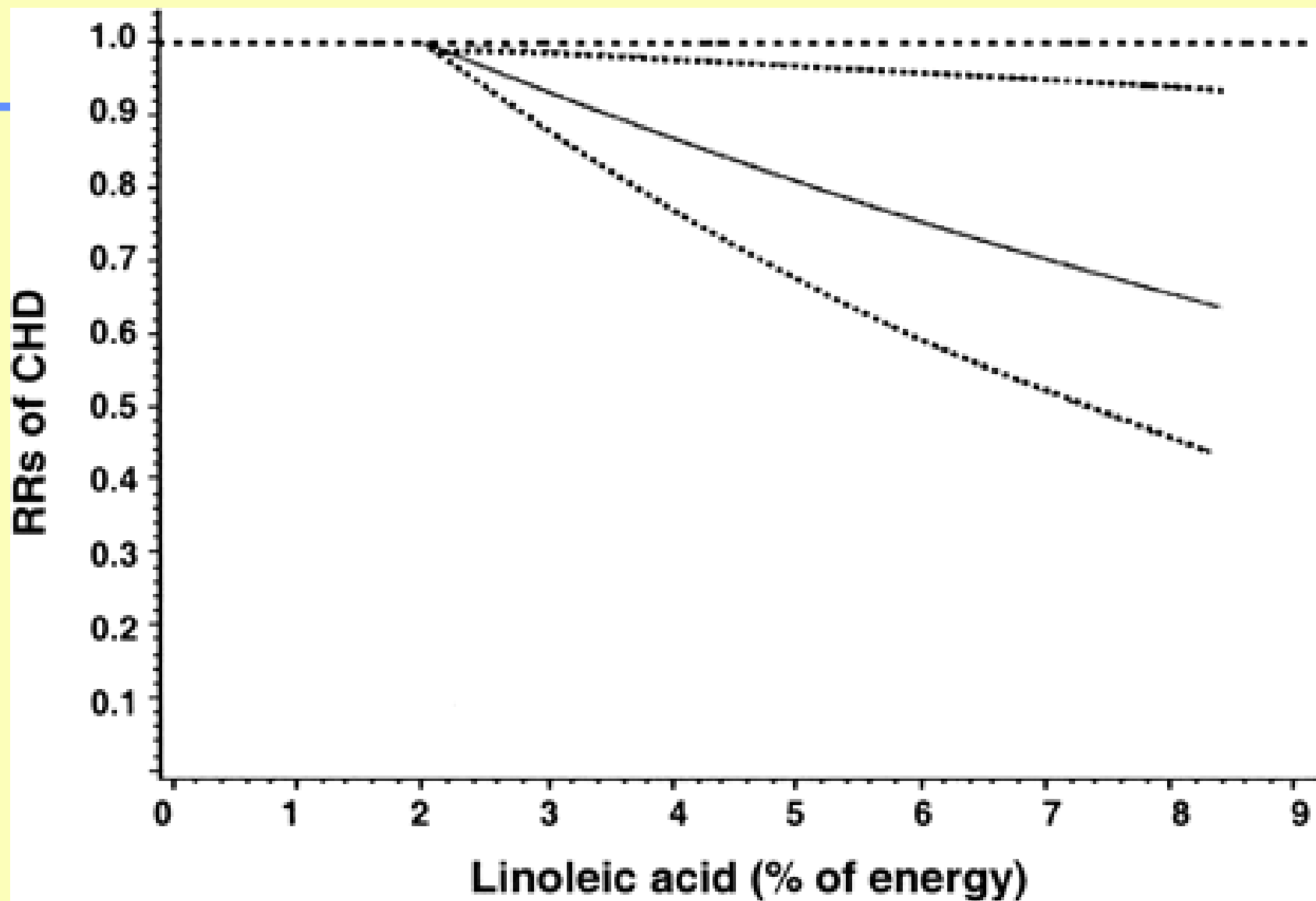

Margarines and Heart Disease

Do they protect?

Heart disease

- ◆ Several studies, including our own link margarine consumption with heart disease.
- ◆ Probably related to trans fatty acids – elevate LDL cholesterol and lower HDL cholesterol. Also increase inflammation which is linked to heart disease.
- ◆ Polyunsaturated fat intake linked to lower heart disease.



