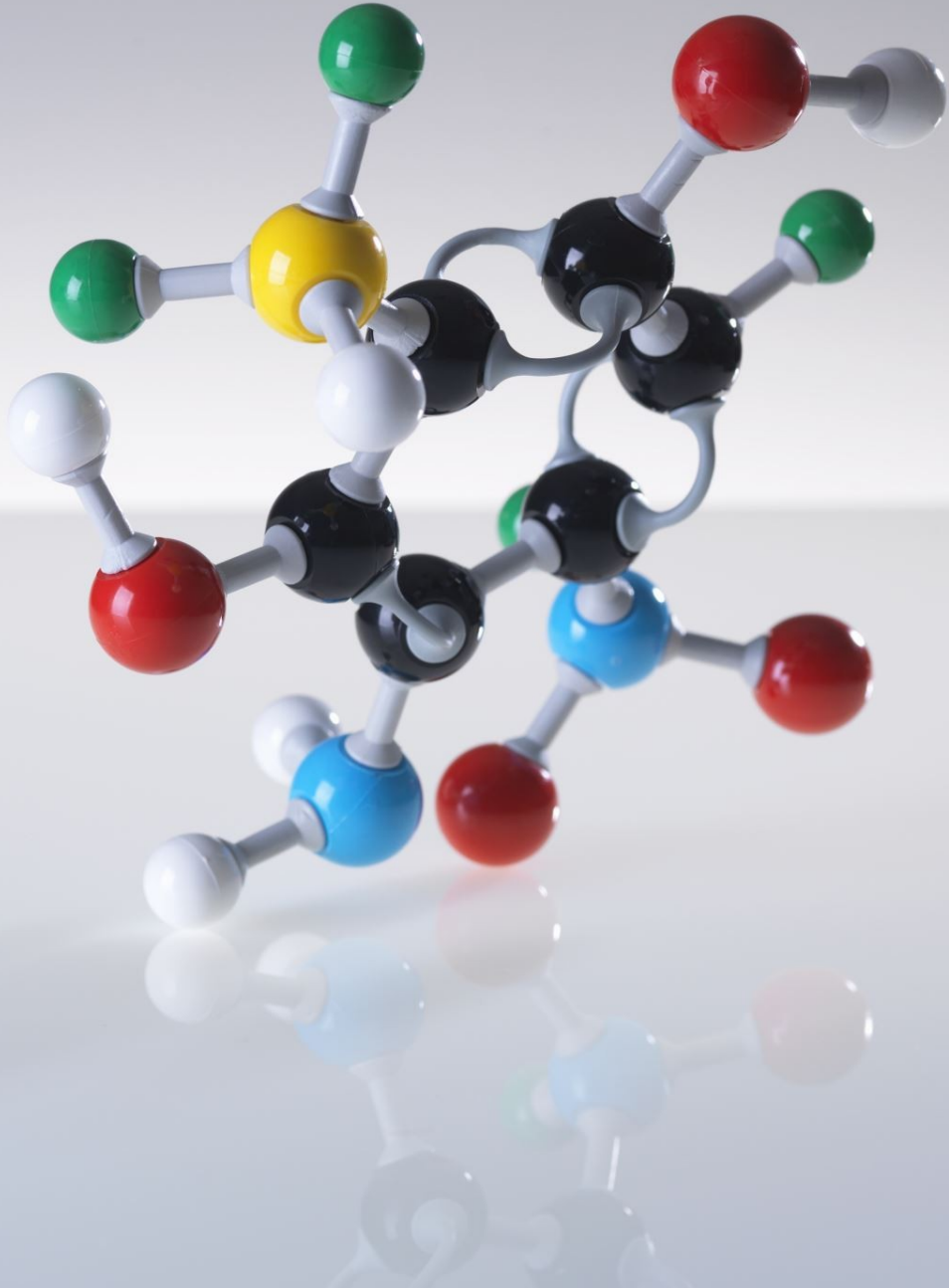


Role of Dietary Fat in Heart Health



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Need for Fat

- Essential Macronutrient
- Contributes 1/5 to 1/3 of energy intake
- Required for absorption of fat-soluble molecules and micronutrients
- Building blocks of brain and nervous system
- Second messengers

