Scaling Up of Nutrition through Edible Oil

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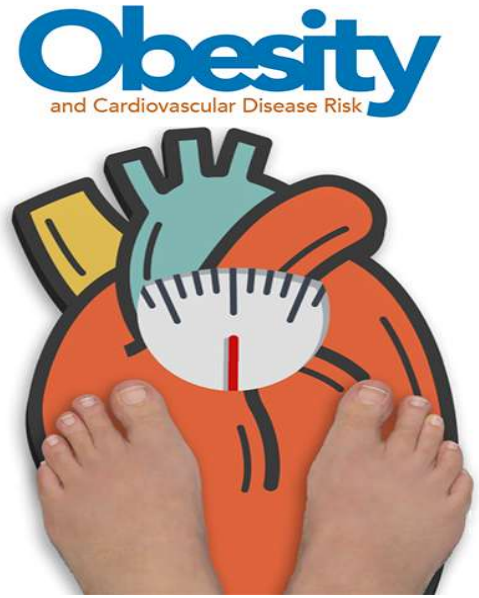
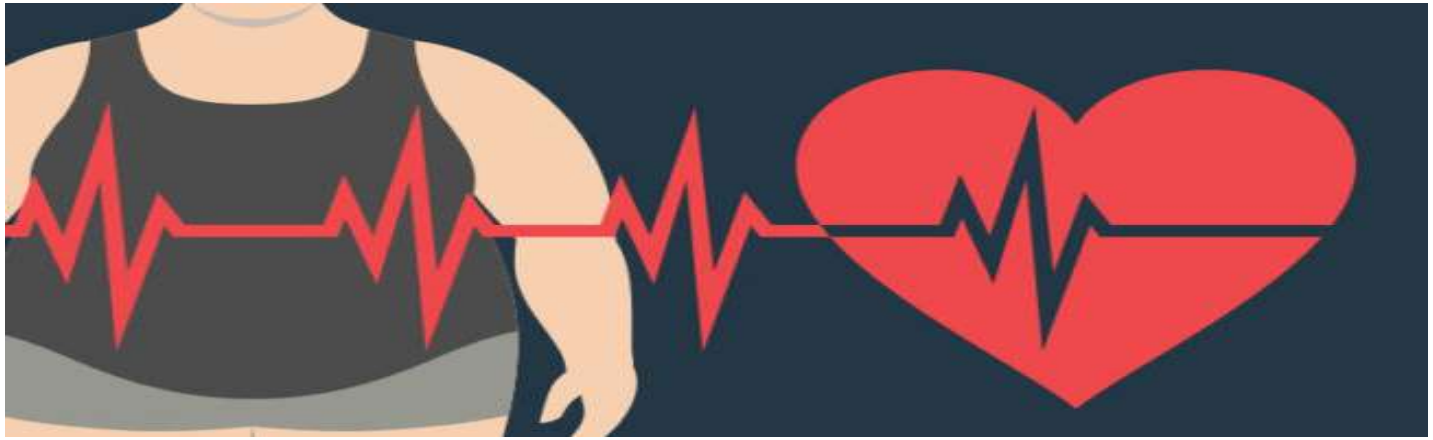
CHALLENGES

In India, more than 135 million individuals were affected by obesity.

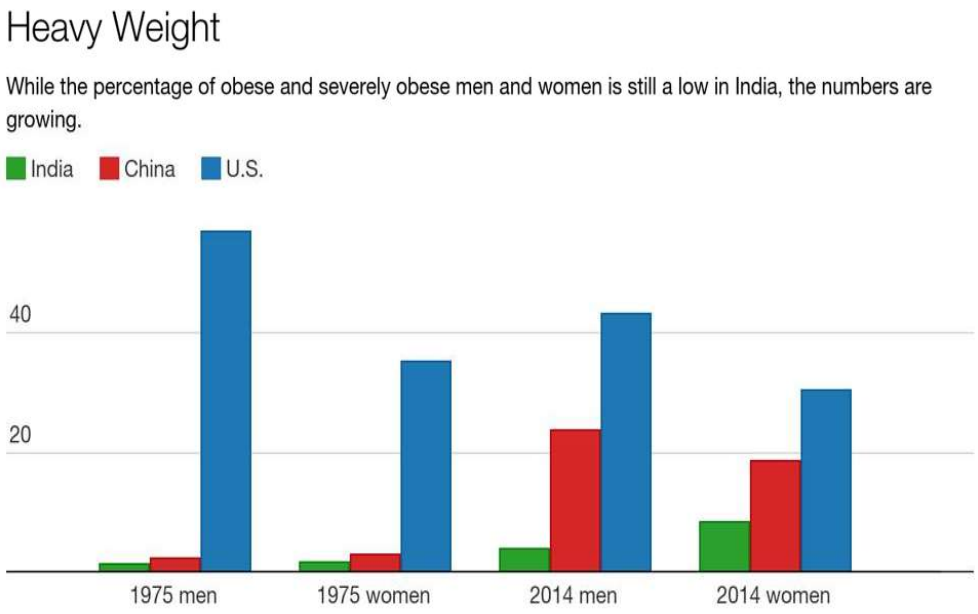
According to ICMR-INDIAB study 2015, **prevalence rate of obesity varies from 11.8% to 31.3%.**