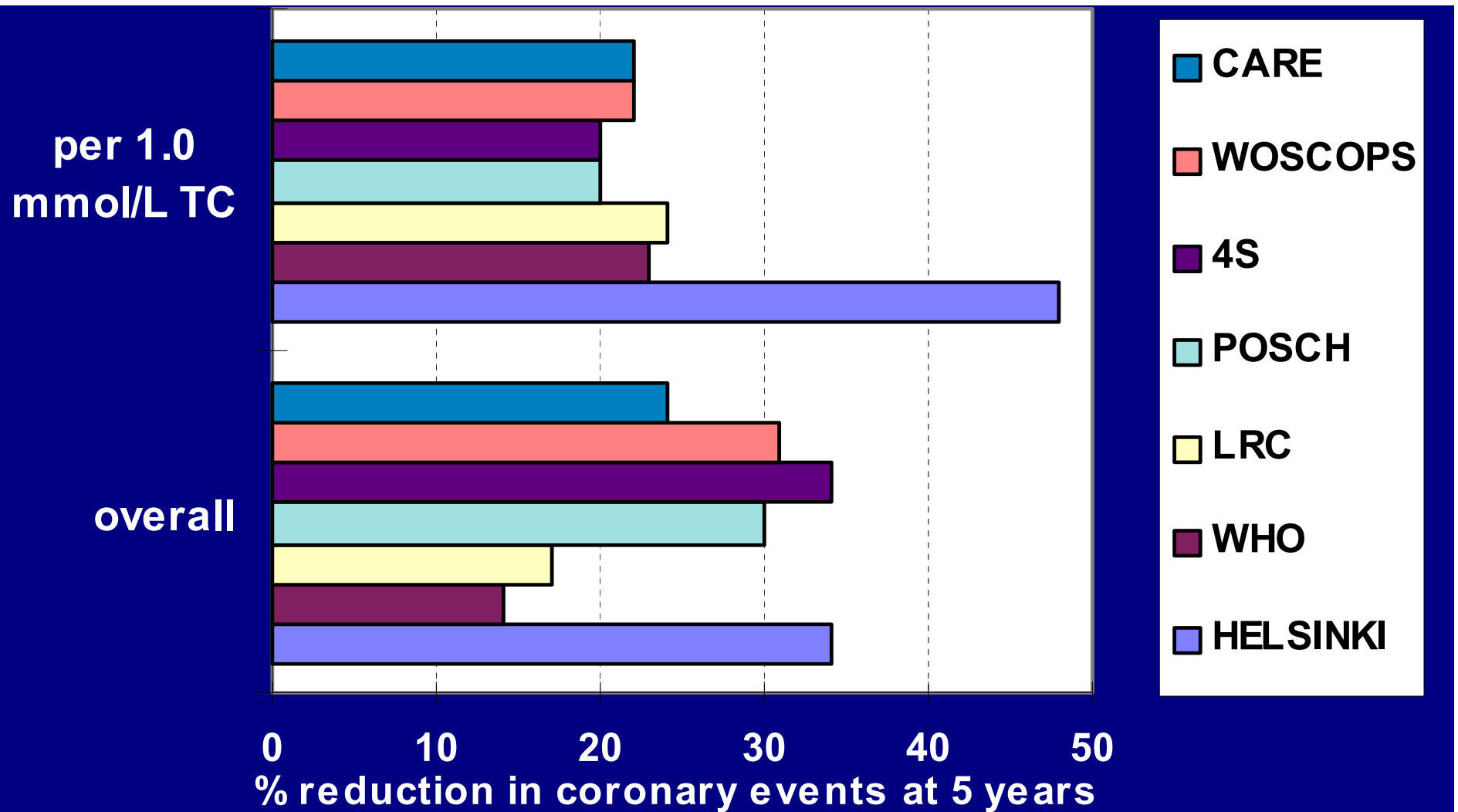
Linoleic acid

- ◆ Poly intake 37% reduction of heart disease in women with BMI>25 (ie overweight or obese) going from 4.1% to 7.4% of energy.
- ◆ Trans fat 53% increase in disease in women with BMI<25. From 1.3 to 2.8%.
- ◆ Total fat, saturated fat and monounsaturated fat not related to disease