Food Sources of Fat

Invisible eg Fat in
Dairy, Meat, Fish etc or
nuts and seeds

Visible – Solid fats eg
Butter, Ghee, Cheese

Liquid Fats eg vegetable
oils

Qualitative differences based on fatty acids

Saturated - Palmitic, Stearic,

Monounsaturated (MUFA)- n9 or Oleic

Polyunsaturated – Omega / n 6 (n6 PUFA)- Linoleic

Polyunsaturated – Omega / n3 (n3 PUFA)- ALNA,DHA,EPA

Partially Hydrogenated *Vegetable Oils- Trans Fat*

Carbon atom chain length – Long , Medium, Short

Cholesterol in diets

- Only from animal sources eg Dairy, Meat, Eggs, Sea Food etc
- Plant sources / Vegetable oils do not naturally contain cholesterol
- Blood Cholesterol levels are not directly related to dietary cholesterol intakes
- Carbohydrate and qualitative differences in fat intakes influence blood LDL Cholesterol levels
- Limiting cholesterol intakes may be needed in diabetics



Triglycerides, Diet and Heart

Triglyceride levels are related to calorie intakes

High levels harden blood vessels and increase risk of heart attacks

Directly related to obesity and metabolic syndrome

To lower
TG levels

Exercise, losing weight; Avoiding high refined carbs, Lower saturated fat,, Avoid trans fat

Increase fish and omega 3 intake

Avoid or reduce alcohol

Fat Requirement for Indians – Current Recommendation

Courtesy : Dr Ahmed Ibrahim PhD.

NIN

Total Fat Requirement

Minimum total fat intakes for adults

- **15%E to ensure adequate consumption of total energy (approx. 33 g)**
- **20%E for women of reproductive age and adults with BMI < 18.5 especially in developing countries**

Maximum total fat intakes for adults

- **30-35%E for most individuals (66g – 77g)**

Recommendations for dietary fat (visible and invisible) intake in Indians

Age/Gender/ physiological groups	Physical activity	Minimum level of Total fat (%E) ^a	Fat from foods other than visible fats ^d %E	Visible fat ^g	
				%E	g/p/d
Adult man	Sedentary	20	10	10	25 (6 tsp)
	Moderate				30
	Heavy				40
Adult Woman	Sedentary	20	10	10	20 (5 tsp)
	Moderate				25
	Heavy				30
	Pregnant women	20	10	10	30
	Lactating women				30
Infants	0 - 6 months	40-60	Human milk		
	7 - 24 months	35 ^b	10 ^c	25	25
Children	3-6 years	25	10	15	25
	7-9 years				30
Boys	10 – 12 years				35
	13 – 15 years				45
	16 – 18 years				50
Girls	10 – 12 years				35
	13 – 15 years				40
	16 – 18 years				35

^a FAO/WHO report, 2008

^b gradually reduce depending on physical activity ^c Human milk/infant formula + complementary foods

^d if higher than 10%E, visible fat requirement proportionately reduces

^g cooking oils, butter, ghee and margarine

infant formulae/milk substitutes should mimic contents of fat and fatty acids in human milk including arachidonic and docosahexaenoic acid.

Fatty Acid composition of common cooking oils/fats (% of total)

Proportion of visible fat

RDA= 1/3

RDA=1/3

RDA=1/3

Oil/Fat	MCT- SAT	SAT	MUFA	N6 PUFA	N3 PUFA
Ghee (butter #)	5 (3)	65(66)	23(22)	2(2)	0.5(0.9)
Coconut oil	59	33	7	2	0
Palm oil	0	44	43	11	0.3
Gingelly (Til)	0	16	43	42	0.4
Peanut oil	0	19	54	27	0
Mustard	0	6	67	15	12
RBO	0	24	44	32	0.6
Safflower	0	9	14	77	0.1
Sunflower	0	11	26	63	0
Soyabean	0	16	24	54	5
Cottonseed	0	28	20	52	0.3
Olive Oil*	0	0	55-83	3-21	<1
Canola@ (Rape seed)	0	<7	60	20	10