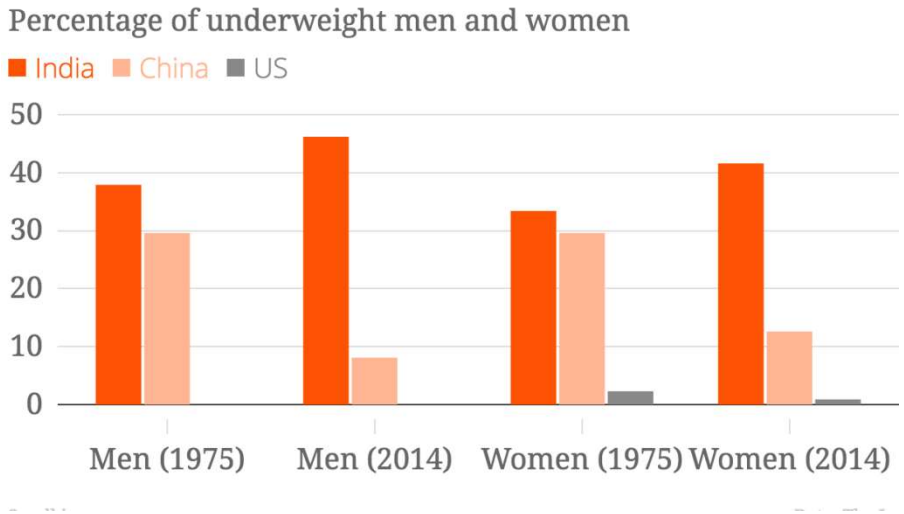


Usually, obesity is considered as one of the factor for cardiovascular diseases.



But, India is facing a higher risk of obesity and on the other side, there is already a great population of underweight





Overweight v/s Underweight

Is FAT really a victim for overweight?

Or

Is there any another reason:
Excess consumption
Sedentary Lifestyle
Etc.

What is this – FAT ?

Major Source – Oilseeds
Minor Source – plant source (vegetables/ fruits) as well as animal source (meat etc.)

Energy dense constituent – Provide energy 9 kcal/g fat

Fat plays a vital role in total diet

Fats: 20 – 30 % of total energy

<u>Physiological Functions of Fatty Acids</u>

1. Membrane Structure
2. Cholesterol Transport
3. Formation of Lipoprotein
4. Energy Source during Starvation – ketone body
5. Formation of Lipoprotein
6. Promote absorption of 4 fat soluble vitamins (Vit A, D, E, K)
7. Pre-cursor for some hormone

Composition of Fat

Fat seems to be victim which provides double calories (as compared to protein and carbohydrate – 4kcal)

Oils and Fats

Major Component (%95-99)

Triglycerides

Minor Components (%1-5)