Polyunsaturated fat

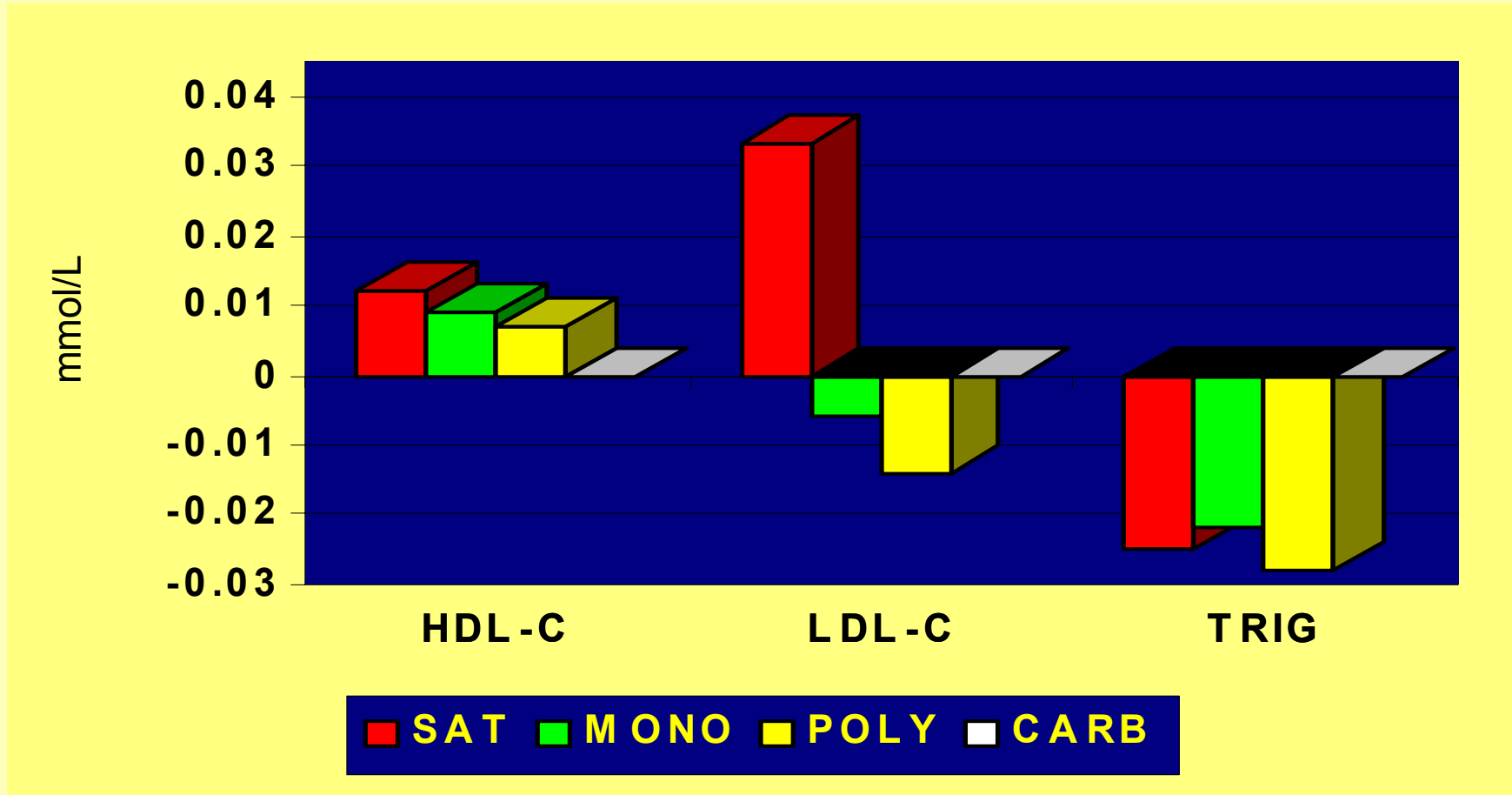
- ◆ Western Electric Study (in men) similar inverse relationship with heart disease.
- ◆ Slight inverse relationship seen in 2 studies (Oslo Diet Heart Study and MRFIT), none seen in 2 small interventions.
- ◆ Mechanism: lowers cholesterol slightly, antiarrhythmic, stops platelets sticking
- ◆ Monounsaturated fat: olive oil eating countries have low heart disease rates.
- ◆ Post heart attack study: canola margarine beneficial (Lyon Diet Heart Study)

CHOLESTEROL LOWERING AND CHD REDUCTION IN INTERVENTION TRIALS



PREDICTED CHANGES IN SERUM LIPIDS ..

when 1% energy as carbohydrate is replaced by various fatty acid classes



Mensink RP, Katan MB. Effect of dietary fatty acids on serum lipids and lipoproteins. A meta-analysis of 27 trials. Arteriosclerosis and Thrombosis 1992;12:911-919.

Low fat diets

- ◆ 48,000 postmenopausal women, followed up for 8 years.
- ◆ Diet: 20% fat, 5 serves fruit and vegetables, 6 serves grain. (20,000)
- ◆ Saturated fat went down by 2.5% , polyunsaturated fat by 1.5%, monounsaturated fat by 4%, fruit up 1 serve, grains up 0 .5 serves/d
- ◆ 3% reduction in heart disease-not significant.