#BMJopen;2016

* Hernandez et al ;Front Plant Sci 2021

@Barthet VJ;Encyclopedia of Food Grains,2016

Rounded off values IFCT 2017

Key messages

- **Minimum intake of visible fats (vegetable oils/butter/ghee/vanaspati) for Indian adults range between 25-50gm/d/p .**
- **Single vegetable oil does not ensure optimal intake of fatty acids and balance of n-6 and n-3 PUFA. Hence ICMR-NIN recommends to use two or more vegetable oils.**
- **Non-vegetarians should prefer non-fried oily fish (200gms of salmon, sardines, mackerel, tuna etc per week).**
- **Include nuts (unsalted) such as almonds, walnuts, hazelnuts, pistachios and n-3 PUFA rich oil seeds such as chia seed and flax seed.**
- **Avoid using Vanaspati as the cooking medium and limit the intake of processed foods containing *trans* fats**

Quantities of selected foods which provide 0.1gm ALA (n-3 PUFA)

Sources	gm
Cereal/Millet	
Wheat & pearl millet (Bajara)	70
Pulses	
Blackgram, Rajmah & Cowpea	20
Vegetables	
Green leafy	60
Purslane (lunia)	25
Other vegetables	400
Fruits	
Raspberry	80
Avocado	90
Guava	100
Strawberry	155
Kiwi	240

Sources	gm
Spices	
Fenugreek seed (Methi)	5
Mustard seed	2
Nuts	
Walnut	1.2
Unconventional oil seeds	
Flax seed (alsi)	0.5
Perilla seed (Bhanjira)	0.5

Dietary Fat and Risk of Cardiovascular Disease

The Evidence

Does the amount of total fat consumed relate to risk of CVD ?

Reference: [Lipids Health Dis.](#) 2019; 18: 91.

Published online 2019 Apr 6. doi: [10.1186/s12944-019-1035-2](https://doi.org/10.1186/s12944-019-1035-2)

PMCID: PMC6451787

PMID: [30954077](https://pubmed.ncbi.nlm.nih.gov/30954077/) 

Dietary total fat, fatty acids intake, and risk of cardiovascular disease: a dose-response meta-analysis of cohort studies

[Yongjian Zhu](#),^{#1} [Yacong Bo](#),^{#2,3} and [Yanhua Liu](#)

Findings and conclusions

No association was observed between total fat, and risk of CVDs.

Subgroup analysis found a cardio-protective effect of PUFA in the studies that has been followed up more than 10 years [0.95(0.91–0.99), $I^2 = 62.4\%$].

Dose-response analysis suggested that the risk of CVDs increased 16% [1.16 (1.07–1.25), $P_{\text{linearity}} = 0.033$] for an increment of 2% energy/day of TFA intake.

Dairy Foods (other than Butter/ Ghee) intake and risk of CVD

- Guideline: **Choose low fat dairy foods (double toned milk with fat content <1.5%) or curd prepared from such milk.**
- Moderate dairy consumption up to 200g / day globally has no detrimental effects on Cardiovascular health and their effect depends more on food type (cheese, yoghurt, milk) **than their fat content**
- **Yoghurt > 200 g/day or cheese up to 50g/day was associated with a lower CVD risk**
- **Giosue et al (2022); Consumption of Dairy Foods and Cardiovascular Disease: A systematic Review; Nutrients; 14(4)**

Role of Saturated fat in CVD risk (a)

Controversial – may not have any role

Can increase LDL-C and increase risk of heart disease

Upto 10% of calories from Sat fat has no additional risk

Risk higher with Sat fat from meat than Dairy

Association of Sat fat intakes with CVD is lost if corrected for BMI

Role of Saturated fat in CVD risk (b)

- No visible advantage of low-fat dairy over full fat
- Replacing even a small amount of Sat fat with PUFA reduces the risk(Walter Willet HSPH)
- Independent of source of Sat fat coronary artery disease risk not different
- European Society of Cardiology 2021

Harvard School of Public Health(a)

- Higher intake of the most commonly consumed major saturated fatty acids—lauric acid, myristic acid, palmitic acid, and stearic acid—was associated with a 18% increased relative risk of coronary heart disease.
- Replacing just 1% of daily consumption of these fatty acids with equivalent calories from polyunsaturated fats, whole grain carbohydrates, or plant proteins, was estimated to reduce relative coronary heart disease risk by 6%-8%.