Triglyceride Derivatives

Glycerol

Free Fatty Acids

Mono- and Diglycerides

Non-Triglyceride Derivatives

Phospholipids

Sterols

Pigments

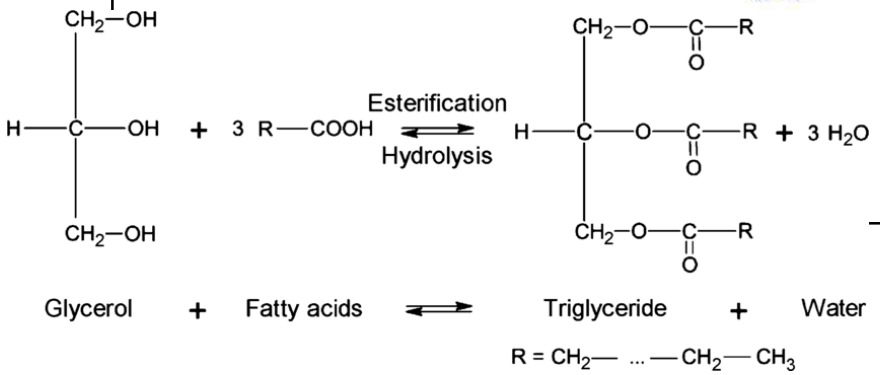
Vitamins

Antioxidants

Oxidation Products

Trace Metals

Hydrocarbons



Oil/ Fat comprises of varying proportion of SFA, MUFA, PUFA

Oils	SFA	MUFA	PUFA	Omega-6	Omega-3
Coconut Oil	90.86	7.24	1.9	1.9	
Palm Oil	44.98	43.53	11.49	11.18	0.3
Gingelly Oil	16.25	41.41	42.34	41.96	0.39
Rice Bran Oil	23.76	44.12	32.12	31.56	0.56
Canola Oil	4-10%	55-62	30-35	21	11
Mustard Oil	5.72	67.09	27.19	15.55	11.64
Olive Oil	19.4	68.2	18	16.4	1.6
Groundnut Oil	10.7	71.1	18.2	18.2	
Safflower Oil	7.8	77.55	15.05	76	0.2
Corn Oil	16.6	33.67	49.74	48.97	0.76
Cottonseed Oil	28.17	19.66	52.16	51.81	0.35
Soyabean Oil	15.96	24.06	59.98	54.78	5.2
Sunflower Oil	11.39	25.96	62.65	62.65	
Flaxeed Oil	9.6	22	68	17	58

SFA rich Oils

- Coconut Oil
- Palm Oil

MUFA rich Oils

- Safflower Oil (Oleic rich)
- Groundnut Oil
- Olive
- Mustard
- Canola
- Rice bran

PUFA rich Oils

- Safflower Oil (linoleic rich)
- Flaxseed Oil
- Sunflower Oil
- Soyabean Oil
- Cottonseed Oil
- Corn Oil

Oils	Major Fatty Acid	% Composition	Type of Fatty Acid
Coconut Oil	Lauric Acid (C12:0)	44 – 53.2 %	Saturated Fat
Palm Oil	Palmitic Acid (C16:0) & Oleic Acid (C18:1)	32 – 47.5 % & 36 – 44 %	Saturated Fat & Monounsaturated Fat
Rice Bran Oil	Oleic Acid (C18:1) & Linoleic Acid (C18:2)	38 – 48 % & 21 – 42 %	Monounsaturated Fat & Polyunsaturated Fat
Mustard Oil	Erucic Acid (C22:1)	44 – 58 %	Monounsaturated Fat (Omega 9)
Olive Oil	Oleic Acid (C18:1)	55 – 83 %	Monounsaturated Fat
Groundnut Oil	Oleic Acid (C18:1) & Linoleic Acid (C18:2)	35 – 69 % & 12 – 43 %	Monounsaturated Fat & Polyunsaturated Fat
Safflower Oil	Linoleic Acid (C18:2)	67.8% - 83.2 %	Polyunsaturated Fat
Corn Oil	Oleic Acid (C18:1) & Linoleic Acid (C18:2)	20 – 42.2 % & 34 – 65.6%	Monounsaturated Fat & Polyunsaturated Fat
Cottonseed Oil	Linoleic Acid (C18:2)	46.7 – 58.2 %	Polyunsaturated Fat
Soyabean Oil	Linoleic Acid (C18:2)	48 – 59 %	Polyunsaturated Fat
Sunflower Oil	Linoleic Acid (C18:2)	48.3 – 74 %	Polyunsaturated Fat

NOTE : In nutshell, one oil is not rich in all essential fatty acid. So, every oil has its unique tri-glyceride and non-glyceride combination.