Palm oil, high oleic sunflower and partially hydrogenated fats and plasma lipids

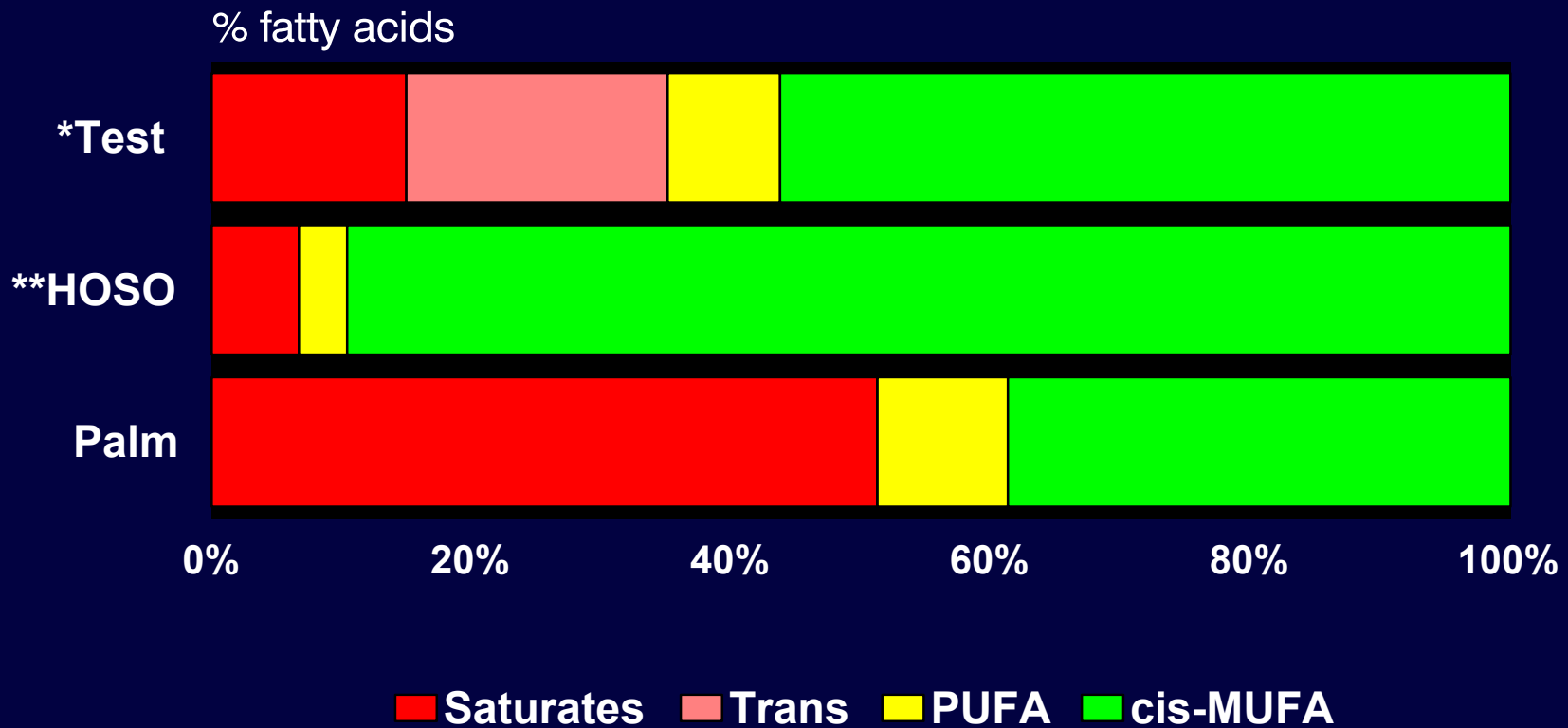
Aim

To assess the cholesterol raising potential of *trans* fatty acids relative to palmitic acid and oleic acid by comparing 3 oils:

- 1. Trans Blend (moderate trans 20%)**
- 2. High Oleic Sunflower Oil (HOSO)**
- 3. Palm Oil**

Palm oil, high oleic sunflower and partially hydrogenated fats and plasma lipids

Fatty Acid Profile of Test Fats



Palm oil, high oleic sunflower and partially hydrogenated fats and plasma lipids

Study Design

- * 14 women, 9 men; mean TC 6.1; mean age 51
- * **Baseline diet** (<20% energy from fat)
- * **Intervention phases**- test fats taken in random order and in cross-over fashion.

