An updated perspective on the role of dietary saturated fat on cardiovascular risk

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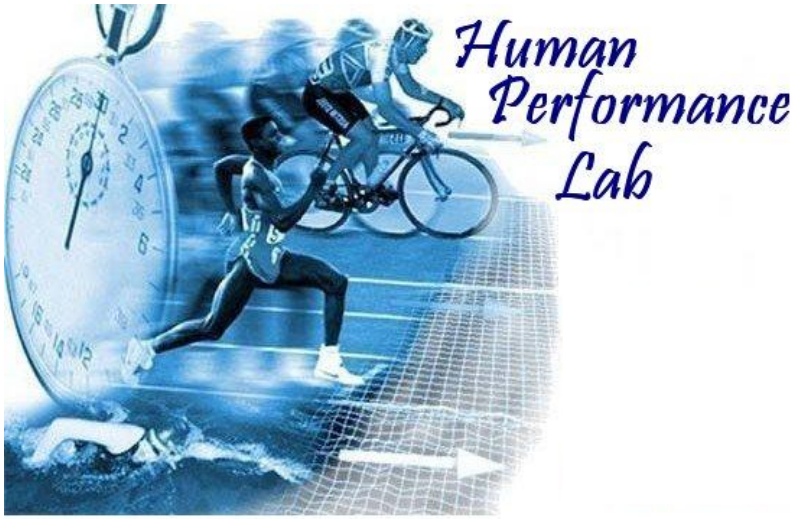
Department of Kinesiology
University of Connecticut
Storrs, CT



Widespread concern about the role of SFA in heart disease: Is it justified?

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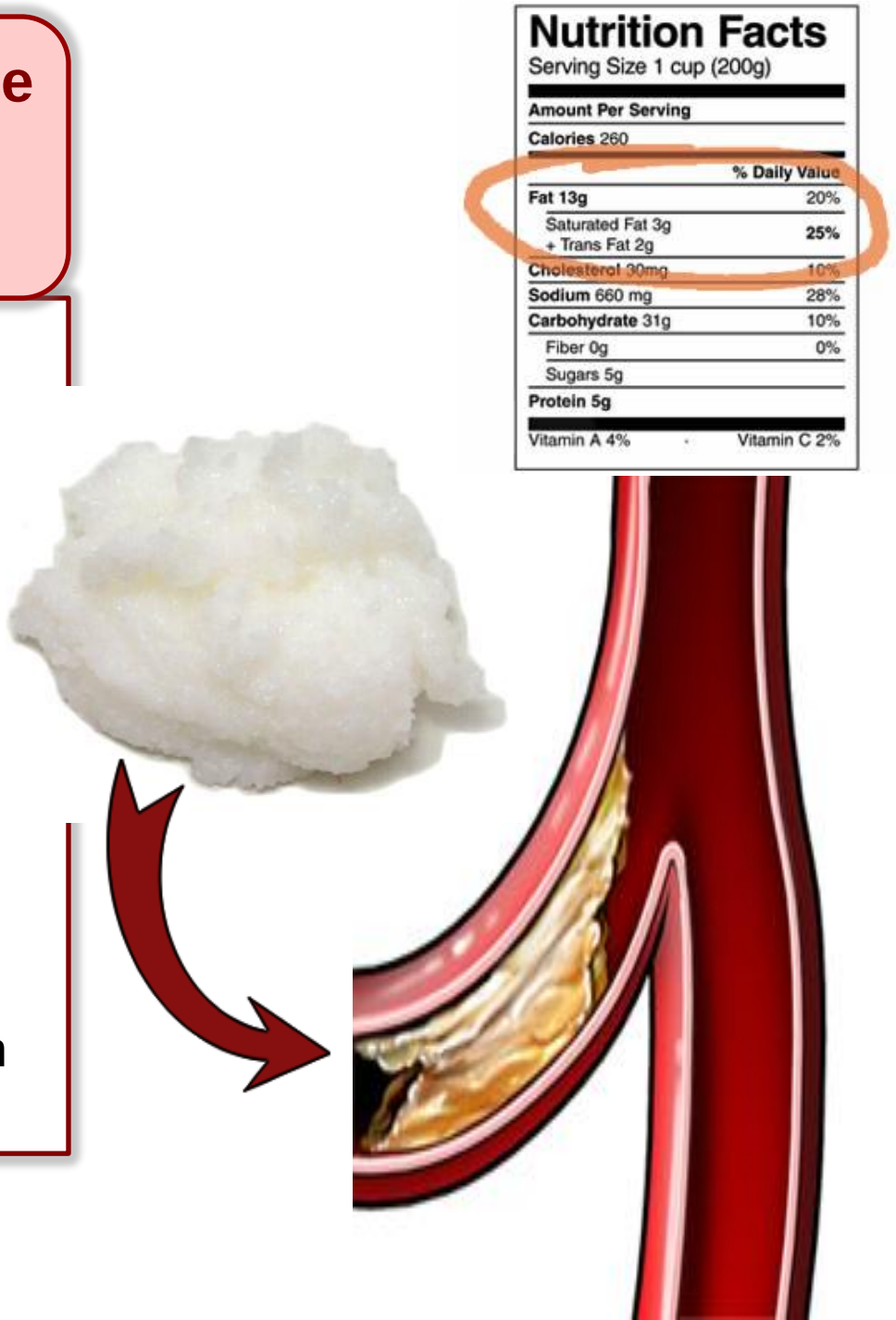


AHA Scientific Statement

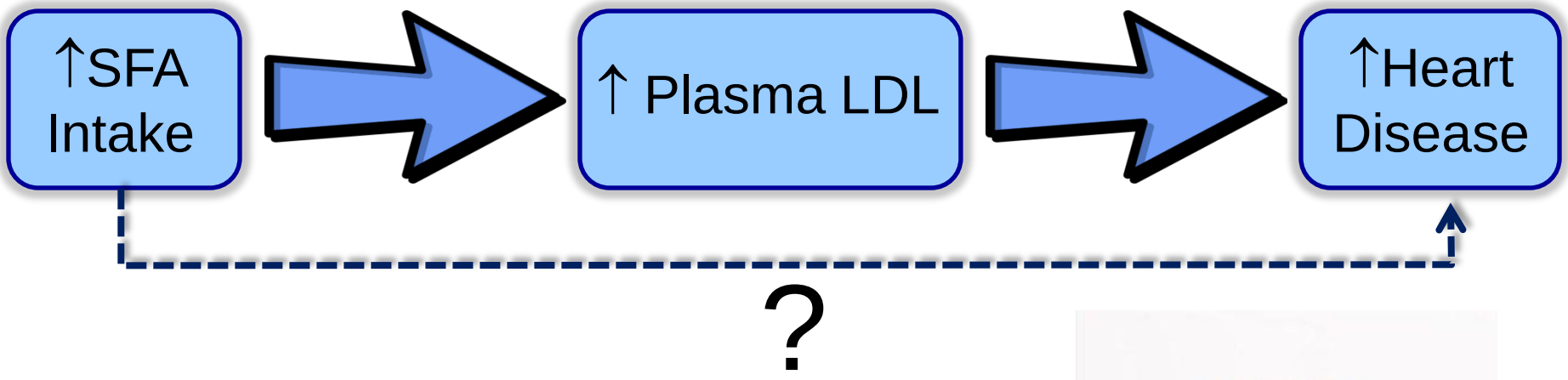
Diet and Lifestyle Recommendations Revision 2006

A Scientific Statement From the American Heart Association Nutrition Committee

"Limit your intake of saturated fat to <7% of energy."

"Diets low in saturated and *trans* fatty acids and cholesterol reduce the risk of CVD, in large part through their effects on LDL cholesterol levels.""

Saturated Fat & the Diet Heart Hypothesis

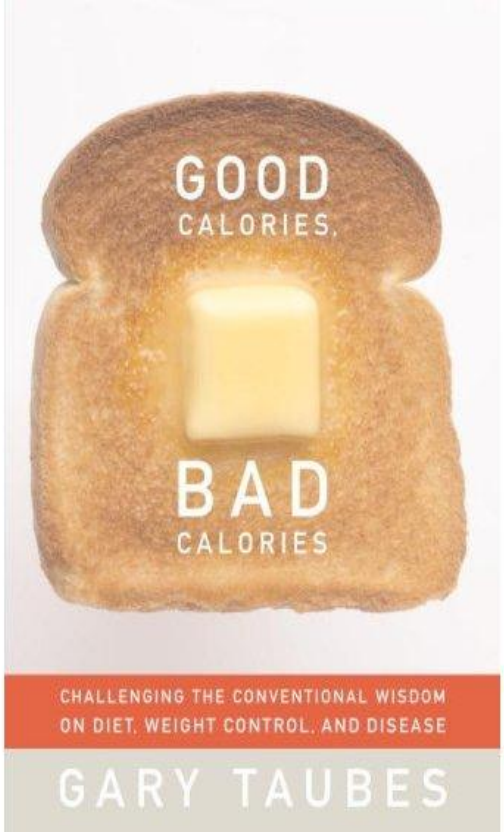


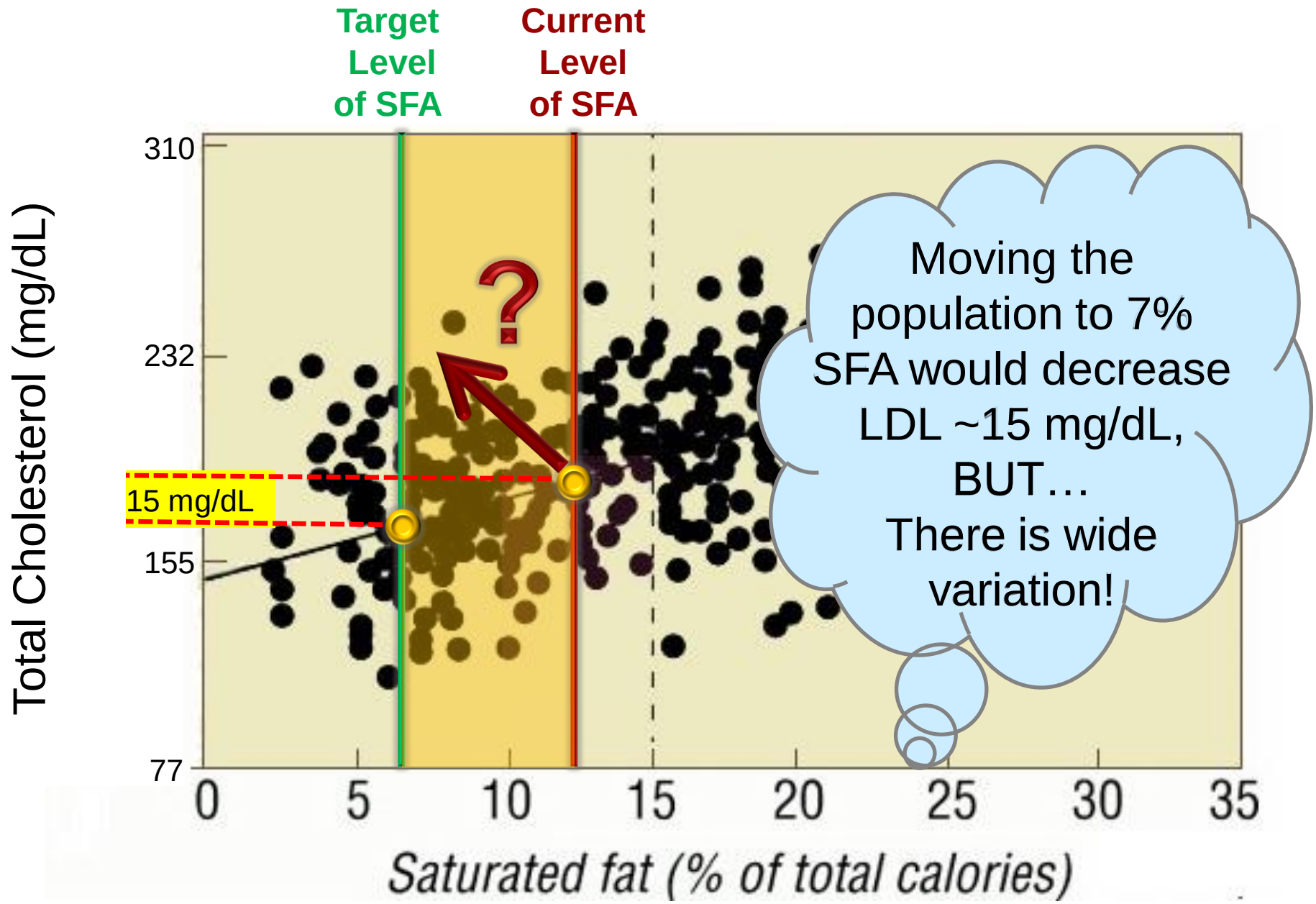
Renowned science writer Gary Taubes

"What if It's All Been a Big Fat Lie?" - 2002

"Good Calories, Bad Calories" - 2007

Provocative articles exposing the lack of quality science behind low-fat diets.