Minor Components of Fat

Triglyceride is the major component of the vegetable oil and its fatty acids play a vital role in human health

Other minor components play a significant role are:

Phytosterol/ Phytostanol

Vitamin E

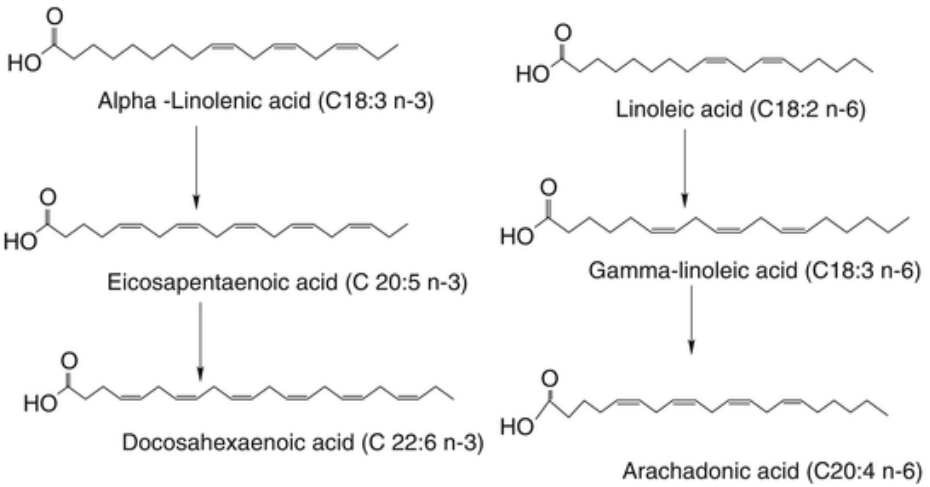
Oryzanol

Polyphenols

Medium Chain Triglycerides

Omega 3 Fatty acids

Omega 6 Fatty acids

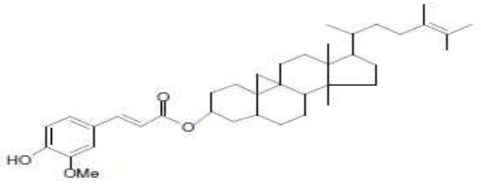


These compounds act as bioactive compounds

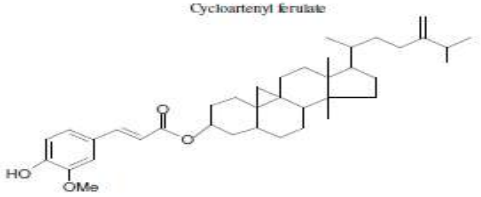
Oryzanol

Source – Rice Bran Oil

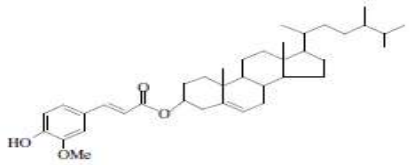
Chemical Structure - It is a mixture of ferulic acid esters of sterol and triterpene alcohols.



Cycloartenyl ferulate



24 methylene Cycloartanyl ferulate



Campesteryl ferulate

Scheme 1—Shows cycloartenyl ferulate, 24-methylenecycloartanyl ferulate and campesteryl ferulate the three major components

Nutraceutical Property –

✓Antioxidant Property

✓Effects on Cholesterol

Mechanism of Action

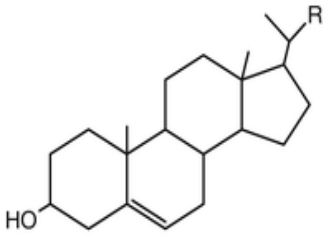
Gamma-oryzanol found in rice bran oil is also a potent antioxidant. Antioxidants serve to deactivate certain particles called free radicals. Free radicals are the natural by-products of many oxidative metabolic processes within cells. These free radicals can cause damage to cell walls, certain cell structures.

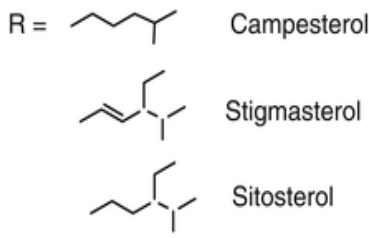
Rice bran oil (RBO) has the property of lowering low density lipoprotein cholesterol and total serum cholesterol - and increasing the high density lipoprotein cholesterol to some extent either by influencing absorption of dietary cholesterol or by enhancing the conversion of cholesterol to faecal bile acids and sterols.