Baseline Phase 1 Phase 2 Phase 3

2 weeks X 3 weeks X 3 weeks X 3 weeks

Palm oil, high oleic sunflower and partially hydrogenated fats and plasma lipids

Study Design

Intervention Phases

Background Diet

15% Fat energy

Self-selected low fat foods

+

Test Supplements

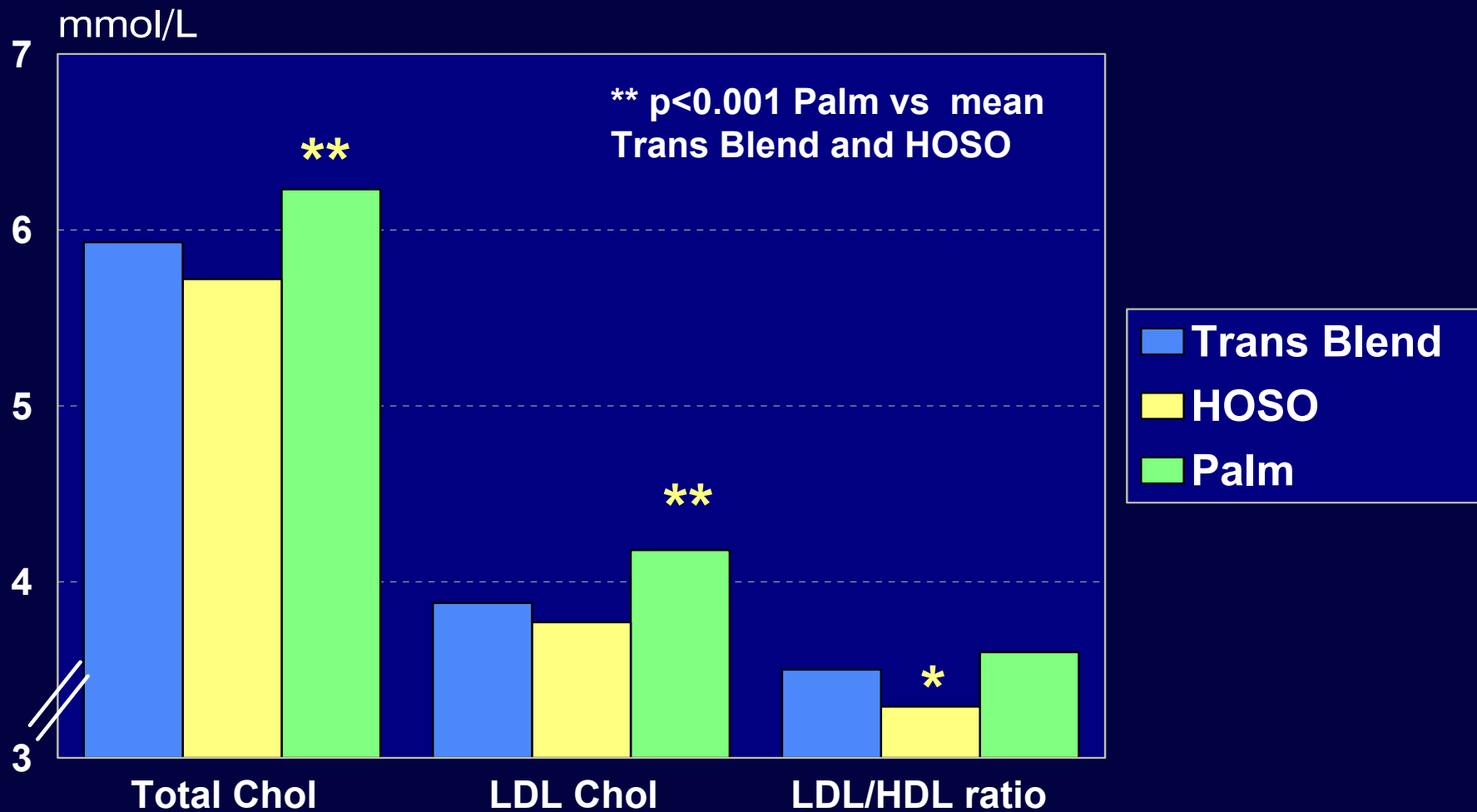
20% Fat energy

Provided as margarine and muffins containing the test fats

The test supplements contained either palm oil, high oleic sunflower (HOSO) or the trans blend.

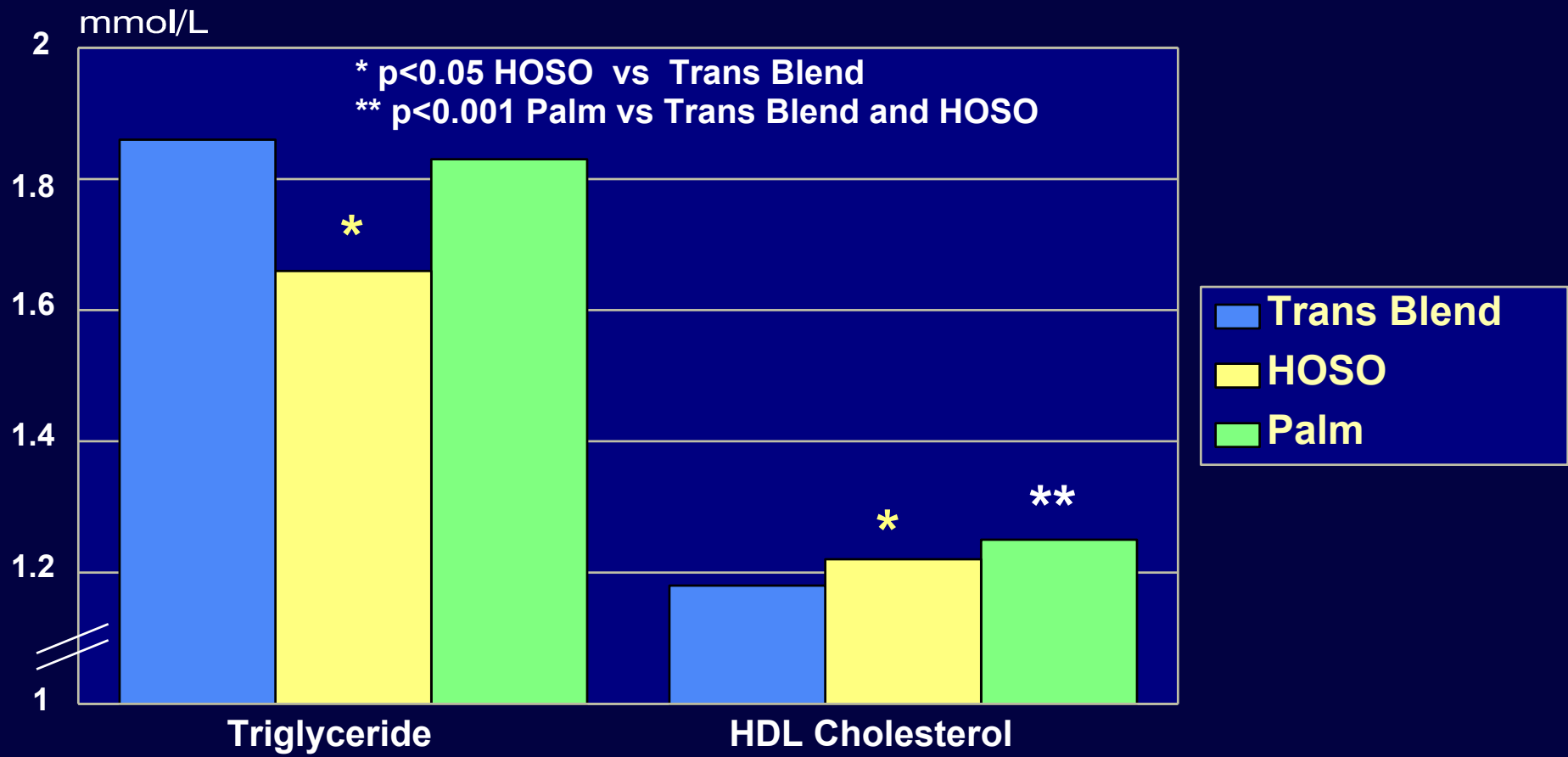
Palm oil, high oleic sunflower and partially hydrogenated fats and plasma lipids