Clarke et al: Dietary lipids and blood cholesterol: quantitative meta-analysis of metabolic ward studies. *BMJ* 1997, 314:112-7.

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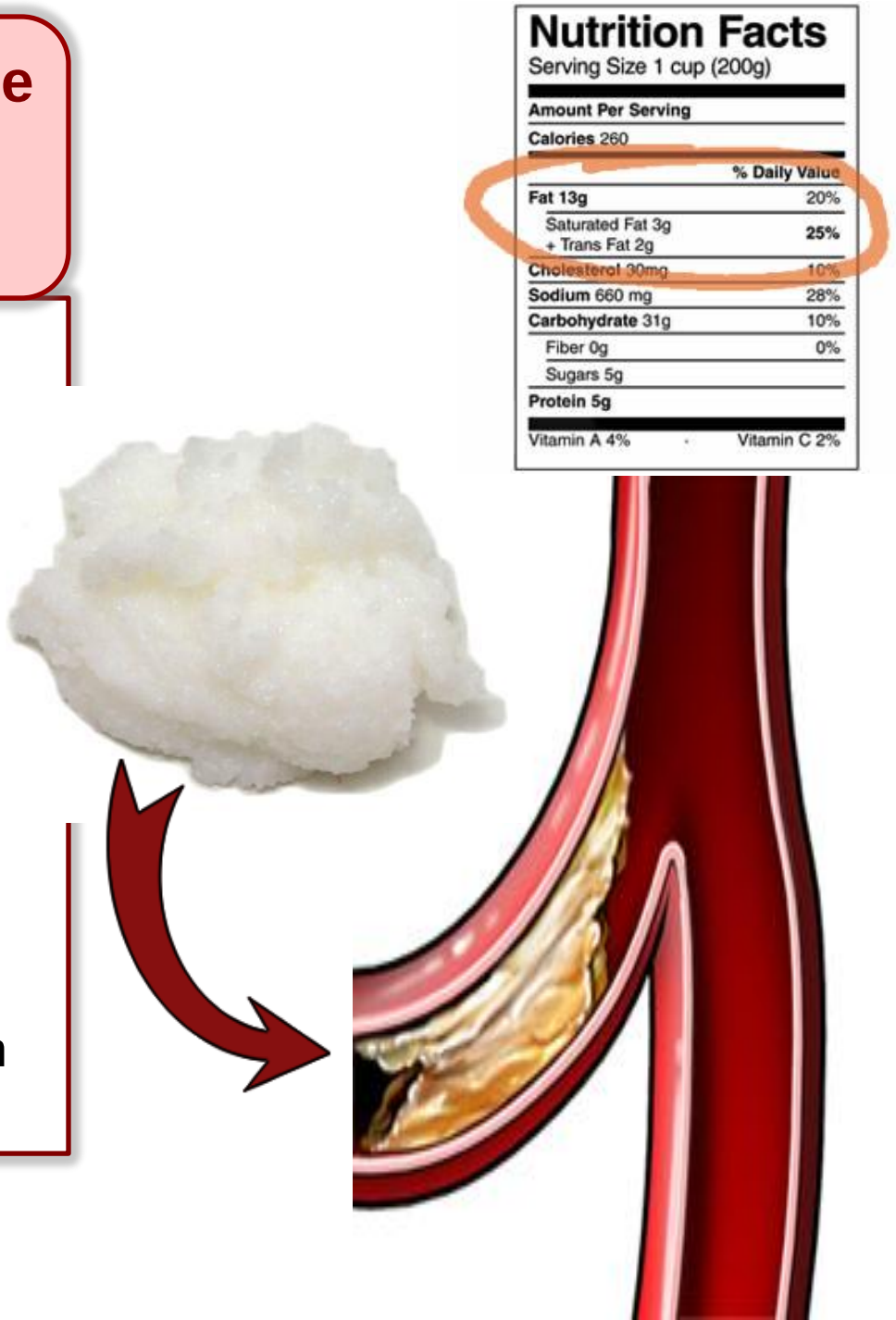
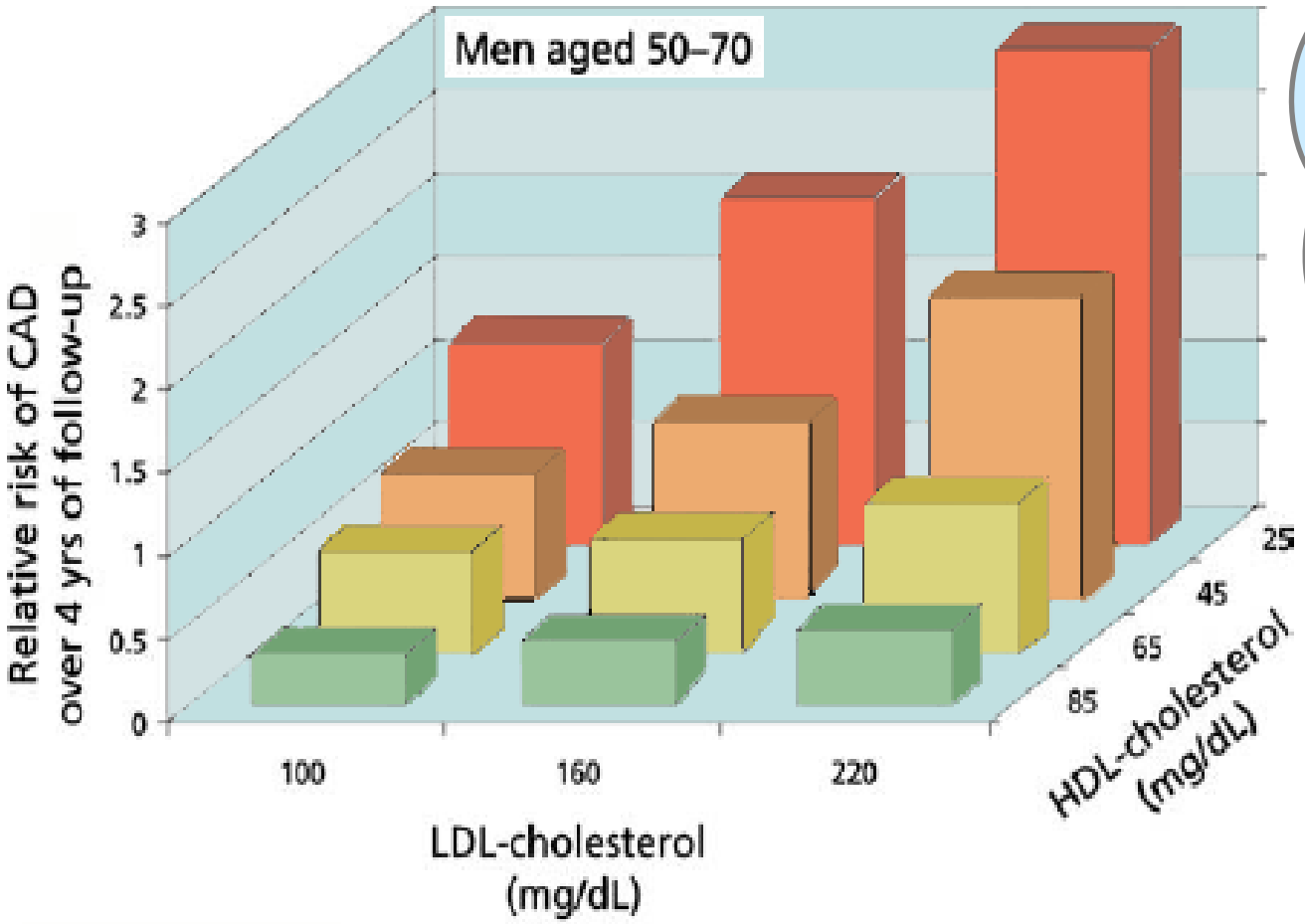
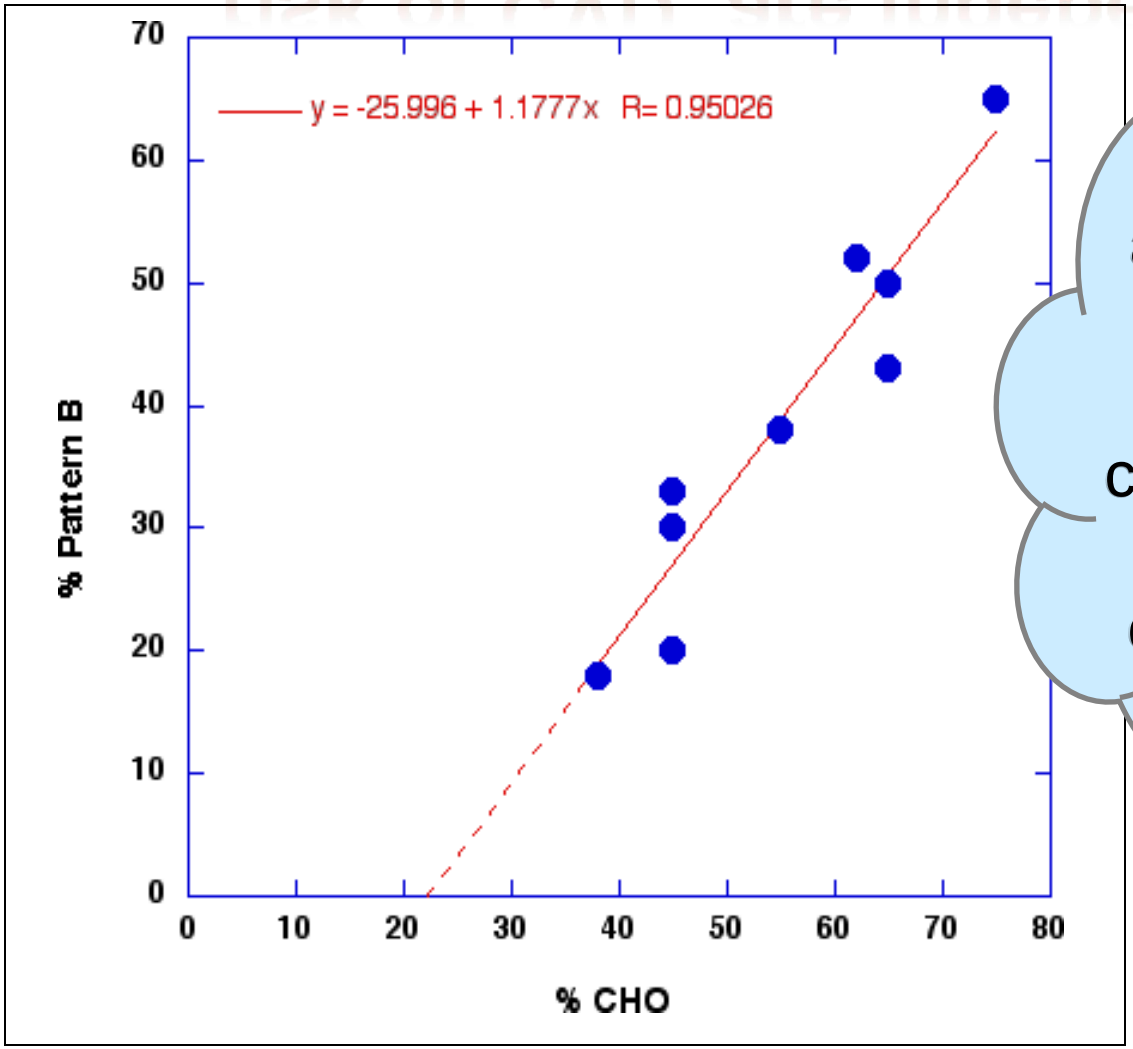




Low HDL stronger risk factor than high LDL (Framingham data)

Metabolic syndrome and pattern B, two highly prevalent conditions that increase risk of CVD, are independent of LDL



Metabolic syndrome and pattern B are both rapidly improved in response to carbohydrate restriction, even in the presence of higher saturated fat.

