty acid profiles

Some plant-derived oils are rich in SFA (coconut, palm)

Only a few oils contain significant levels of n-3 PUFA

Linseed oil is the only common oil rich in n-3 PUFA

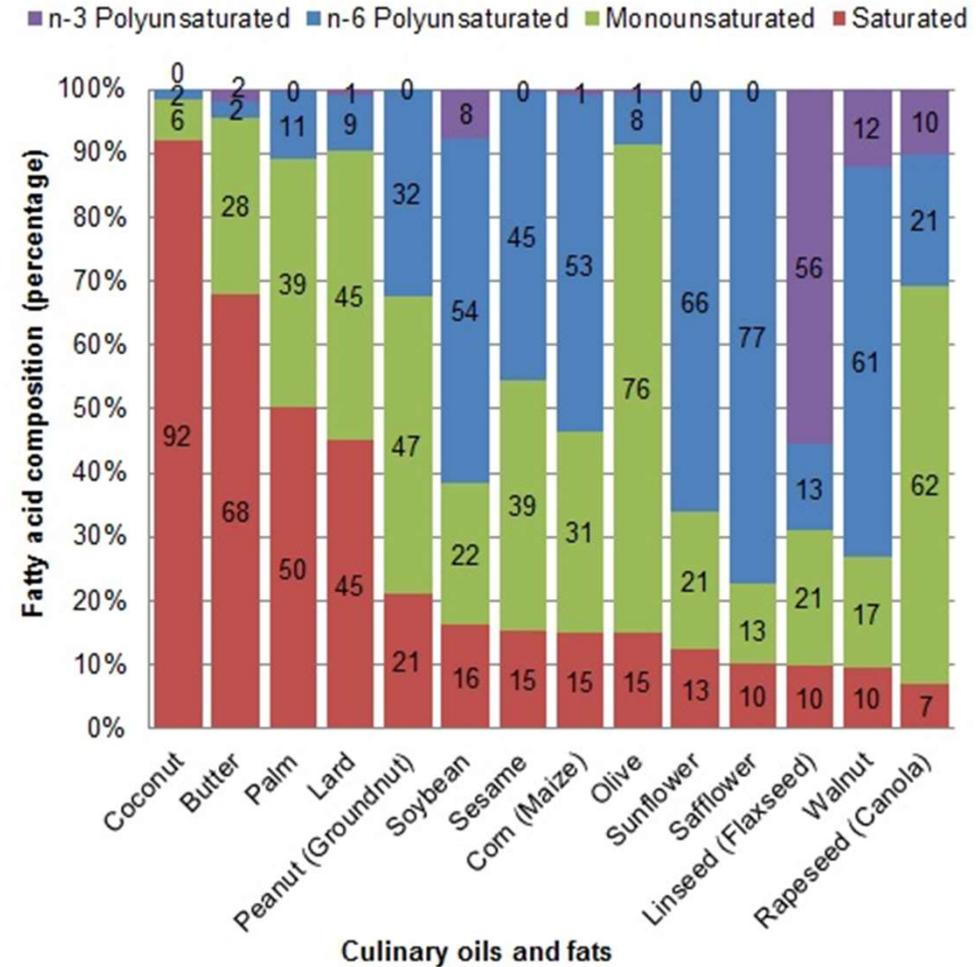
Rapeseed oil is the only common oil with a good balance between n-6 and n-3 PUFA



Rapeseed oil production and consumption has increased on the European market

Linseed oil consumption has started
(But this oil is prone to oxidation)

The European consumer is looking for alternative oil sources





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Emerging plant oil sources on the European market

Camelina oil (from the seeds of *Camelina sativa*, also called “false flax” or “gold-of-pleasure”)

- FA profile : SFA = 11% ; MUFA = 32% ; n-6 PUFA = 23% ; n-3 PUFA = 34%
- Rich in vitamin E → resistant to oxidation

Chia oil (from the seeds of *Salvia hispanica*)

- FA profile : SFA = 10% ; MUFA = 7% ; n-6 PUFA = 19% ; n-3 PUFA = 64%

Sacha Inchi oil (from the seeds of *Plukenetia volubilis*, also called Inca peanut)