And other functional properties such as protecting body from carcinogenic effects.

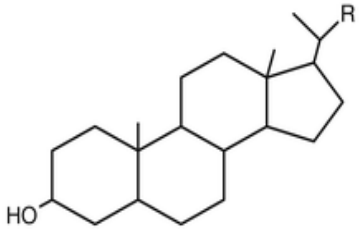
Phytosterol/ stanol

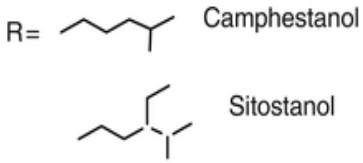
Source – present in varying proportion in different oil (refer table in next slide)





Chemical Structure - A phytosterol is a plant compound that has resemblance to cholesterol.





Nutraceutical Property –

✓Hypo-cholesterolemic effect

✓Antioxidant Effect

✓Anti-inflammatory Effect

Mechanism of Action:

Studies have shown that phytosterol compete for absorption with cholesterol in the digestive tract.

They while preventing the absorption of regular dietary cholesterol, are themselves not easily absorbed, leading to a total lower cholesterol level.

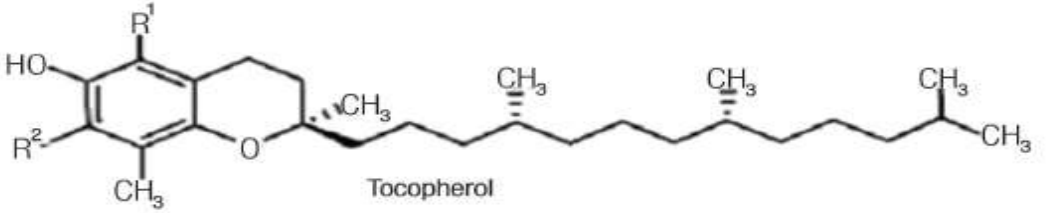
It is a known fact that lowers cholesterol lead to other benefits, such as a reduced risk for heart disease, stroke and heart attacks

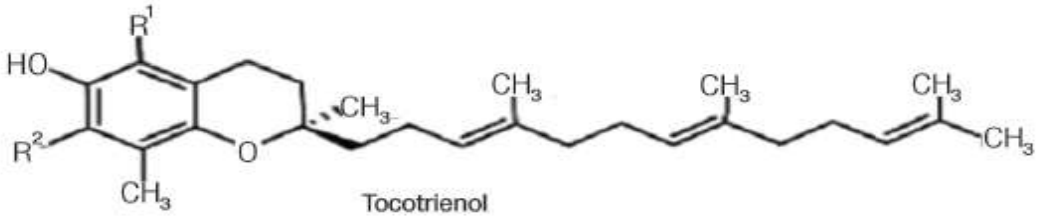
Phytosterol

No.	Phytosterol food sources	Total phytosterols content (mg/100g)	
		Aparna., *et al.* 2011 [6]	Gupta., *et al.* 2011 [5]
	Oils and fats		
1.	Coconut oil	91	NR
2.	Corn oil	952	909
3.	Cottonseed oil	327	NR
4.	Flax seed oil	338	NR
5.	Olive oil	176	300
6.	Palm oil	49	NR
7.	Peanut oil	206	NR
8.	Rapeseed oil	NR	668
9.	Rice bran oil	1055	NR
10.	Sesame oil	NR	411
11.	Soybean oil	221	320
12.	Sunflower	NR	400
13.	Wheat germ oil	553	919

Vitamin E

Eight naturally occurring forms of vitamin E; namely, the alpha, beta, gamma and delta classes of tocopherol and tocotrienol, which are synthesised by plants from homogentisic acid.