Krauss RM. Annu Rev Nutr. 21:283-95, 2001

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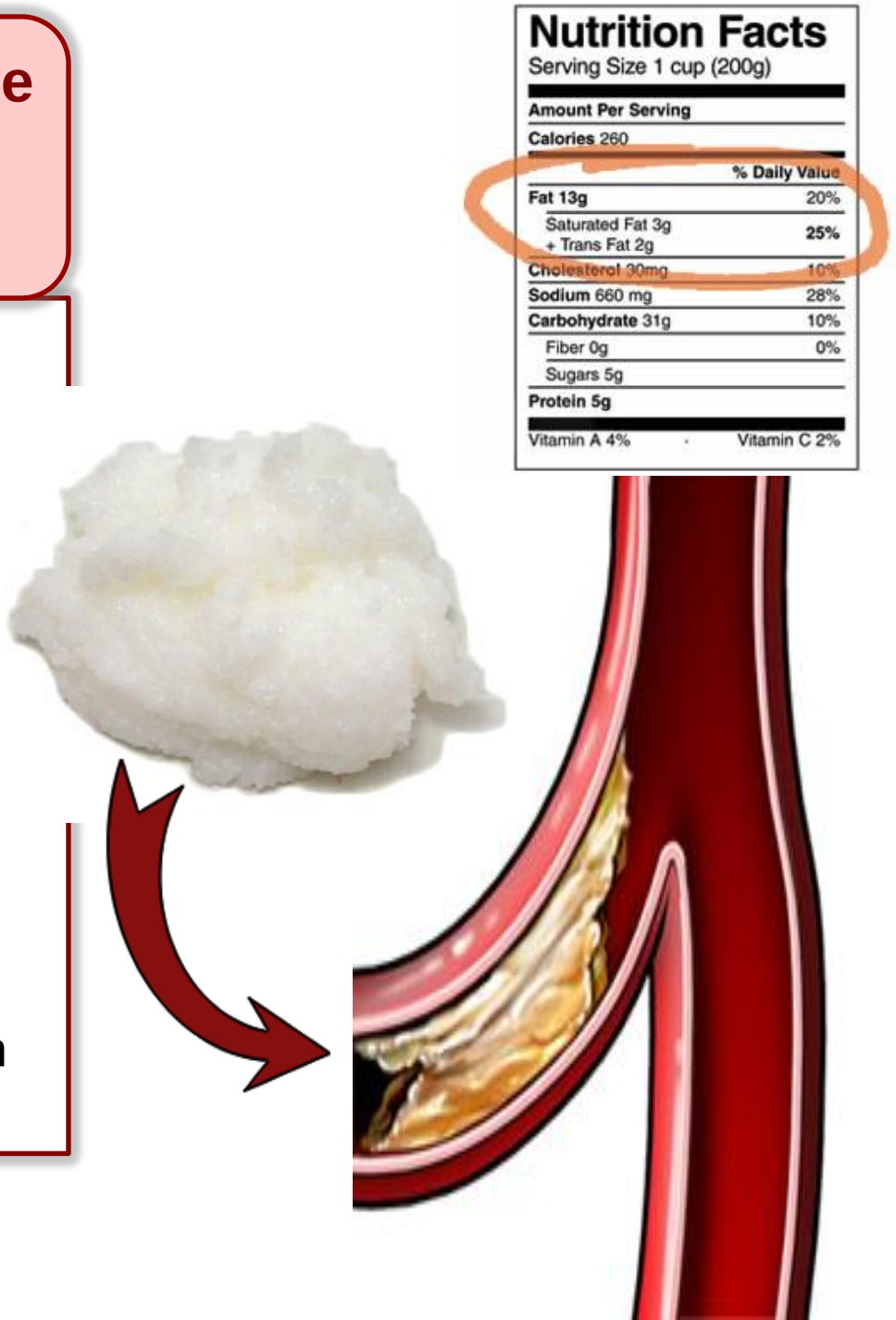
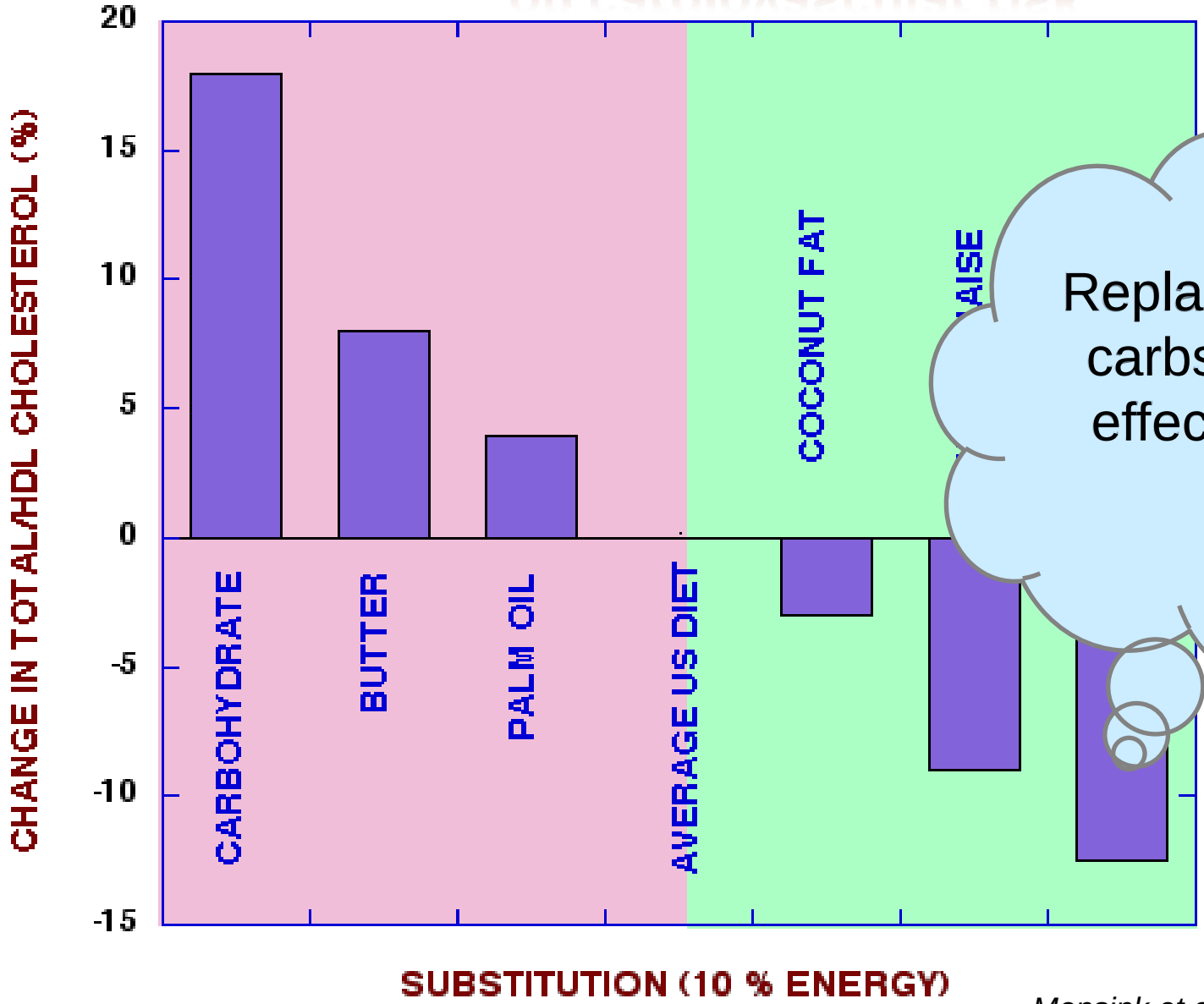


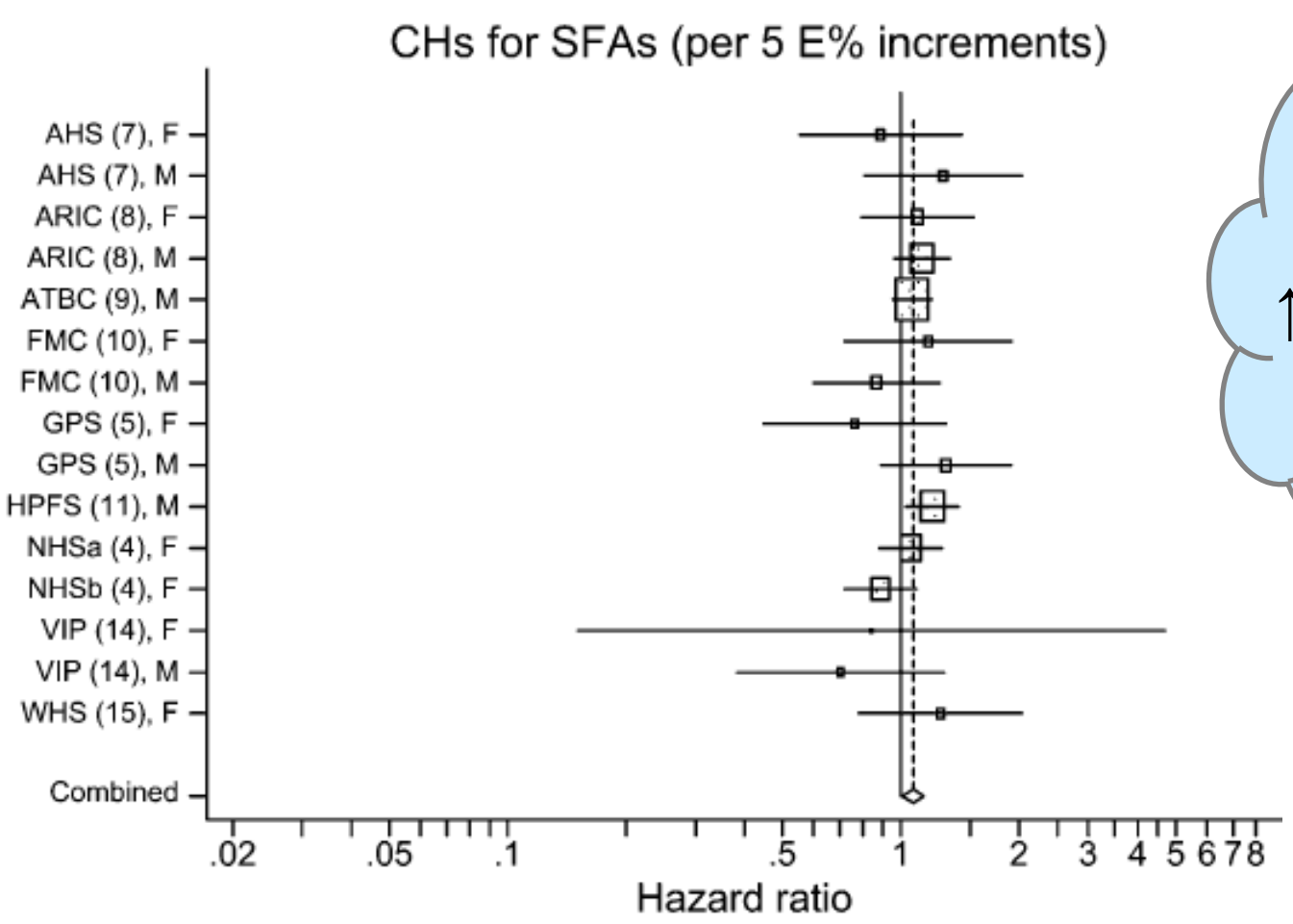
Effects of replacing the average American fat on cardiovascular risk



Replacing fat with carbs adversely effects TC/HDL

Mensink et al. AJCN. 77:1146-55, 2003.

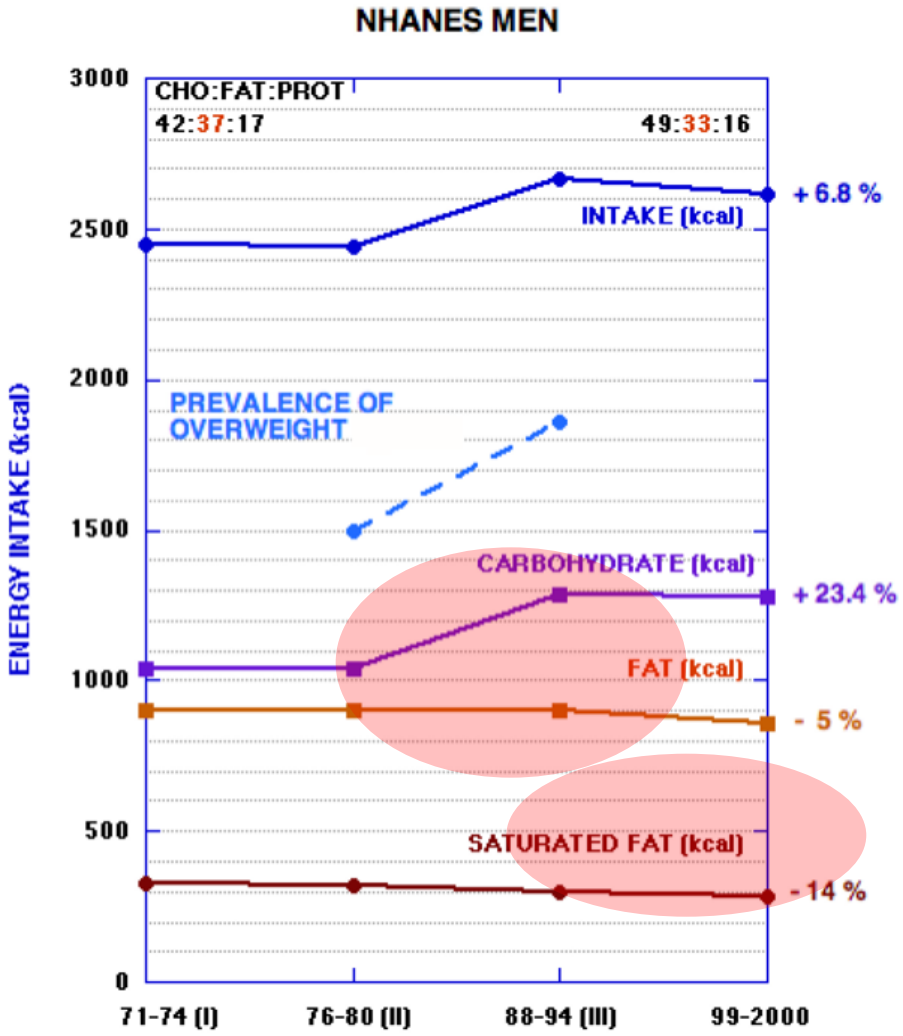
Effects of Decreasing SFA and Replacing it with Carbohydrate



P value, test for heterogeneity=0.51; combined hazard ratio (95% CI)=1.07 (1.01, 1.14)

Replacing 5%en of SFA w/ ***carbs*** *↑ coronary events (HR 1.07)*

Jakobsen et al. AJCN Feb 11 (Epub)



The increase in calories during the obesity & diabetes epidemic was due largely to carbohydrate intake.