“Intakes of Individual Saturated Fatty Acids and Risk of Coronary Heart Disease in Two Large Prospective Cohort Studies of U.S. Men and Women,” Geng Zong, Yanping Li, Anne J. Wanders, Marjan Alsema, Peter L. Zock, Walter C. Willett, Frank B. Hu, and Qi Sun, *BMJ*, online November 23, 2016, doi: 10.1136/bmj.i5796

Effect of Medium chain saturated fatty acids(MCT eg Coconut oil) on blood lipids

- McKenzie et al ; J Nutrition 2021.
- A systematic review and metanalysis of randomized trials
- Conclusions: Does not affect Total Cholesterol , LDL-C or HDL-C but a small increase in TG
- Coconut oil has 60% Medium Chain Saturated Fats

- Replacing palmitic acid—found in palm oil, meat, and dairy fat—was associated with the strongest risk reduction.

•“Intakes of Individual Saturated Fatty Acids and Risk of Coronary Heart Disease in Two Large Prospective Cohort Studies of U.S. Men and Women,” Geng Zong, Yanping Li, Anne J. Wanders, Marjan Alsema, Peter L. Zock, Walter C. Willett, Frank B. Hu, and Qi Sun, *BMJ*, online November 23, 2016, doi: 10.1136/bmj.i5796

Dietary fats and coronary heart disease

- Because both N-6 and N-3 polyunsaturated fatty acids are essential and reduce risk of heart disease, the ratio of N-6 to N-3 is not useful and can be misleading.
- In practice, reducing red meat and dairy products in a food supply and increasing intakes of nuts, fish, soy products and nonhydrogenated vegetable oils will improve the mix of fatty acids and have a beneficial effect on rates of CHD.
- W.C Willet : J Intern Med 2012 Jul;272(1):13-24

Fats & fatty acids in Indian diets: Time for serious introspection

Mean intakes per day	RDA-India ²¹	High-income economies ^{33#}	Low-/middle - income economies ^{33#}	India (rural - NNMB) ²⁴	India (urban women)*	India - urban ³⁴
Energy (kcal)		3400	2550	2300	2140	2325
CHO (%E)	55-70	51	67	71	61	63
Protein (%E)	8-12	12.4	10.5	10	12.5	12.5
Fat (%E)	15-30	36	22.5	19	26	24
SFA (%E)	<10	12.3	13.1	4.5	8.8	7.2
LA (%E)	2.5-9	5.4	4.2	4.9	8.2	6.8
ALNA (%E)	>0.5	0.28	0.22	0.24	0.24	
LC n-3 PUFA (mg/day)	200	335	220	-	20	-

*Unpublished data (personal communication), #Data on dietary intakes categorized into different economies based on the World Bank definitions (<http://data.worldbank.org/country>). PUFA, polyunsaturated fatty acid; LC, long chain; ALNA, alpha-linolenic acid; LA, linoleic acid; SFA, saturated fatty acid; CHO, carbohydrate; NNMB, National Nutrition Monitoring Bureau; RDA, recommended dietary allowance

[Indian J Med Res. 2016 Oct; 144\(4\): 507-514.](#)
[doi: 10.4103/0971-5916.200904](#)
 Indu Mani and Anura V. Kurpad'

In Indian diets(a)

- Sat Fat intakes are low
- Fats are mostly from from ghee, Vegetable oils and Dairy
- Replacing the Sat fat with n 6 makes it pro inflammatory and no advantage

Indian J Med Res. 2016 Oct; 144(4): 507-514.

doi: [10.4103/0971-5916.200904](https://doi.org/10.4103/0971-5916.200904)

[Indu Mani](#) and [Anura V. Kurpad'](#)

In Indian diets(b)

- The balance of n6 to n3 is unfavorable towards n3
- Maintaining ideal body weight and balance of fatty acids with higher n3 intakes are recommended.
- The increased consumption of PUFA-rich oils such as safflower (>70% LA, 0% ALNA) and sunflower (>60% LA, 0% ALNA), at the expense of more traditional oils such as coconut, groundnut and sesame, has resulted in a very skewed ratio of n-6 and n-3 FA.

• Indian J Med Res. 2016 Oct; 144(4): 507–514.

• doi: [10.4103/0971-5916.200904](https://doi.org/10.4103/0971-5916.200904)

• [Indu Mani](#) and [Anura V. Kurpad](#)

In Indian diets

- SFA may not be the main dietary culprit in increasing the risk of obesity, and that it is important to look at other factors such as CHO, and the PUFA, as more likely candidates.