- FA profile : SFA = 7% ; MUFA = 9% ; n-6 PUFA = 33% ; n-3 PUFA = 51%

Not much of rice bran oil sold as a food item on the European Market

☹ FA profile : SFA = 18% ; MUFA = 42% ; n-6 PUFA = 39% ; n-3 PUFA = 1%



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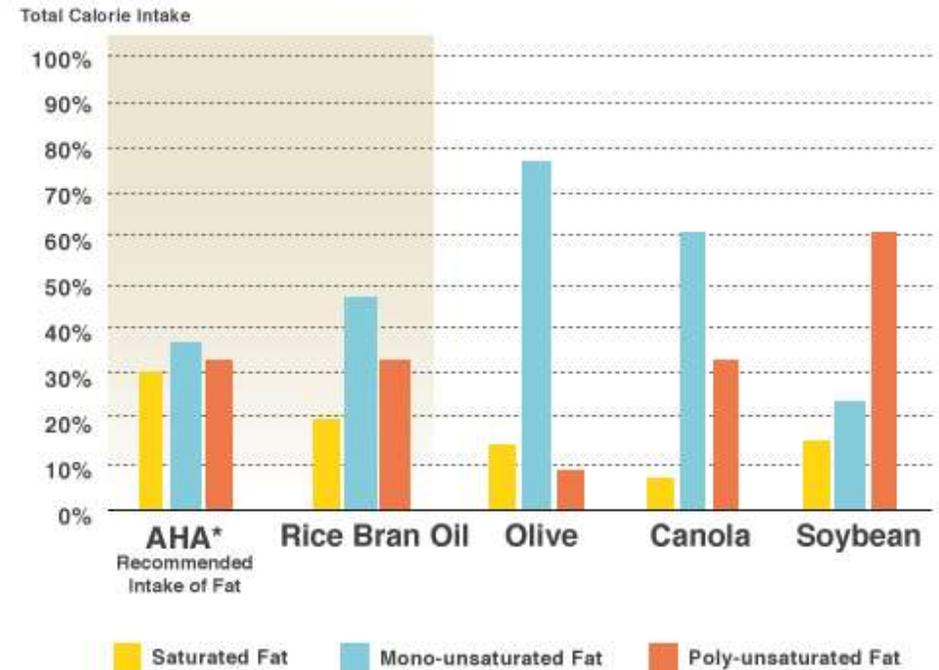
The fatty acid profile is not a good argument to promote the consumption of Rice Bran Oil

- ☹️ SFA: 18%, MUFA: 42%, n-6 PUFA: 39%, n-3 PUFA: 1%
- ☹️ Ratio n-6 PUFA / n-3 PUFA close to 40 !!!

☹️ Do not use misleading arguments such as the appropriate balance between SFA, MUFA and PUFA

😊 Rice Bran Oil is a great source of highly valuable bioactive phytochemicals

Comparison of balance of fats in some commonly used oils



* AHA - The American Heart Association





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Rice Bran Oil is a great source of highly valuable bioactive phytochemicals

RBO contains more than 4 % of unsaponifiable constituents

These include: phytosterols (1.5–2 %): campesterol, stigmasterol, β -sitosterol, + 4-méthylsterols

triterpene alcohols (1-1.5 %): 24-methylene cycloartenol, cycloartenol

tocopherols and tocotrienols (0.2–0.5 %)

polar compounds (0.5-1.0 %): aliphatic alcohols, hydrocarbons

oryzanol (1.0–1.8 %): a mixture of ferulic acid esters of triterpenoid alcohols

RBO contains numerous bioactive phytochemicals:

γ -Oryzanol

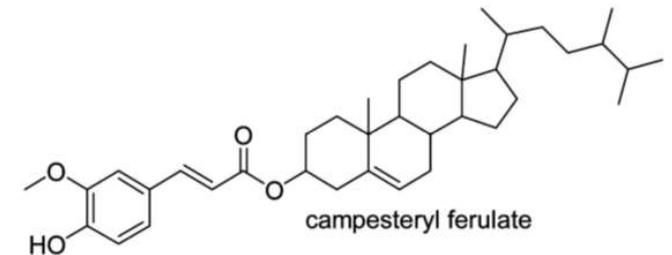
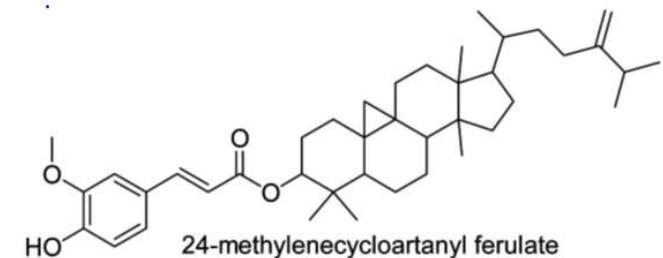
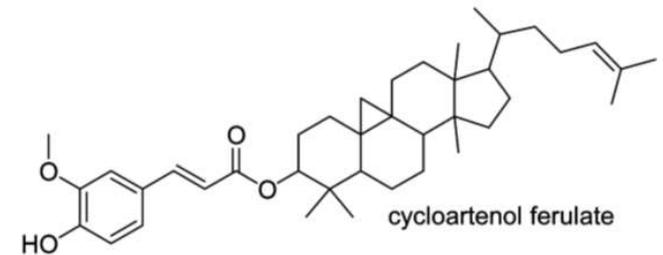
γ -oryzanol is an extract quite unique to RBO