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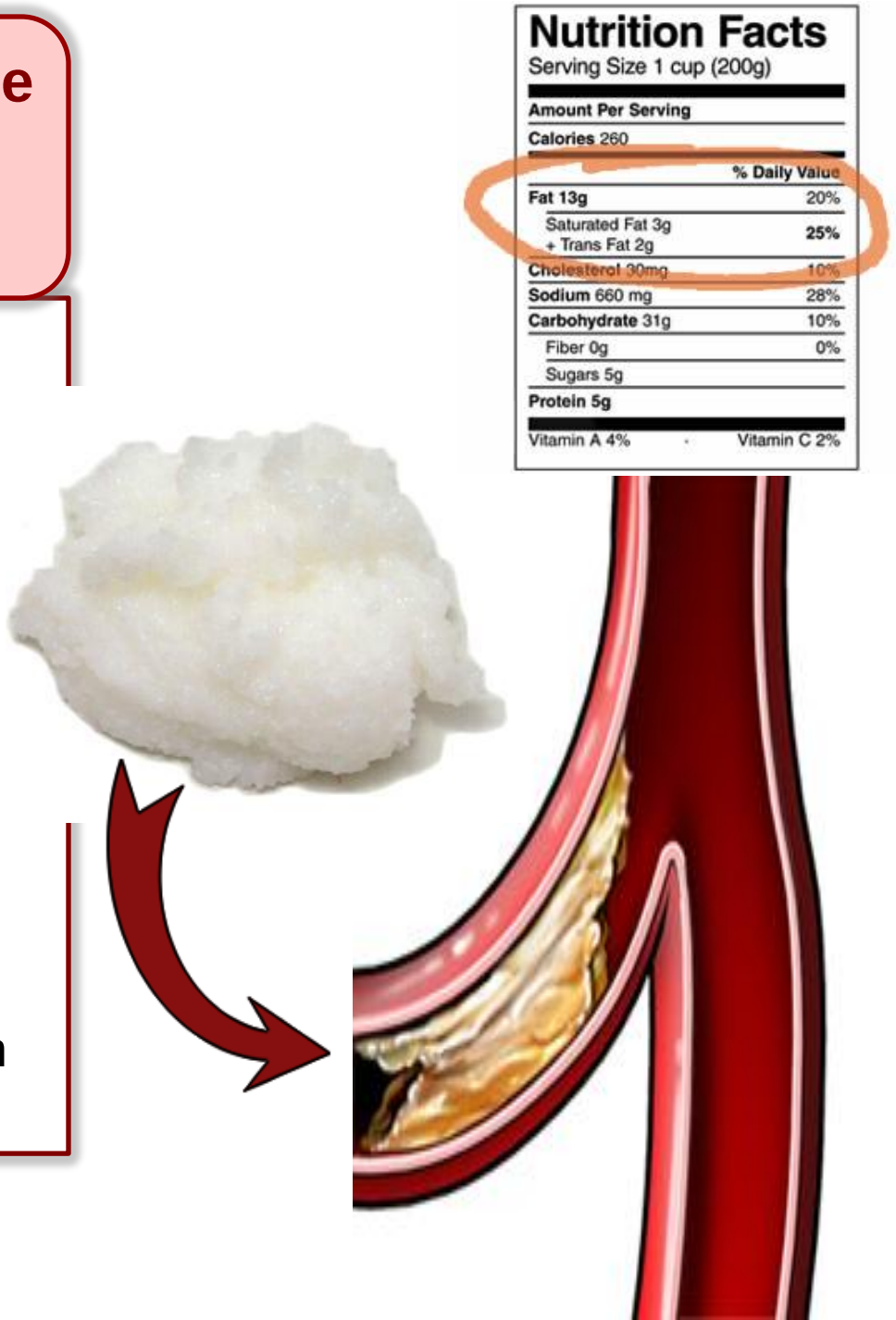
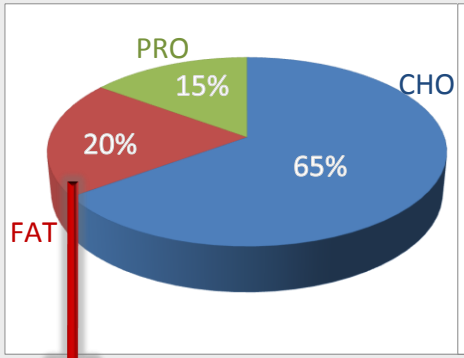
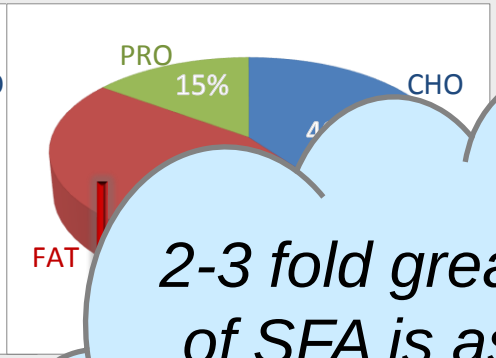


Low Fat

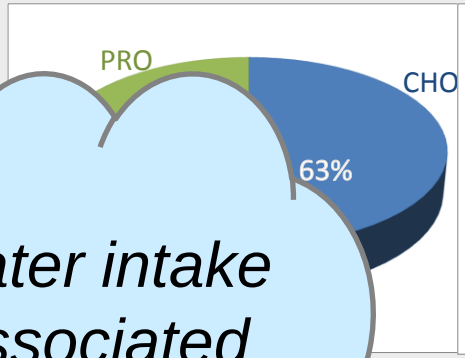


SFA = 7 g

Moderate Fat

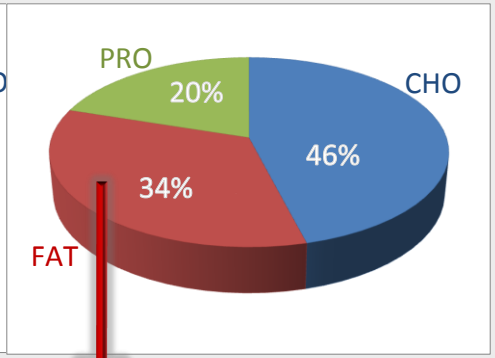


Low Fat



SFA = 33 g

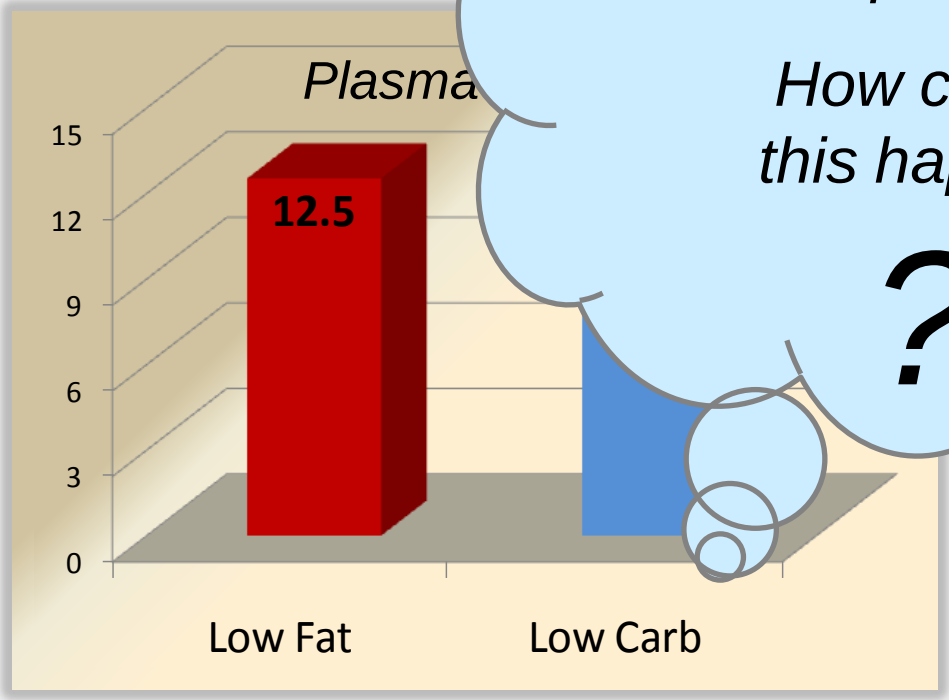
Moderate Fat

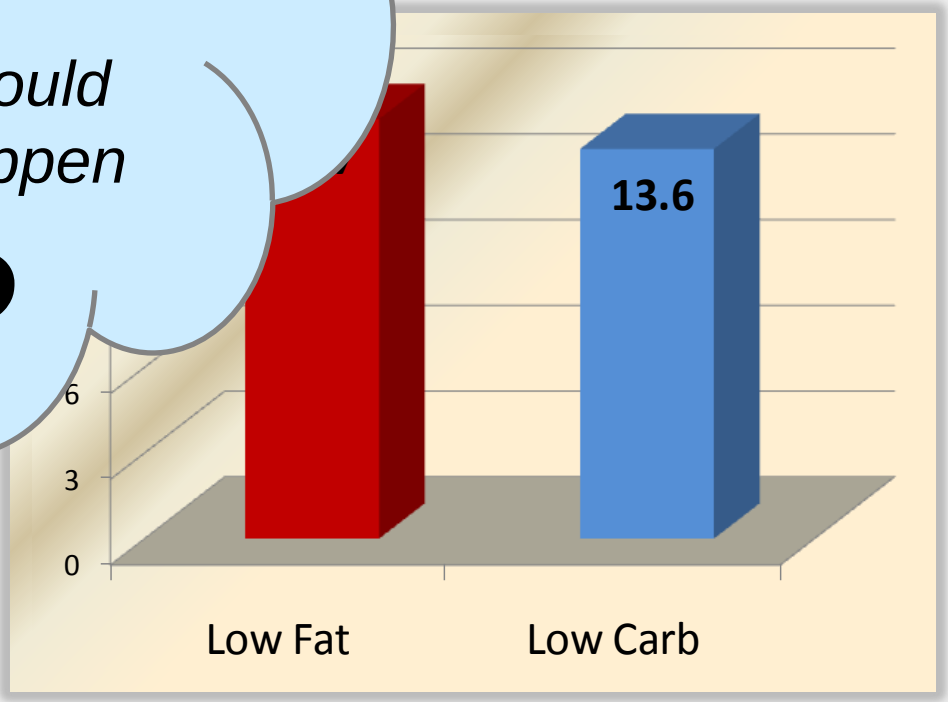


2-3 fold greater intake of SFA is associated with lower plasma SFA…

How could this happen

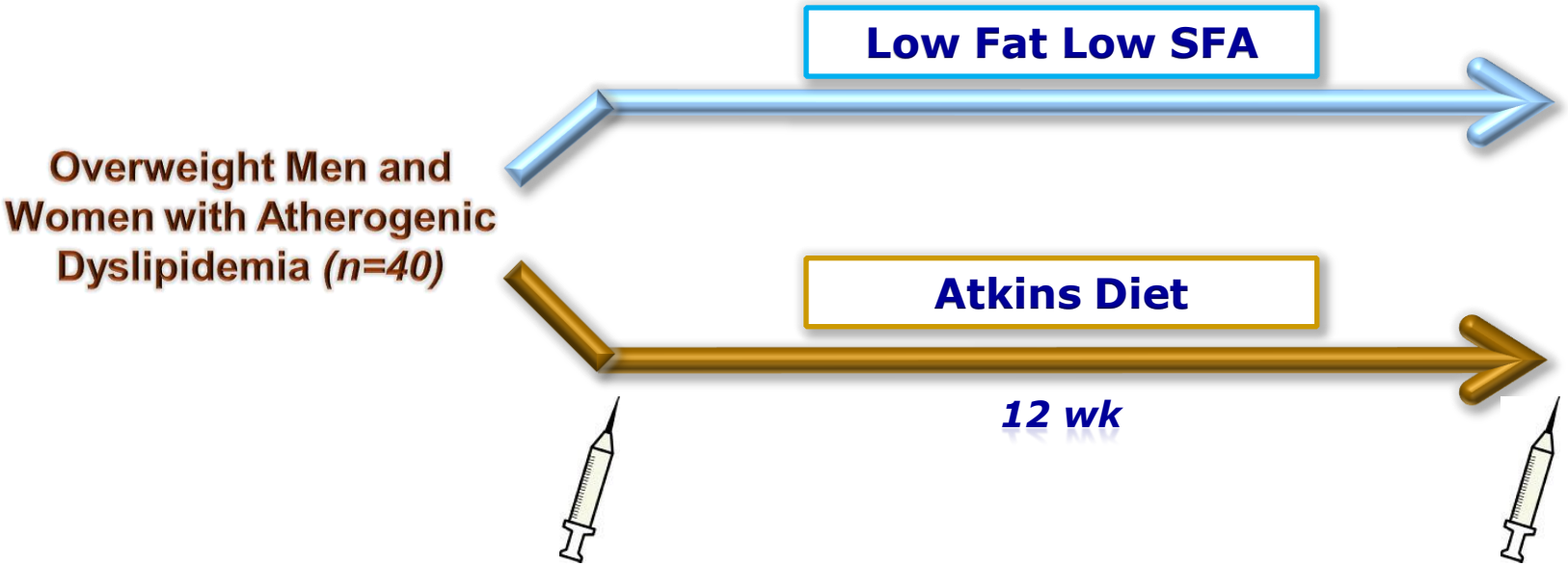
?