R^1	R^2	
CH_3	CH_3	α
CH_3	H	β
H	CH_3	γ
H	H	δ

Functional Properties:

Prevent oxidative stress

Protection of cell membrane

Improve the cardiovascular function

I. $ROO\bullet + \alpha\text{-}TOH \longrightarrow ROOH + \alpha\text{-}TO\bullet$

II. $\alpha\text{-}TO\bullet + CoQ_{10}H_2 \longrightarrow \alpha\text{-}TOH + CoQH\bullet$

$CoQH\bullet \xrightarrow{\text{second electron}} Co\ Q$

II. $ROO\bullet + \alpha\text{-}TO\bullet \longrightarrow$ nonradical products

IV. $\alpha\text{-}TO\bullet + RH\ (PUFA) \longrightarrow \alpha\text{-}TOH + R\bullet$ (Alkyl radical)

$R\bullet + O_2 \longrightarrow ROO\bullet$ (peroxyl radical of PUFA)

Polyphenols

Polyphenol Source: Olive Oil
Wide ranges (50-1000 ppm) have been reported for the levels of total polar phenols in olive oils. Common range is between 100 and 300 ppm.

Hydroxytyrosol (HT) belongs to polyphenols, which are abundant in olives. The **mechanism of action of polyphenols** strongly relates to their antioxidant activity. Polyphenols are known to decrease the level of reactive oxygen species in the human body. Other than that, health-promoting properties of plant polyphenols comprise

anti-inflammatory,

anti-allergic,

anti-atherogenic,

anti-thrombotic, and

anti-mutagenic effects.

Anti- Inflammatory - There is a body of research presenting their ability to modulate the human immune system by affecting the proliferation and activity of white blood cells, as well as the production of cytokines or other factors that participate in the immunological defense.

Medium Chain Triglycerides (MCTs)

Source – Coconut Oil

Chemical Structure – MCTs have 6 -12 carbon atoms (Caproic Acid (C6), Caprylic Acid (C8), Capric Acid (C10), Lauric Acid (C12)

Nutraceutical Property –

✓Instant Source of Energy
✓Weight Management
✓Support Cognitive Function

Mechanism of Action:

Medium Chain Triglycerides (MCTs) are smaller in molecular weight they are rapidly oxidized for energy – because, MCFAs are directly absorbed from the intestine and sent straight to the liver to be rapidly metabolized for energy production and do not participate in the biosynthesis and transport of cholesterol.

MCTs get oxidized to ketone bodies and the brain uses these ketone bodies as an alternate to glucose for energy. Ketones activate BDNF which is the key neurochemical responsible for the growth of neurons (brain cells) and maintenance of neural connections which is fundamental for all brain functions. **Hence the claim "supports cognition".**

Dietary Recommendations

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS

FAO/ WHO/ NIN/ AHA Guidelines

American Heart Association®

Total Fat calories between 15% to 30% (invisible + visible)

World Health Organization

NIN National Institute of Nutrition

Nutrient	RDA
Saturated Fatty Acid (SFA)	<10%
Polyunsaturated Fatty Acid (PUFA)	8-10%
Monounsaturated Fatty Acid (MUFA) n-3 PUFA	By difference 0.6-2%

This guideline is with regard to fat intake for the entire day and NOT just visible fats (through any oils or fat (ghee/ butter etc.))

Limit on saturate is recommended since High SFA is associated with TFA.

WHO GLOBAL ACTION PLAN 2013-2020

39. Such policies and programmes should include a monitoring and evaluation plan and would aim to:

- → Promote and support exclusive breastfeeding for the first six months of life, continued breastfeeding until two years old and beyond and adequate and timely complementary feeding.
- → Implement WHO's set of recommendations on the marketing of foods and non-alcoholic beverages to children, including mechanisms for monitoring.
- → Develop guidelines, recommendations or policy measures that engage different relevant sectors, such as food producers and processors, and other relevant commercial operators, as well as consumers, to:
  - Reduce the level of salt/sodium added to food (prepared or processed).
  - Increase availability, affordability and consumption of fruit and vegetables.
  - Reduce saturated fatty acids in food and replace them with unsaturated fatty acids.

According to the recent WHO action plan states :

-The requirement of reducing saturated fatty acid and

- Replacing with mono-unsaturated fatty acid and poly-unsaturated fatty acid

Most oils are not close to the NIN recommendations

Scientifically, the proven method to obtain best of fatty acid is either by oil rotation or blend of oils.

And

Current NIN guidelines suggest that one should use a

correct combination

OR

a blend of 2 or more vegetable oils

to achieve intake of all kinds of fatty acids

Intent of Blending

Sometimes Blending is misinterpreted with other terms such as adulteration.