Total Cholesterol, LDL-C



Palm oil, high oleic sunflower and partially hydrogenated fats and plasma lipids

Triglyceride and HDL-C



Palm oil, high oleic sunflower and partially hydrogenated fats and plasma lipids

RESULTS

Compared to Palm Oil:

High oleic sunflower oil and the the trans blend resulted in 10.9% and 7.7% falls in LDL-C which were not significantly different.

The Trans Blend resulted in a 5.9% fall in HDL-C consistent with its *trans* fatty acid content, giving it a less favourable LDL/HDL ratio compared to high oleic sunflower oil.

Palm oil, high oleic sunflower and partially hydrogenated fats and plasma lipids

Conclusions

- ◆ Palmitic acid appears to raise LDL-C compared to oleic acid.
- ◆ Trans fatty acids appear less LDL-C elevating than palmitic acid but lower HDL-C
- ◆ *Monounsaturated oils such as high oleic sunflower are preferable to palm oil or partially hydrogenated oils in terms of cardiovascular risk reduction.*

Effect of Interesterifying a Mix of Edible Oils on Plasma Lipids

AIM

To establish whether interesterification influences plasma lipids by comparing three oils:

1. High Linoleic (*control*)
2. High Palm - Blend
3. High Palm - Interesterified

Effect of Interesterifying a Mix of Edible Oils on Plasma Lipids

Study Design



Baseline diet

Low fat (<30% energy).

Intervention phases

Randomized cross-over design.

Low fat diet (<20% energy) plus 15% energy from test fats as food supplements (biscuits + margarine).

Effect of Interesterifying a Mix of Edible Oils on Plasma Lipids

Fatty Acid Profile of Test Fat Blends

g fatty acid/100g	High Linoleic#	High Palm Blend*	High Palm Interesterified*
C12:0 Lauric	0	15.6	16.3
C14:0 Myristic	0.3	6.4	6.2
C16:0 Palmitic	12.1	23.2	23.5
C18:0 Stearic	5.7	10.2	9.7
C18:1cis Oleic	21.7	24.5	24.2
C18:1trans	13	0	0
C18:2 Linoleic	44	18.6	18.4
C18:3 Linolenic	2.4	0.1	0.1

7% hardened soybean oil, 25% hardened cottonseed oil, 28% soybean oil and 40% sunflower oil.

* fully hardened palm kernel oil, 40% palmolein, 20% sunflower oil and 5% palm stearin.

Effect of Interesterifying a Mix of Edible Oils on Plasma Lipids

mmol/L	High Linoleic	High Palm Blend	High Palm Interesterified
Total Cholesterol	5.83±0.98*	6.34±1.05	6.44±1.00
LDL Cholesterol	4.02±0.85*	4.43±0.94	4.54±0.88
HDL Cholesterol	0.96±0.23*	1.07±0.27	1.05±0.24
Triglycerides	1.90±0.90	1.87±1.04	1.86±0.81

* significantly different from both palm blends, p<0.002

Margarines containing *trans* or zero *trans* fatty acids: differential effects on plasma lipids