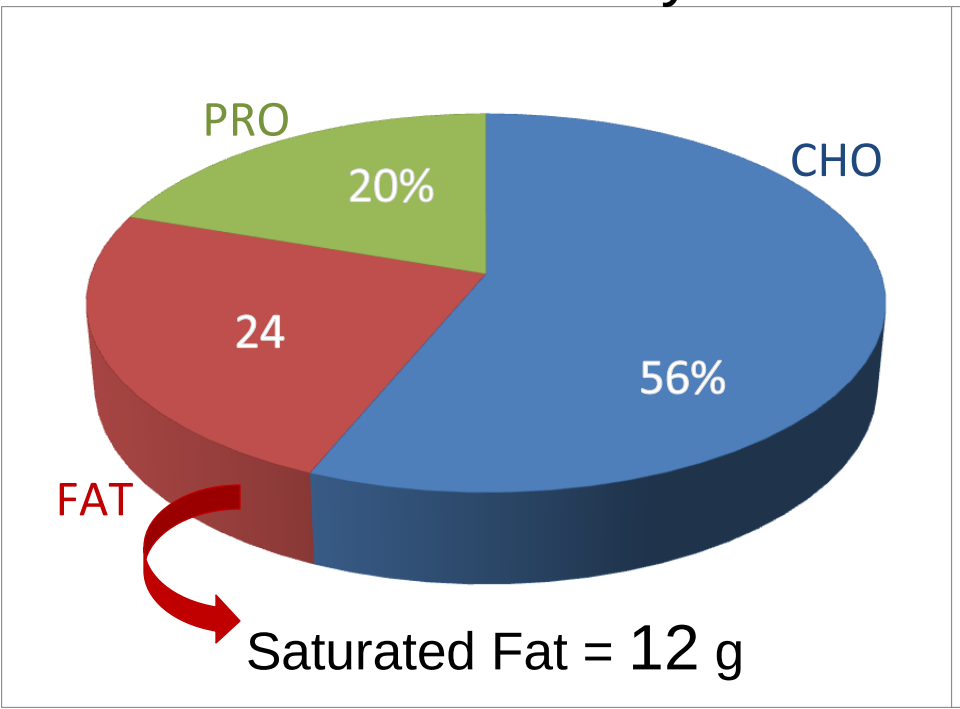
Raatz et al. J Nutr. 131:231-234, 2001.

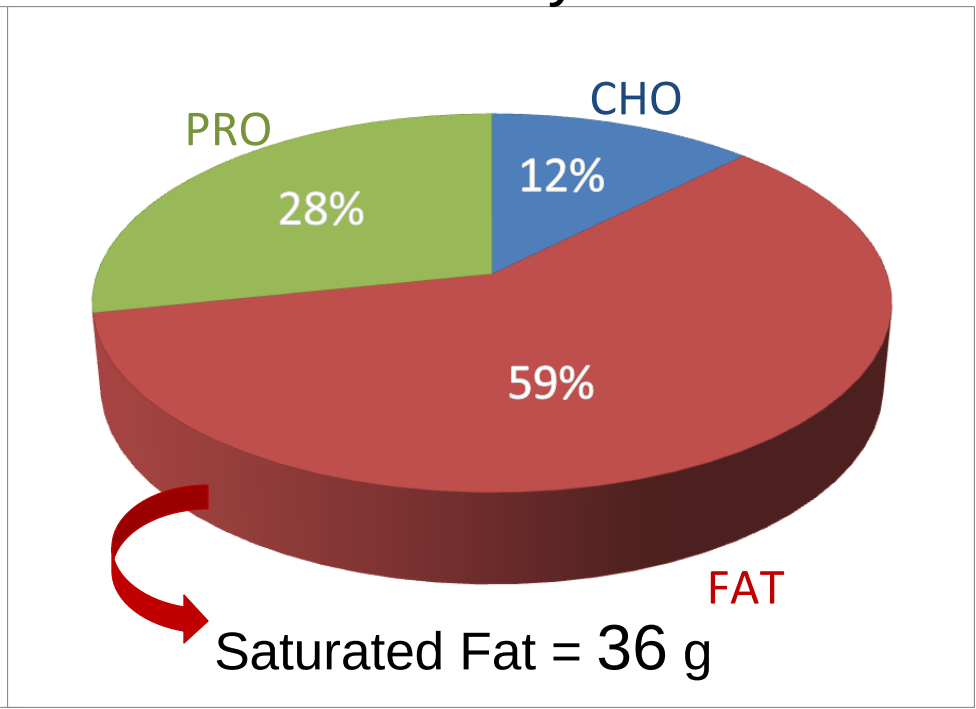
King et al. AJCN. 83:227-236, 2006.