• Indian J Med Res. 2016 Oct; 144(4): 507–514.

• doi:

[10.4103/0971-5916.200904](https://doi.org/10.4103/0971-5916.200904)

• [Indu Mani](#) and [Anura V. Kurpad](#)'

RATIOS OF n6 n3 are probably responsible

- Studies conducted in animals have shown that high LA (n6) diets, especially in combination with a low-fat diet, result in a pro-inflammatory condition resulting in an increased deposition of adipose tissue⁴.

- Alvheim AR, et al. *Obesity (Silver Spring)* 2012, Ailhaud G, et al *Prog Lipid Res.* 2006.

RATIOS OF n6 n3 are probably responsible

- Increased intake of LA (n6) during pregnancy has been found to be associated with an intergenerational cycle of obesity(Muhlhausler BS,et al, *Endocrinol Diabetes Obes.* 2013)
- Indian J Med Res. 2016 Oct; 144(4): 507–514.
- doi: [10.4103/0971-5916.200904](https://doi.org/10.4103/0971-5916.200904)
- [Indu Mani](#) and [Anura V. Kurpad](#)
- Animal studies have shown that low ALNA (n3) intake can result in increased adiposity, thus suggesting that an increased n-6/n-3 ratio could be an emerging risk factor for obesity⁴⁹.



Trans Fats

Must reduce
industrial TFA in the
diet.

Differentiate from
natural sources of
TFA where there is no
evidence of CVD risk.

Pro Inflammatory

Hypercholesterolemia
n=283 (13.9%)

HIGH LDL-C
11.8%

53

32

50

Hypertriglyceridemia
n=602 (29.5%)

158

40

362

Shashank Joshi
et
al :Prevalence
of dyslipidemia
in urban and
rural India: the
ICMR-INDIAB
study, PLoS One,
2014