But,
The intent of blending is to cater the consumer the nutrition of 2 or more food

Therefore, blending is also the part of all food sectors including edible oil

Ex. 1) Mix fruit Juices 2) Mix fruit jams 3) Multi grain atta 4) Blending of tea Powder 5) Blended Edible Vegetable Oil

Benefits of Blending – in case of Oil

- **NIN recommends** avoid excess intake of any one group of fatty acids & to obtain right amount of different fatty acids in the diet
- **However, single oils** have their own set of unique non-glyceride component (ex: rice bran oil has oryzanol and olive oils have polyphenols)
- Hence, blend of 2 or more vegetable oils is recommended in order to get all the fatty acids in a balance & synergy of minor non glycoside component

Benefits of Blending

Is Blending really a best alternative for obtaining maximum benefit from oil ???

Let's see from three different angles

Nutrition of 2 oils
Better balance of saturated to unsaturated fatty acids than single oil.
Benefits of minor non-glyceride components

- Scientific solution to oil rotation
- Convenient alternative to oil rotation
-Improved sensorial/culinary attributes (taste, aroma)
- Better Frying medium
- Improved shelf life

HEALTH

Synergy between minor components helps to maintain better health

Oil Fortification

FORTIFIED
SAMPOORNA POSHAN
SWASTH JEEVAN

Blending is one way to improve its nutritional profile

In addition to this,
Another preferred way to improve nutrition of population –
FORTIFICATION OF EDIBLE OIL

35-60 million people suffer from Vitamin A Deficiency in India.
Vitamin D deficiency affects 70-90% of our population.

FSSAI Fortification Standards for Vegetable Oil

Vegetable Oil shall be fortified with the following micronutrients, at the level given in the table below:

S. No.	Nutrients	Minimum level of Nutrient	Source of Nutrient
1.	Vitamin A	6 µg RE - 9.9 µg RE per gm of oil	Retinyl Acetate or Retinyl Palmitate
2.	Vitamin D	0.11 µg- 0.16 µg per gm of oil.	*Cholecalciferol or *Ergocalciferol (*Only from plant Source)

Note: Vitamin A (retinol): 1 IU= 0.3 µg RE (Retinol Equivalent); Vitamin D (Cholecalciferol or Ergocalciferol):1 IU= 0.025 µg

FoSTaC
Food Safety Training & Certification

Swasth Bharat Yatra

Eat Right Mela

Prime Objective is to bring Social and Behavioural change

FORTIFIED
SAMPOORNA POSHAN
SWASTH JEEVAN

fssai

Safe & Nutritious Food
A Shared Responsibility

Eat Right CAMPUS

FOSTAC – Food Safety Training & Certification

Atleast 1 trained and certified person in every licensed FBO

National Level Resource Person (NLRP) or SLRP

⇩

Provide Training to trainers (identified by training partner)

⇩

Trained trainers will be certified to train the personnel from FBOs

- ✓ Network of knowledge dissemination
- ✓ Develop the web of maximizing food safety awareness
- ✓Ensuring food safety across food chain by rendering trainings

MORE THAN 17 COURSES

Safe & Nutritious Food (SNF)

– a bunch of initiatives for behavioural change everywhere and every time

SCHOOL

WORKPLACE

HOSPITAL

HOME

Safe & Nutritious Food

A Shared Responsibility

HOME

RAILWAY TRACK

SERVE SAFE

CLEAN STREET

Eat Right India Movement

Overall Objective is to educate consumer to make smart choices.

It is a collective effort of key stakeholder including industry to develop low fat, salt, sugar products

THODA KAM!!!

Conclusion

✓ Fat is equally important constituent for body, but quantity matters (Fat is not a victim)

✓ Because, excess consumption of even water (beyond recommendation) is not advisable

✓ Nutrition through edible oil can be improved through either oil rotation or blended oil and using fortified oil – to fight against major deficiencies

✓Physical exercise - directly proportional to food i.e excess food $\Longrightarrow$ excess physical workout
Or, avoid excess consumption

Conclusion

PERCIEVE : Make yourself aware of the requirement of changing lifestyle and avoid excess consumption

ADOPT : Change is the first step towards acceptance

PERSEVERENCE : It is not a one day activity.


Thank
you