Low Fat Diet
~1500 kcal/day

Atkins Diet
~1500 kcal/day

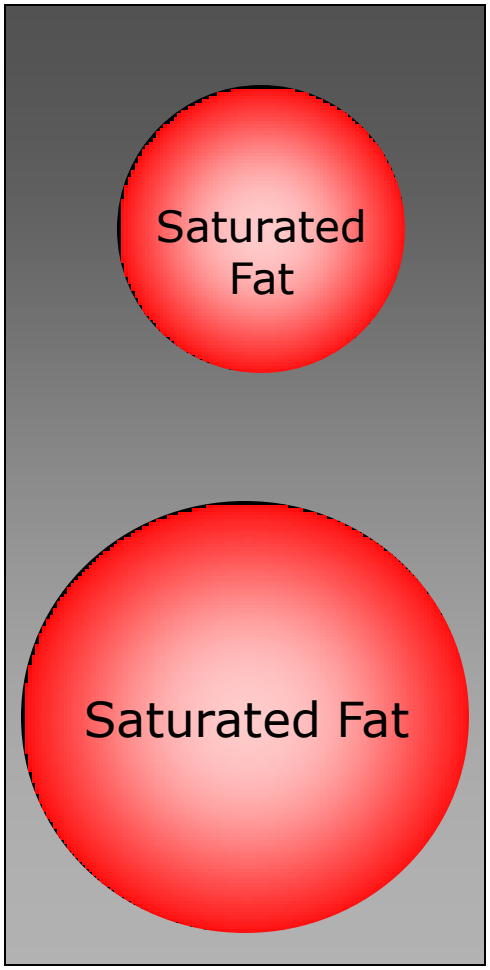




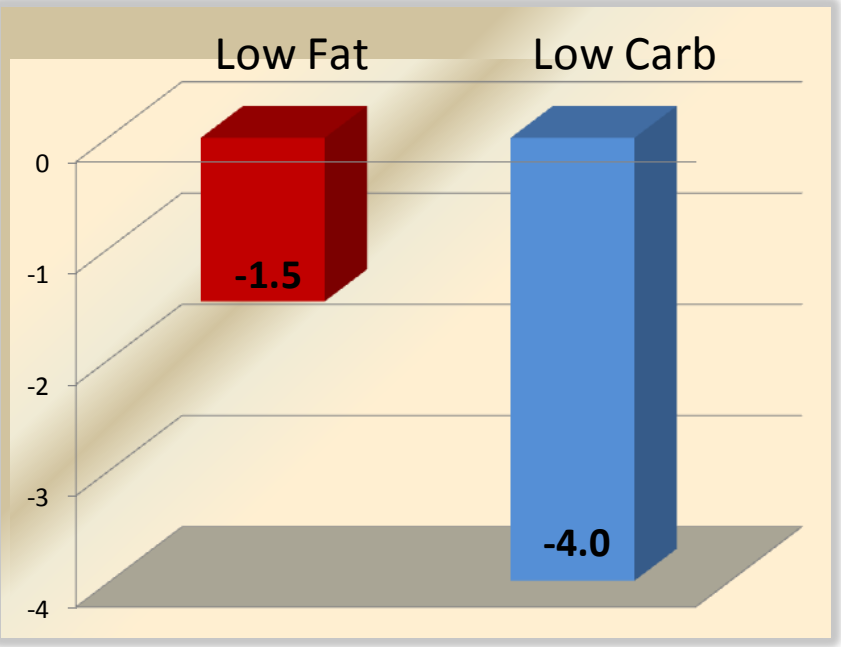
Blood Saturated Fat Levels

Low Fat Diet
12 g SFA/d
208 CHO/d

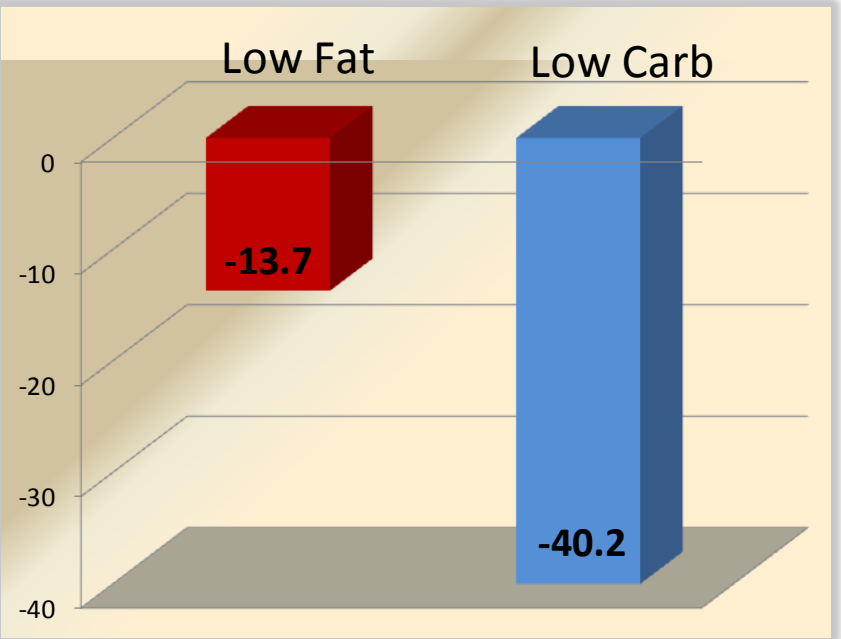
Atkins Diet
36 g SFA/d
45 CHO/d



Change Plasma SFA (%wt) in TAG

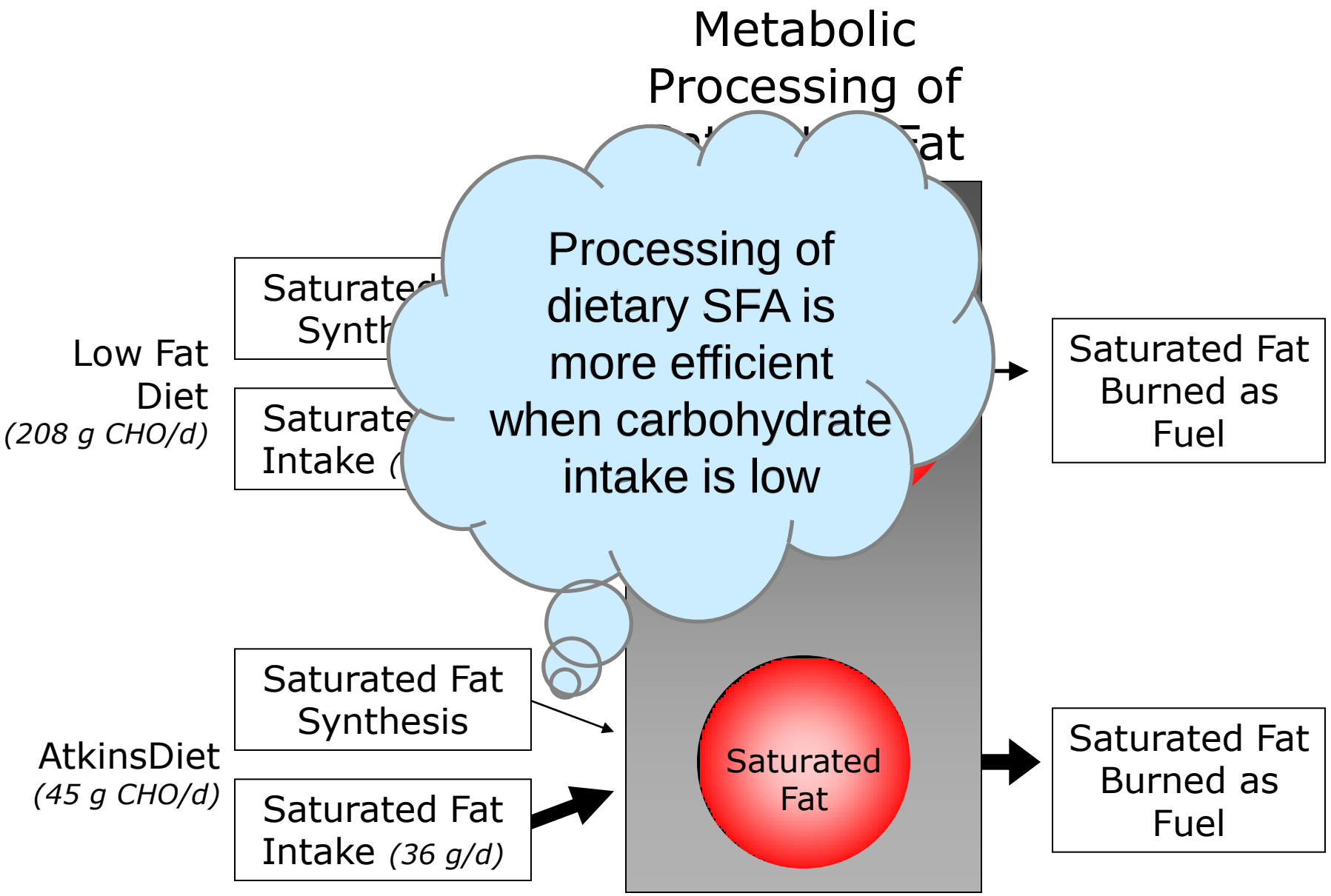


Change Plasma SFA (mg/dL) in TAG

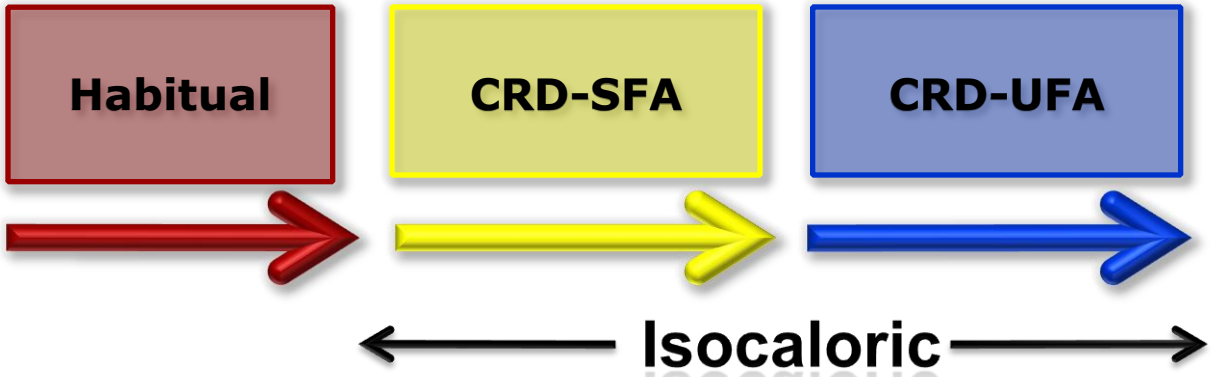


Despite eating 3 times more SFA compared to low-fat, subjects showed significantly greater reductions in plasma SFA on a low carbohydrate diet

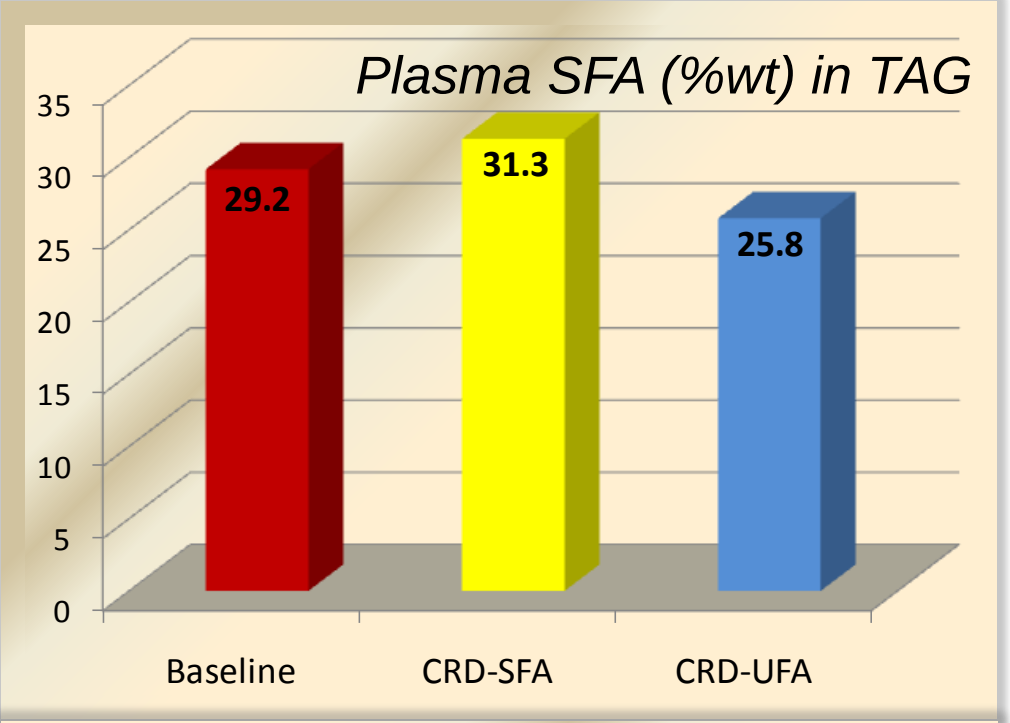
Forsythe et al. Lipids. 43(1):65-77, 2008

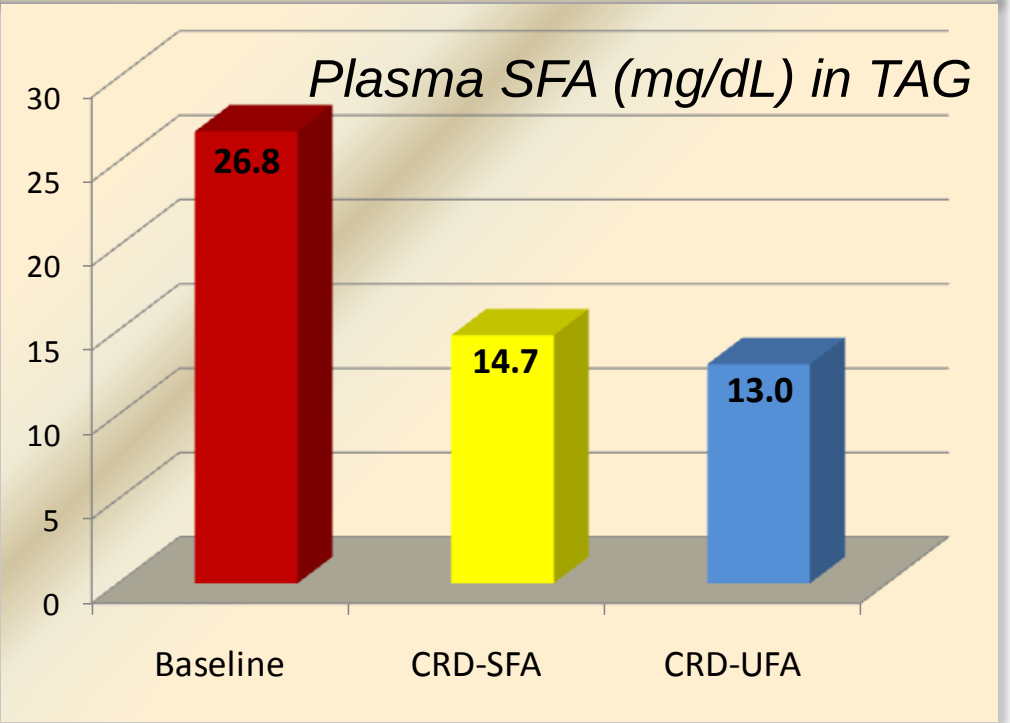

Metabolic Processing of
Fat
Processing of dietary SFA is more efficient when carbohydrate intake is low
Low Fat Diet
(208 g CHO/d)
Saturated
Synth
Saturate
Intake (
Saturated Fat Burned as Fuel
AtkinsDiet
(45 g CHO/d)
Saturated Fat Synthesis
Saturated Fat Intake (36 g/d)
Saturated Fat
Saturated Fat Burned as Fuel

Does the quality of fat matter on a very low carbohydrate diet during iso-weight conditions?



PRO (%)	25	29	30
CHO (%)	34	13	12
Fat (%)	41	58	58
Fat (g)	94	164	161
SFA (g)	40	86	47
MUFA (g)	37	58	69
PUFA (g)	16	12	41
n-3 (%)	0.7	0.6	2.9
n-6 (%)	6.6	3.8	10.8
Chol (mg)	426	854	820



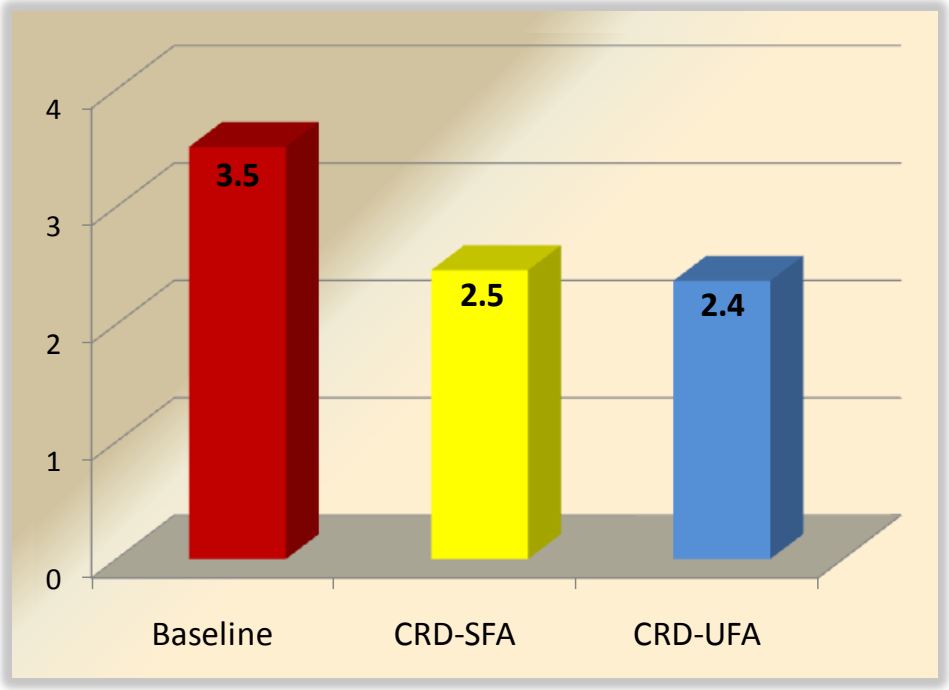


Low carbohydrate is a profound stimulus impacting the metabolic processing of ingested SFA

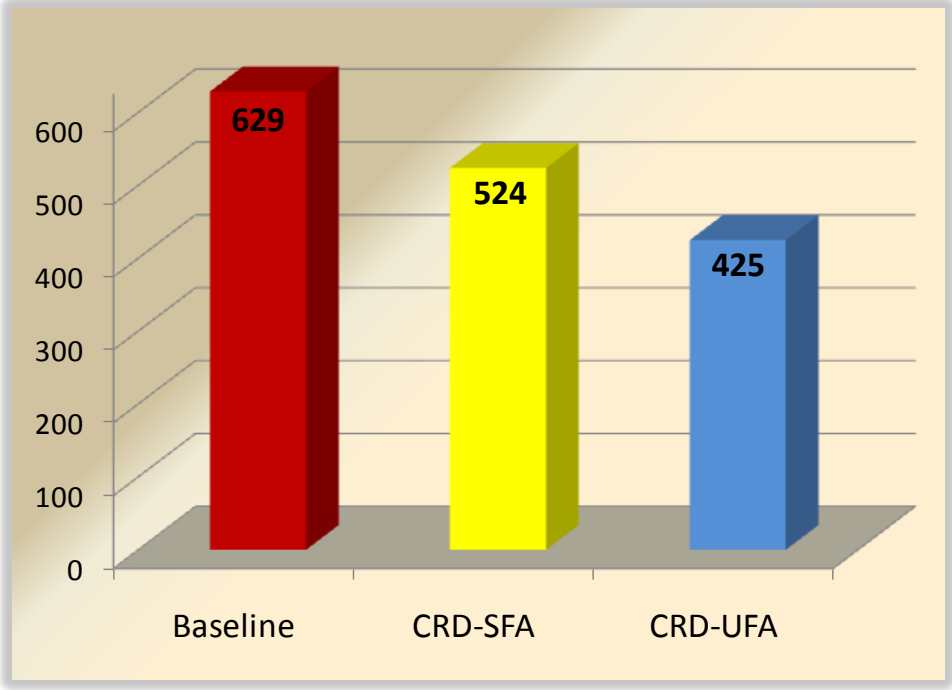
A CRD decreases fat synthesis regardless of fat quality

A CRD emphasizing MUFA and n-3 PUFA decreases oxidative stress

Plasma 16:1 (%wt) in TAG



8-iso $PGF_{2\alpha}$ (pg/mg creatinine)

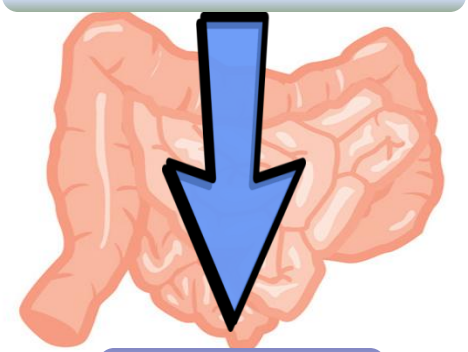


You are what you eat…

…or you are what you do with what you eat!