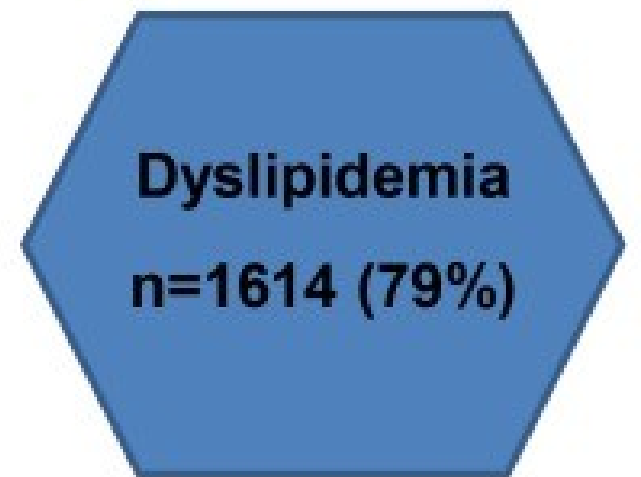
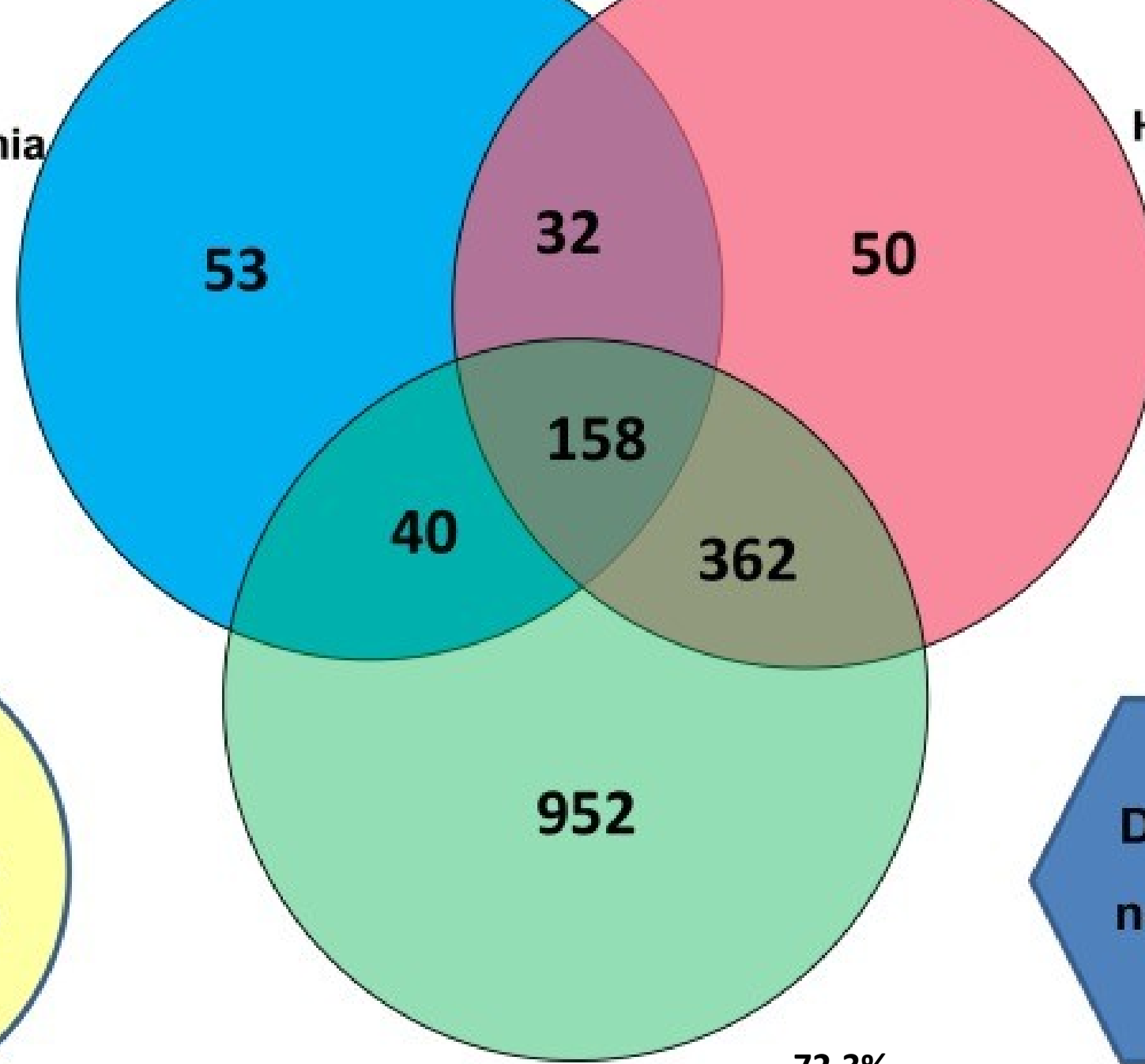
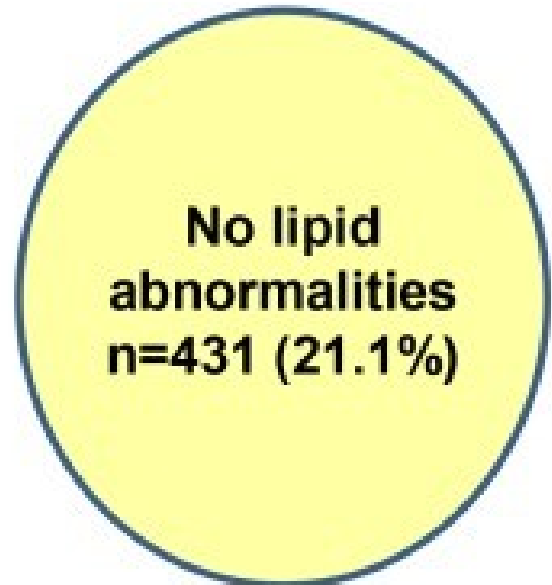
**No lipid
abnormalities**
n=431 (21.1%)

952

Dyslipidemia
n=1614 (79%)