Made of more than 10 compounds, the major ones being:

- Cycloartenyl ferulate
- 24-methylene cycloartanyl ferulate
- campesteryl ferulate

Crude RBO may contain up to 18 g of γ -oryzanol / kg

Loss of γ -oryzanol during refining: 80% by chemical refining
10% by physical refining





RBO contains numerous bioactive phytochemicals:

γ -Oryzanol

γ -oryzanol appears to have numerous health-promoting impacts

- antioxidant activity (probably due to ferulic acid = phenolic acid antioxidant)
- reduction of serum cholesterol level and LDL cholesterol + increase of HDL cholesterol
 - * studies made on animals and humans
 - * studies made with either a RBO enriched diet or with extracted γ -oryzanol
 - * synergistic effects with other bioactive compounds of RBO or other oily food items
- inhibition of cholesterol absorption and increase of bile salt fecal excretion
- inhibition on platelet aggregation
- inhibition of tumor promotion
- ...



RBO contains numerous bioactive phytochemicals:

Phytosterols - Tocopherols - Tocotrienols

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Phytosterols of RBO compete with dietary and biliary cholesterol for intestinal absorption / reabsorption

- **inhibition of dietary cholesterol absorption and of the enterohepatic cycle of body cholesterol**

RBO appears to contain a significant level of tocotrienols, especially γ -tocotrienol

- **protection of lipoproteins and cellular lipid structures against oxidation**
- **Inhibition of cholesterol synthesis**



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RBO contains numerous bioactive phytochemicals: Synergistic effects ?

It is likely that the health impacts of RBO are not only due to its high concentrations in numerous phytochemicals but also to the unique combination of these compounds enabling potential synergistic effects



Three major features are to be considered regarding the interest of the European consumer for RBO

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RBO contains a unique mixture of bioactive phytochemicals giving it an attractive set of health promoting properties

RBO has a strong antioxidant capacity given by its cocktail of phytochemicals

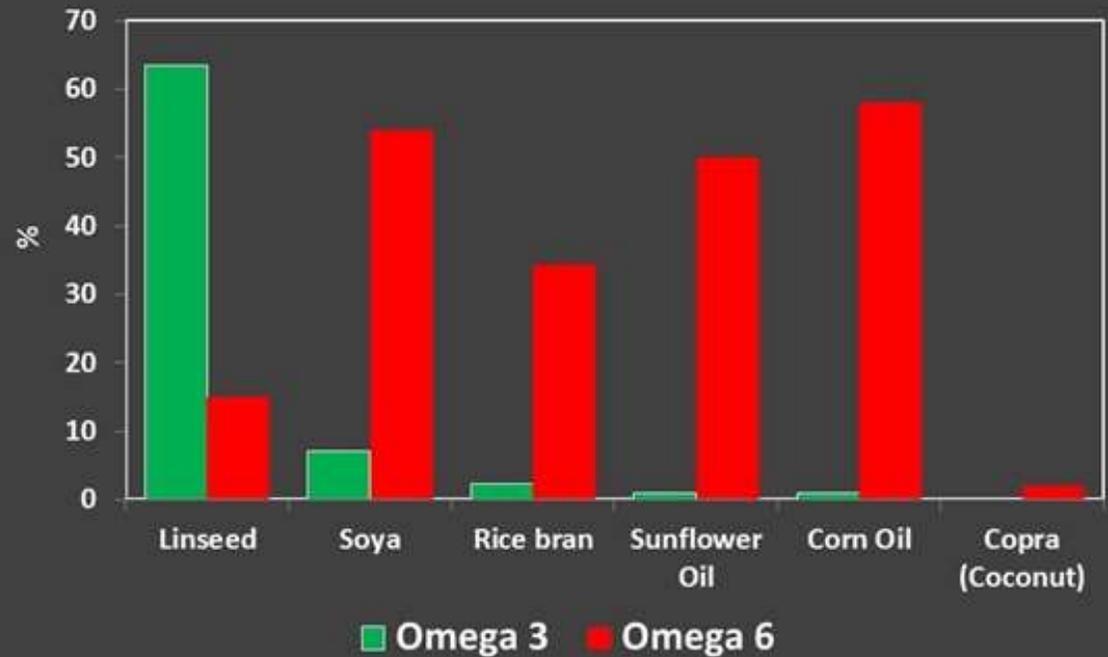
RBO has an inappropriate balance between its PUFA