Why should we be concerned about too many carbohydrates?

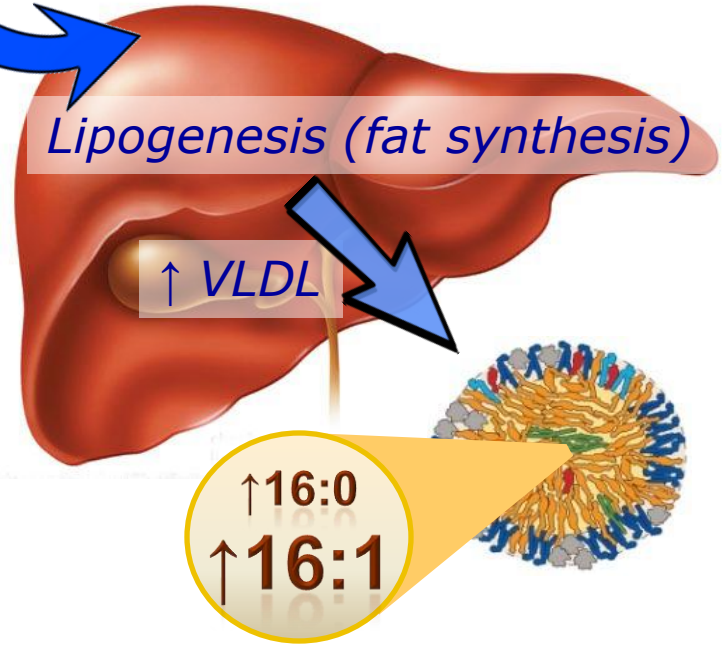
Carbohydrate



Glucose

Healthy
Disposal

Obese
Insulin resistance
Glycogen saturated

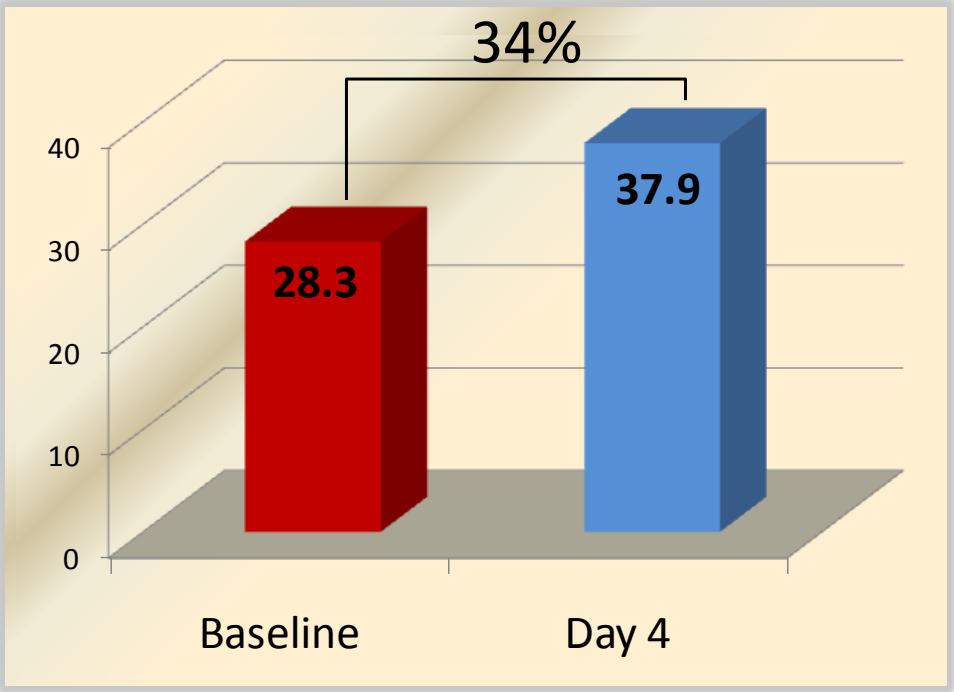


Glycogen Storage (limited ~400 g)
Oxidation

Effects of short-term CHO overfeeding on fatty acid composition

Health Men (4 days feeding)
4400 kcal (60 kcal/kg)
Fat (none)
CHO (90%)
~1000 g CHO/day (NG/IV)

VLDL 16:0 (%wt) in TG



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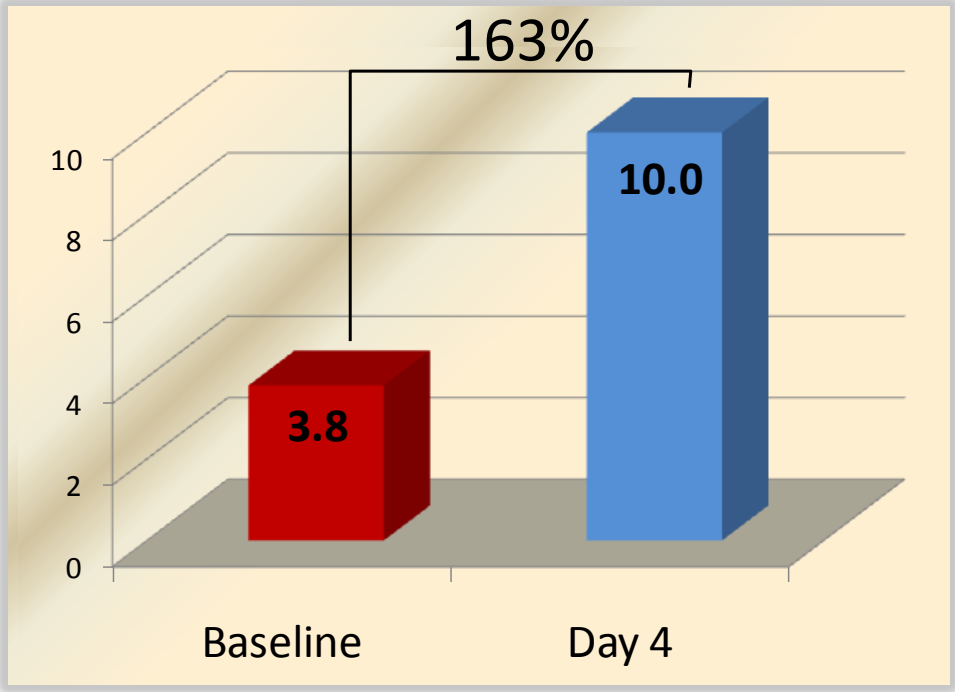

Aarsland and Wolfe. J Lipid Res. 39:1280-6, 1998.

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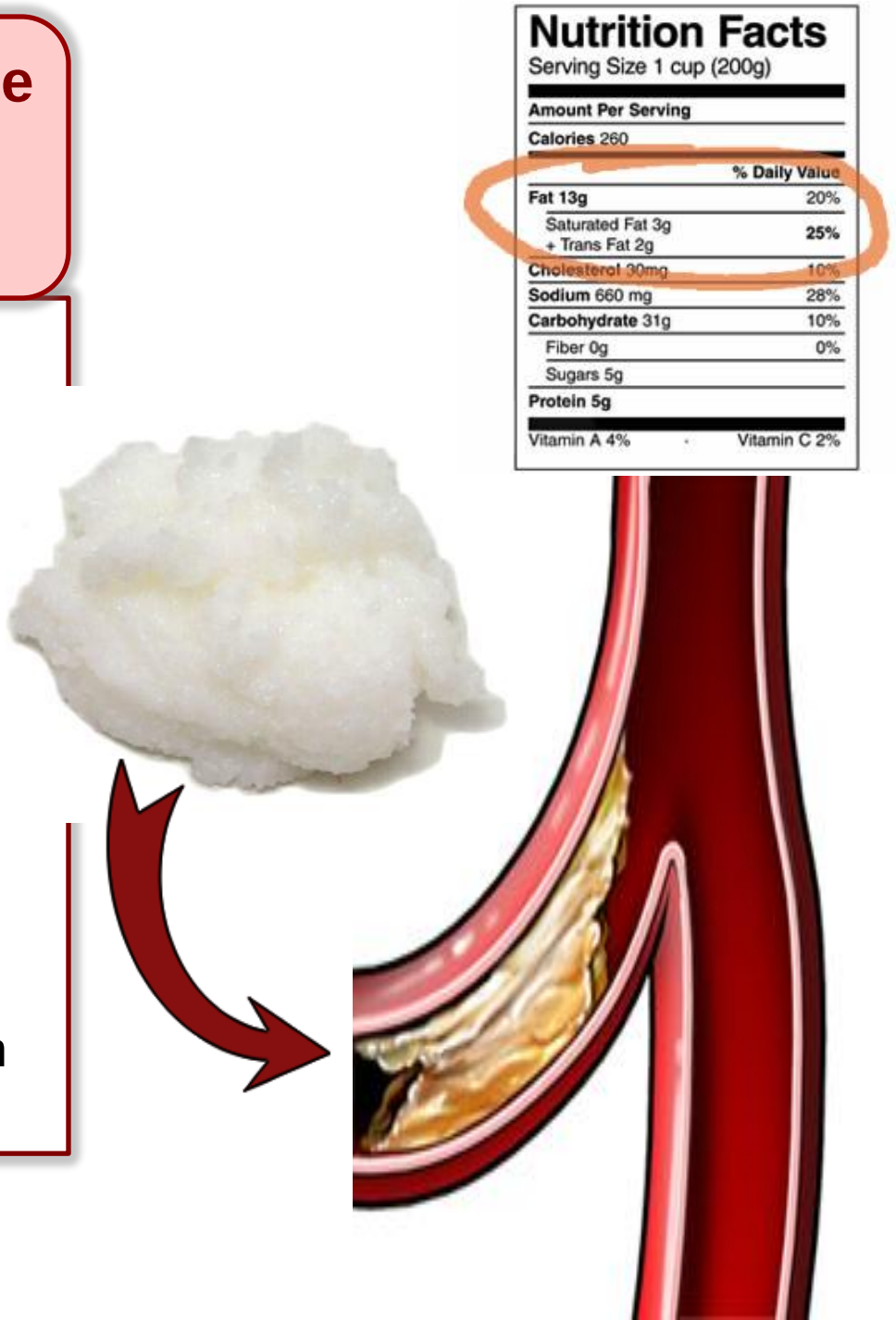

Nutrition & Metabolism

BioMed Central

Review

Open Access

Carbohydrate restriction improves the features of Metabolic Syndrome. Metabolic Syndrome may be defined by the response to carbohydrate restriction

Jeff S Volek[1] and Richard D Feinman*[2]