72.3%

Low HDL cholesterol

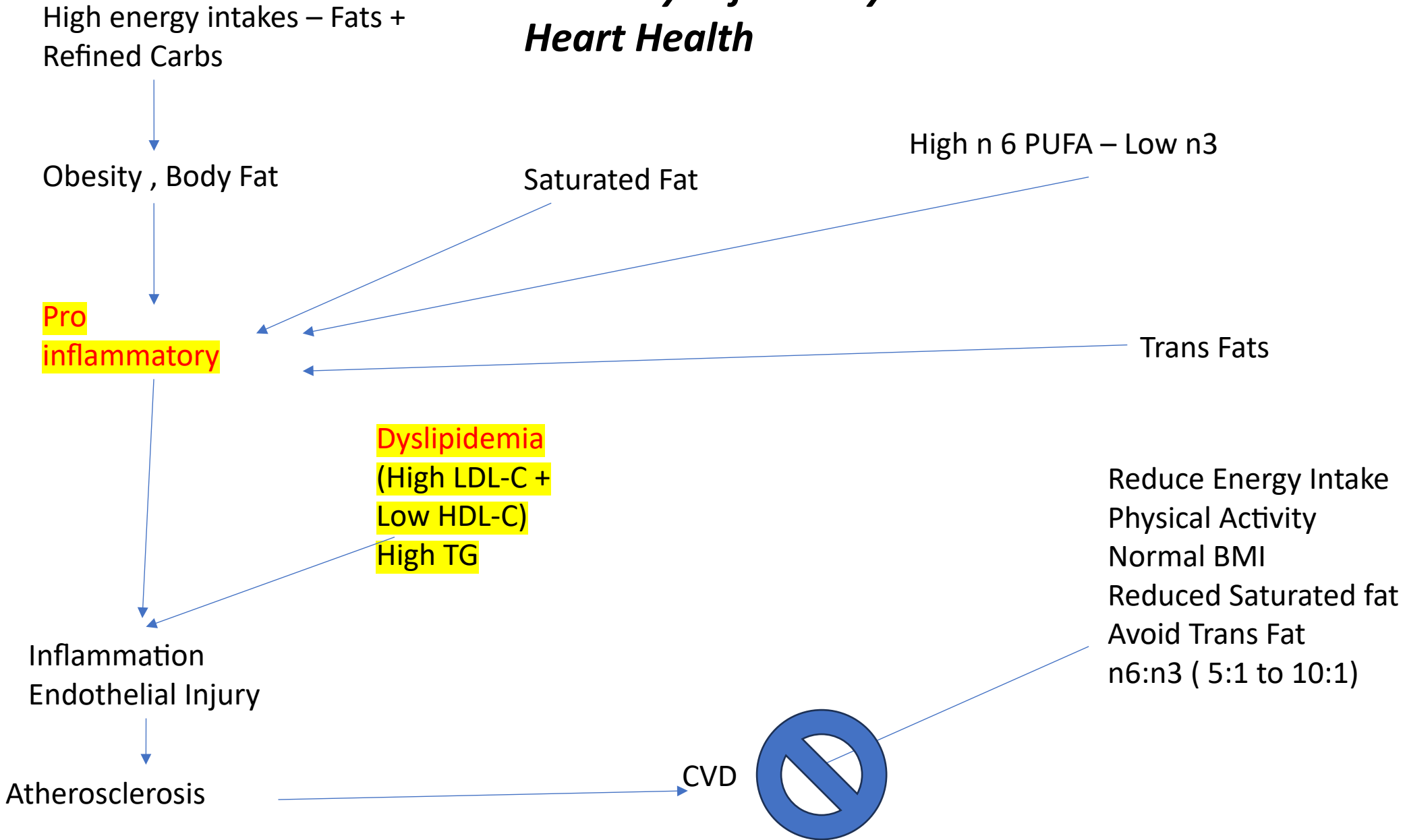


Common significant risk factors for dyslipidemia included obesity, diabetes, and dysglycemia.

Conclusion: The prevalence of dyslipidemia is very high in India, which calls for urgent lifestyle intervention strategies to prevent and manage this important cardiovascular risk factor.

(Shashank Joshi et al :Prevalence of dyslipidemia in urban and rural India: the ICMR-INDIAB study, PLoS One, 2014

Pathways of Dietary Fat to Heart Health



Pro
Inflammatory
markers we
may need to
monitor along
with
lipoproteins to
prevent CV
mortality and
morbidity

- IL6- pro coagulant cytokine
- CRP- Routinely measured
- IL-8 – links obesity with CVD
- Increased Apo B/ApoA1 ratios in MetS
- TNF- α , IL-1 β - Both come down with cruciferous vegetable intakes
- Procalcitonin
- Hs-CRP

Thank You for your attention