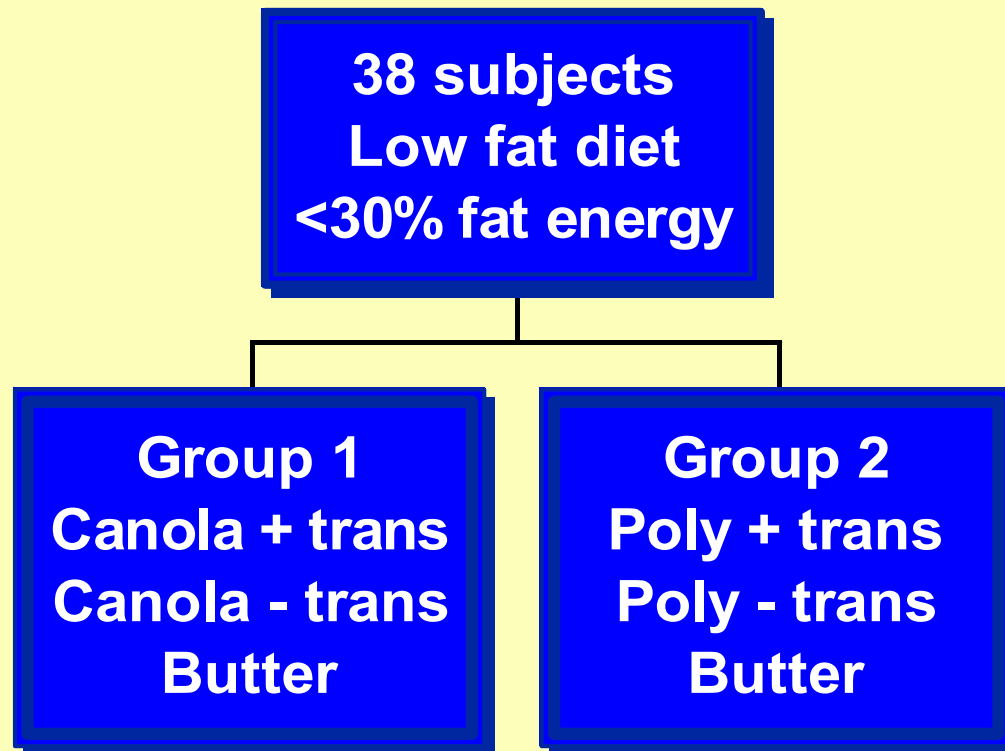
AIM

To establish whether *trans* fatty acid free margarines containing an *interesterified* hard fraction (from primarily saturated fatty acids) are at least as effective in lowering LDL cholesterol as those containing a *partially hydrogenated* fraction.

Margarines containing *trans* or zero *trans* fatty acids: differential effects on plasma lipids

METHODS

11 WEEK DIETARY STUDY



Margarines containing *trans* or zero *trans* fatty acids: differential effects on plasma lipids

EXPERIMENTAL DESIGN

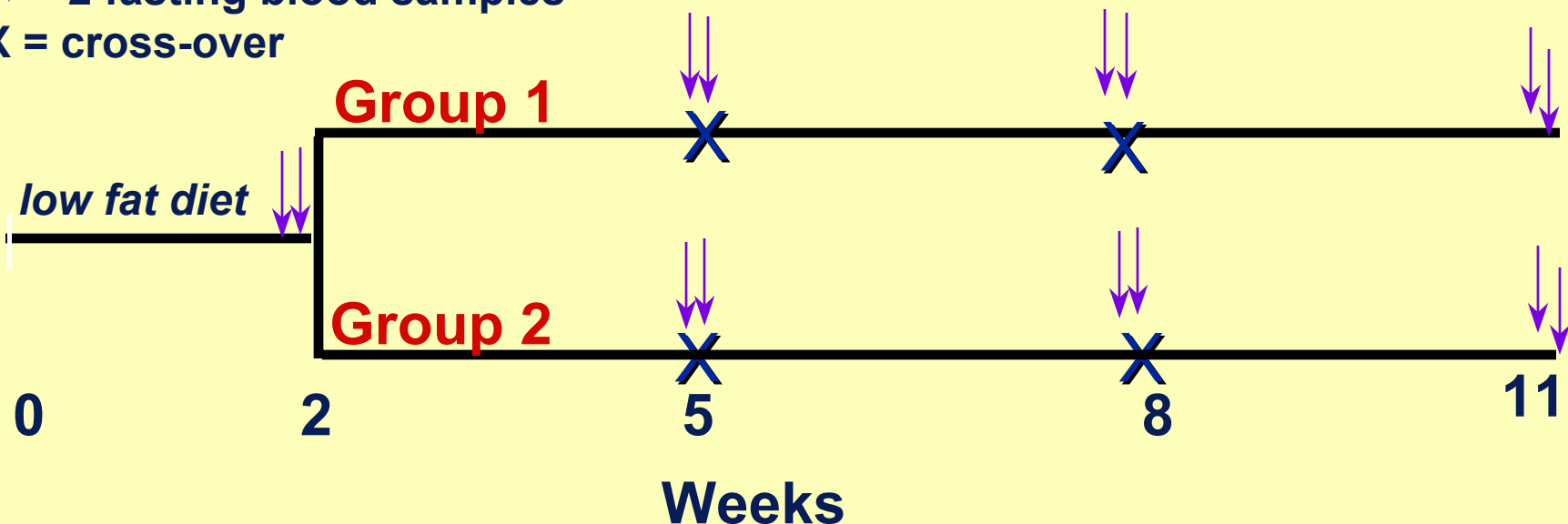
Schematic representation of the dietary phases

margarines and butter taken in random order

diet :35% fat energy

test fats:20% fat energy

↓↓ = 2 fasting blood samples
X = cross-over



Margarines containing *trans* or zero *trans* fatty acids: differential effects on plasma lipids