RBO should be mixed with other valuable plant-derived oils

- **to convince the European market**
- **to provide the consumers with an innovative and totally healthy product**

A concrete and practical proposal: Combination of RBO with Linseed oil (50-50)

Omega 3 & Omega 6 In Different Oils



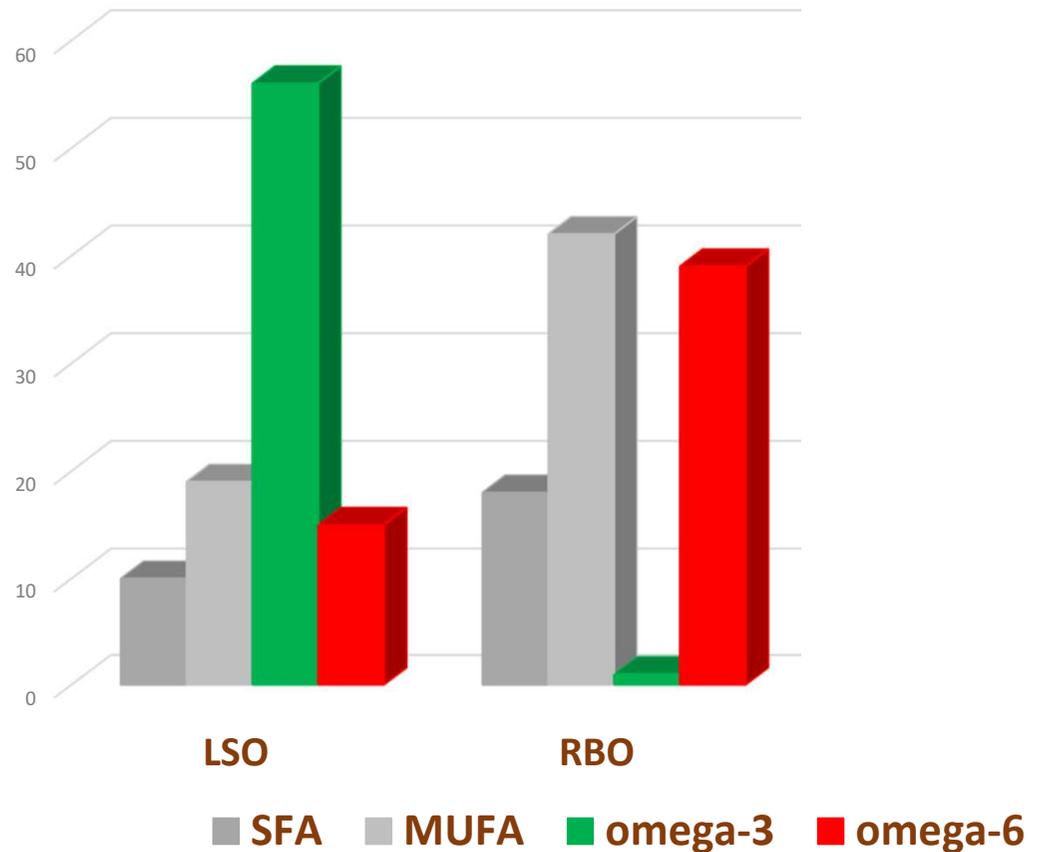


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A concrete and practical proposal: Combination of RBO with Linseed oil (50-50)

High content in essential fatty acids
n-6 / n-3 ratio of 1
Protection of linseed oil from oxidation
Valuable phytochemical cocktail retained

Such a combination should be evaluated:
Resistance to oxidation and shelf-life
- Accumulation of oxidized metabolites
- Disappearance of bioactive chemicals
Health-promoting effects
Determination of consumer acceptability





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Many thanks for your kind attention

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