Progress in Lipid Research 47 (2008) 307–318

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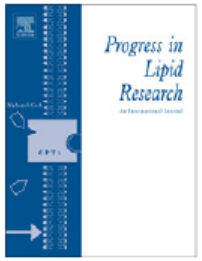
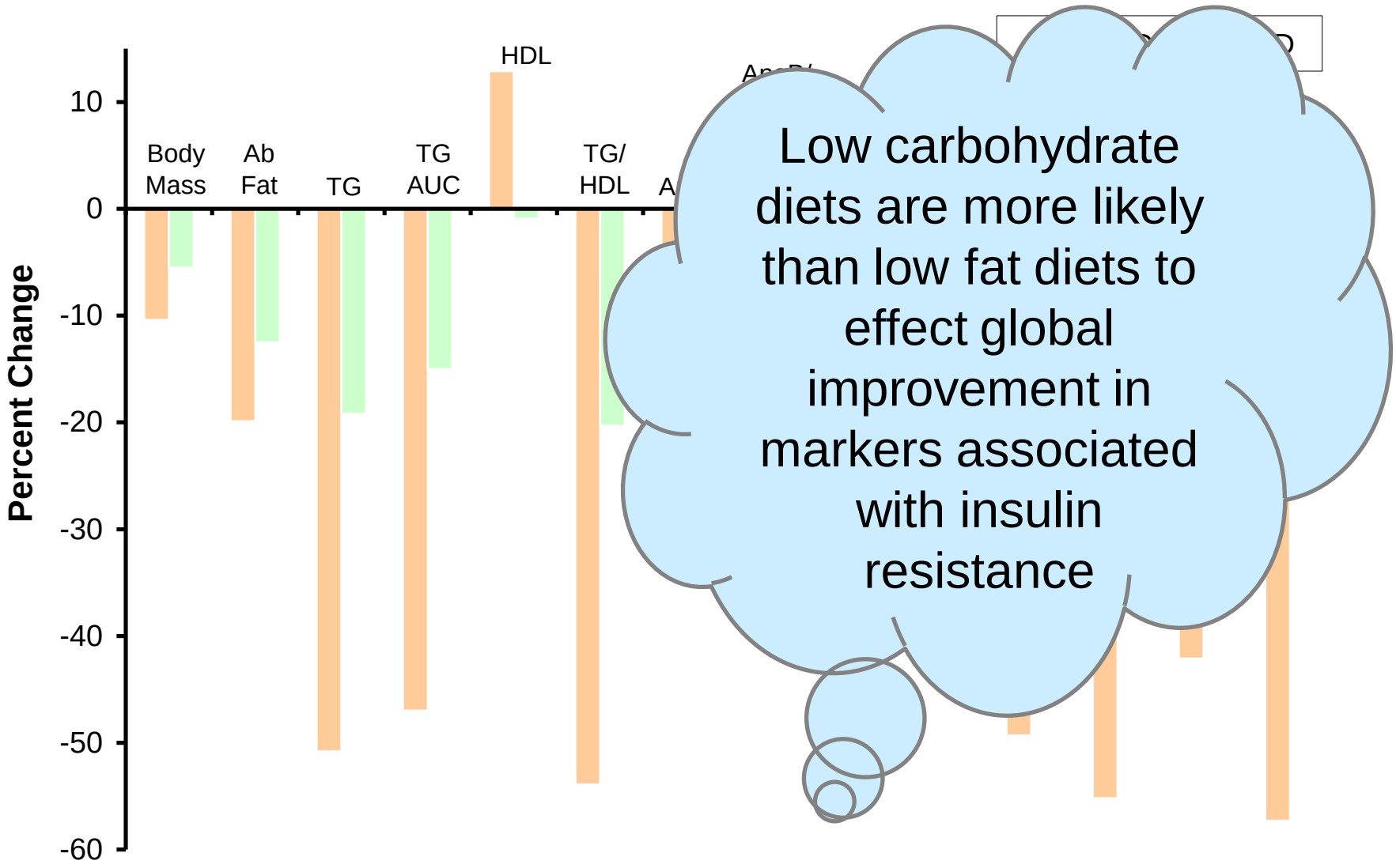
journal homepage: www.elsevier.com/locate/plipres

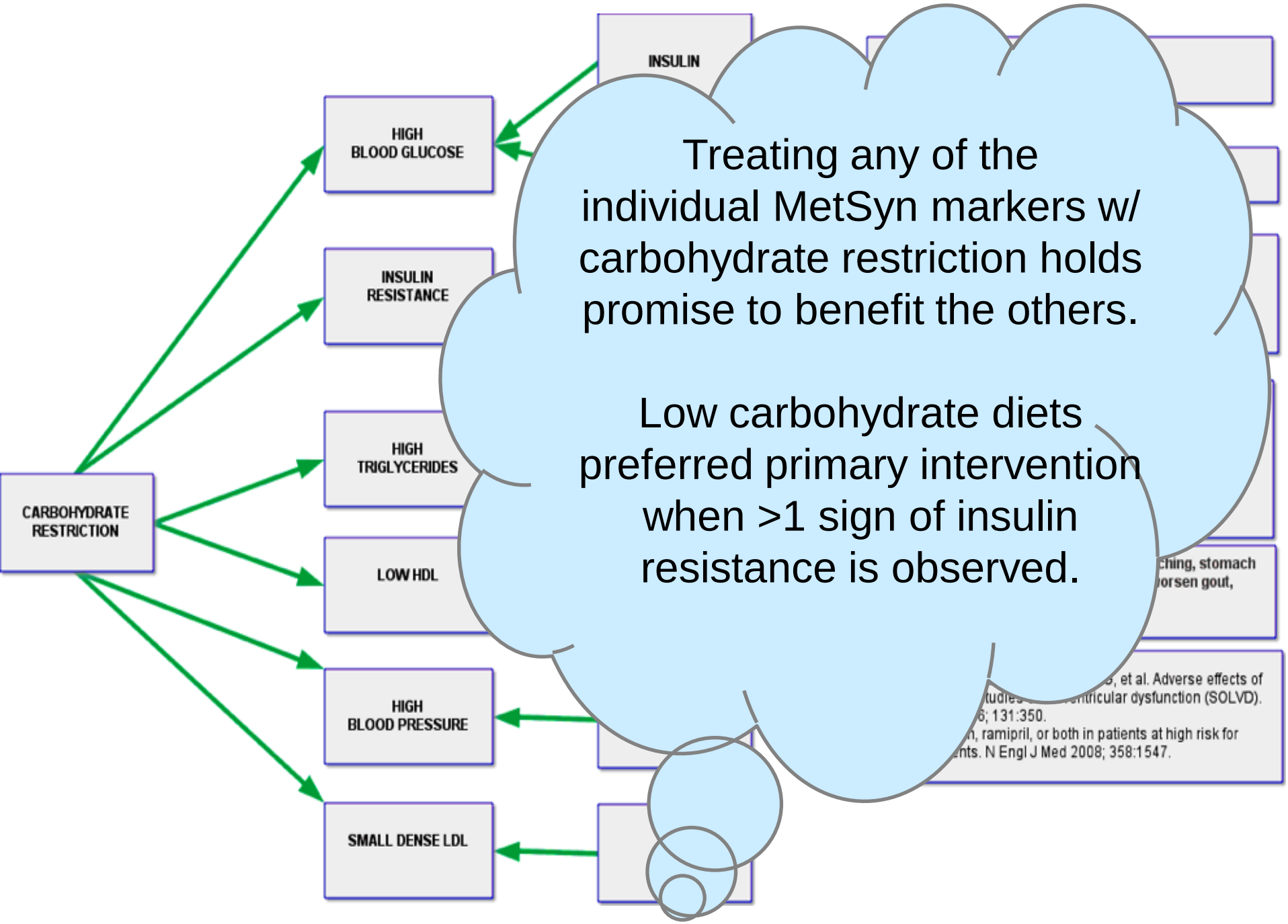


Review

Dietary carbohydrate restriction induces a unique metabolic state positively affecting atherogenic dyslipidemia, fatty acid partitioning, and metabolic syndrome

Jeff S. Volek[a,*], Maria Luz Fernandez[b], Richard D. Feinman[c], Stephen D. Phinney[d]

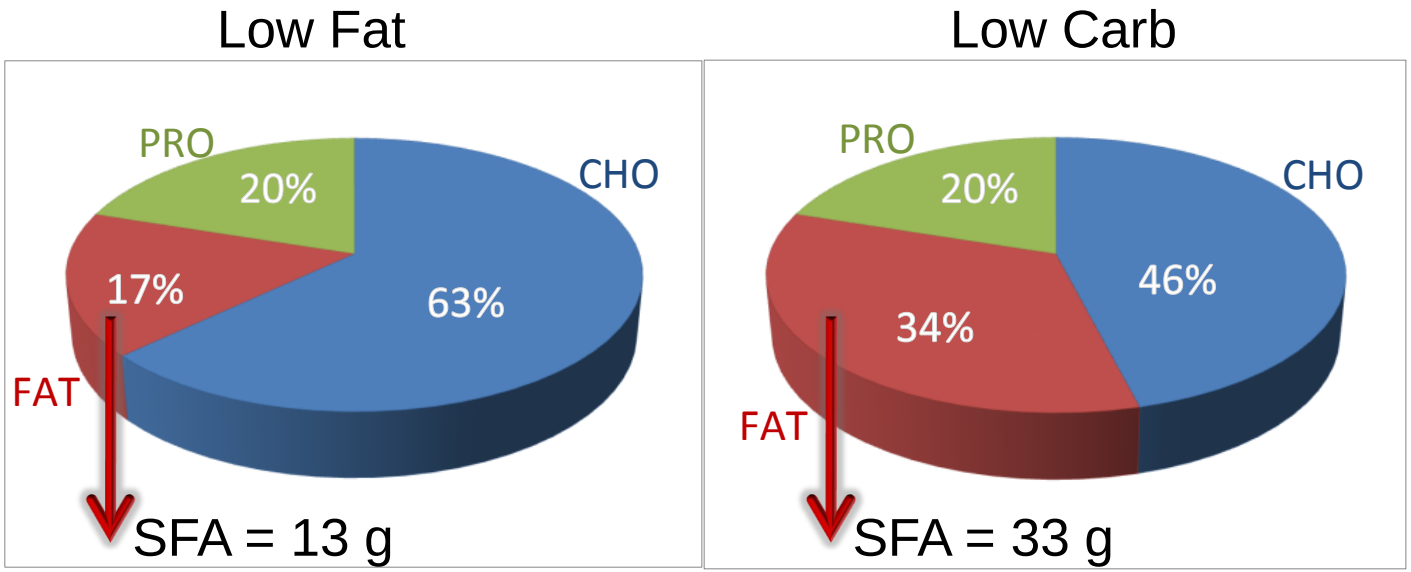

Percent Change
10
0
-10
-20
-30
-40
-50
-60
Body Mass
Ab Fat
TG
TG AUC
HDL
TG/ HDL
Low carbohydrate diets are more likely than low fat diets to effect global improvement in markers associated with insulin resistance


INSULIN
HIGH BLOOD GLUCOSE
INSULIN RESISTANCE
HIGH TRIGLYCERIDES
CARBOHYDRATE RESTRICTION
LOW HDL
HIGH BLOOD PRESSURE
SMALL DENSE LDL
Treating any of the individual MetSyn markers w/ carbohydrate restriction holds promise to benefit the others.
Low carbohydrate diets preferred primary intervention when >1 sign of insulin resistance is observed.

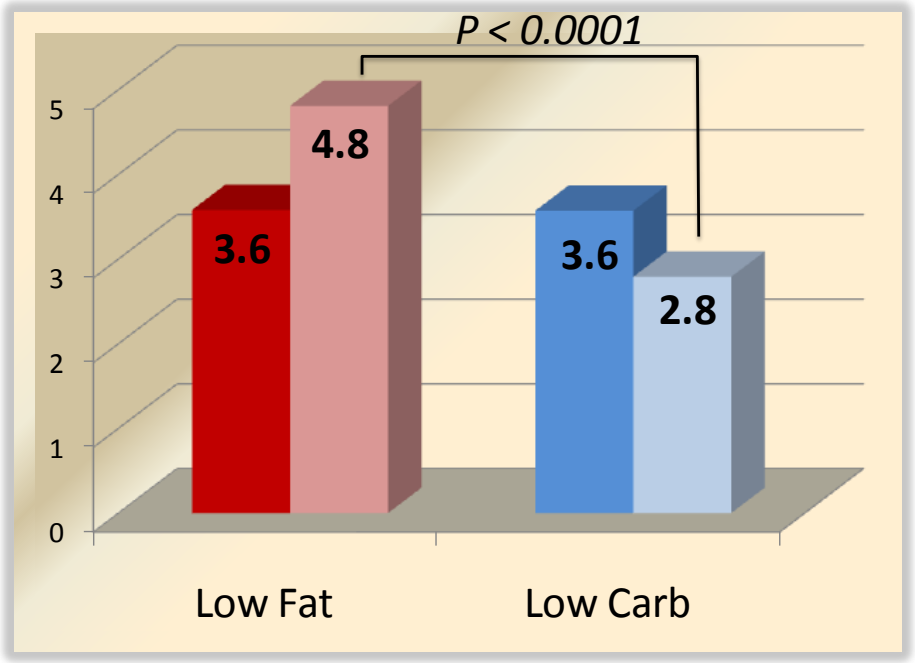
Scorecard:

Impact of restricting dietary fat vs carbohydrate on risk factors

	Low Fat	Low Carbohydrate
LDL Concentration	✓	
Small LDL (Pattern B)		✓
Fasting & Postprandial TG		✓
HDL (concentration and size)		✓
TC/HDL or apoB/apoA-1		✓
Fasting & Postprandial Glucose		✓
Fasting & Postprandial Insulin		✓
Insulin Sensitivity (HOMA, Clamp, TG/HDL, RBP-4)		✓
CRP (Inflammation)		✓
Vascular Function		✓
Serum SFA (Fatty Acid Composition)		✓
Oxidative Stress		✓



Plasma 16:1 (%wt) in CE



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