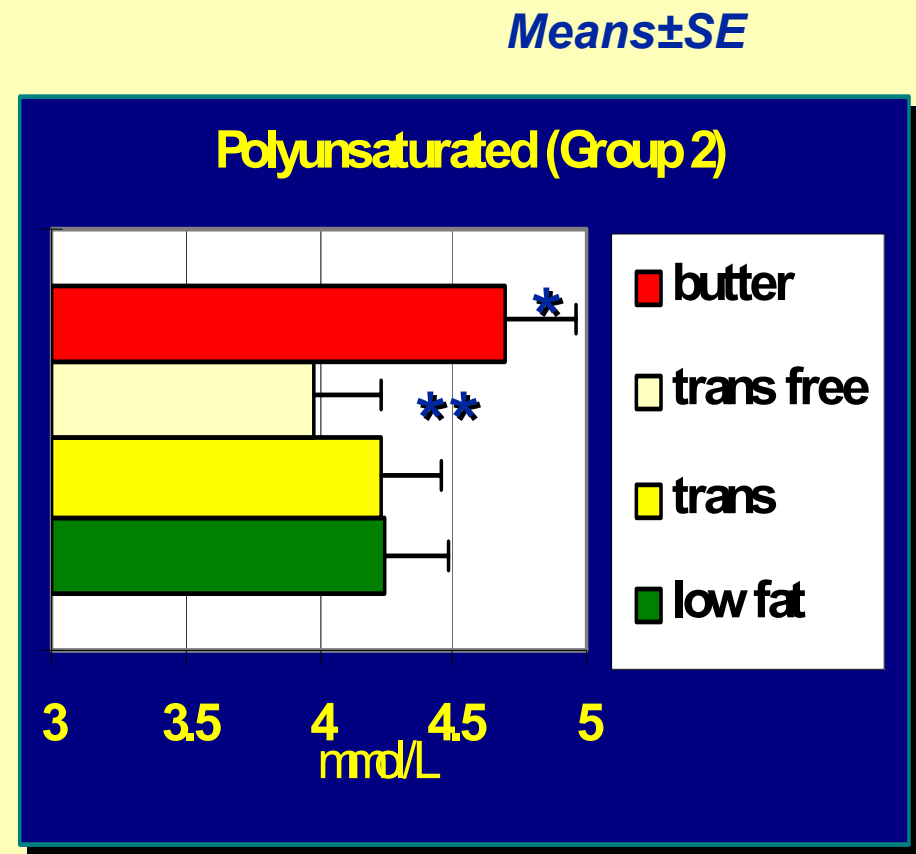
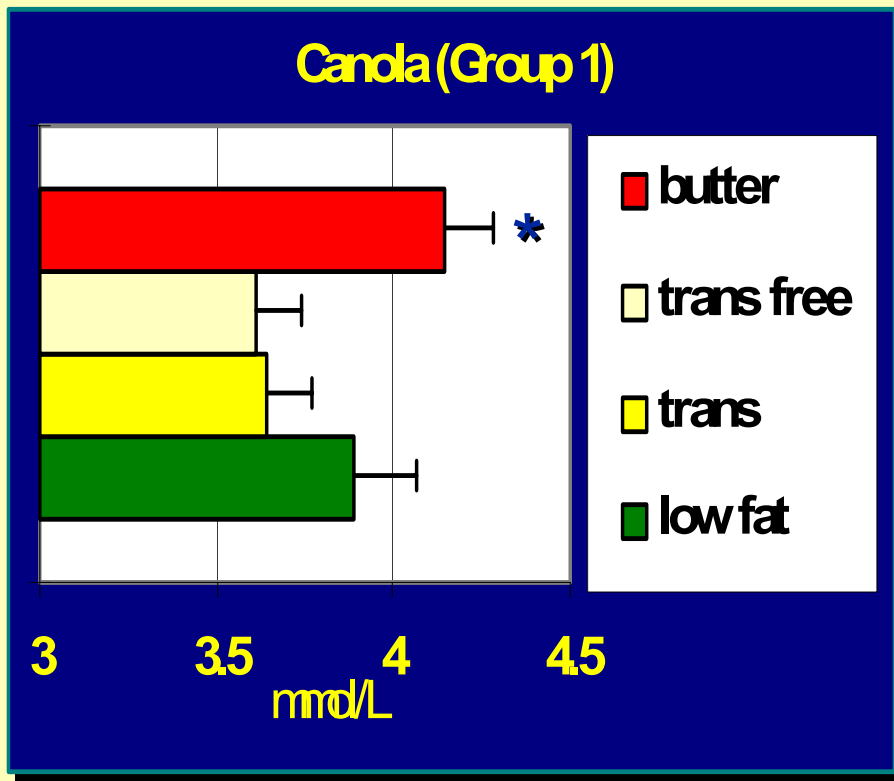
Fatty Acids % total	BUTTER	CANOLA +trans*	CANOLA trans free**	POLY +trans	POLY trans free
12:0	3.3	0.1	6.2	0.1	5.6
14:0	10.0	0.3	2.7	0.4	2.3
16:0	25.9	7.9	10.0	10.3	9.8
18:0	11.7	6.5	10.0	7.9	10.0
18:1 <i>cis</i>	22.8	50.7	44.9	26.8	29.6
18:1 <i>trans</i>	3.4	10.40	0	10.30	0
18:2	1.5	14.4	15.7	40.6	35.4
18:3	0.7	6.5	6.5	1.7	2.7

* **+trans** denotes addition of partially hydrogenated hard fraction

** **trans free** denotes addition of the interesterified hard fraction

Margarines containing *trans* or zero *trans* fatty acids: differential effects on plasma lipids

LDL Cholesterol

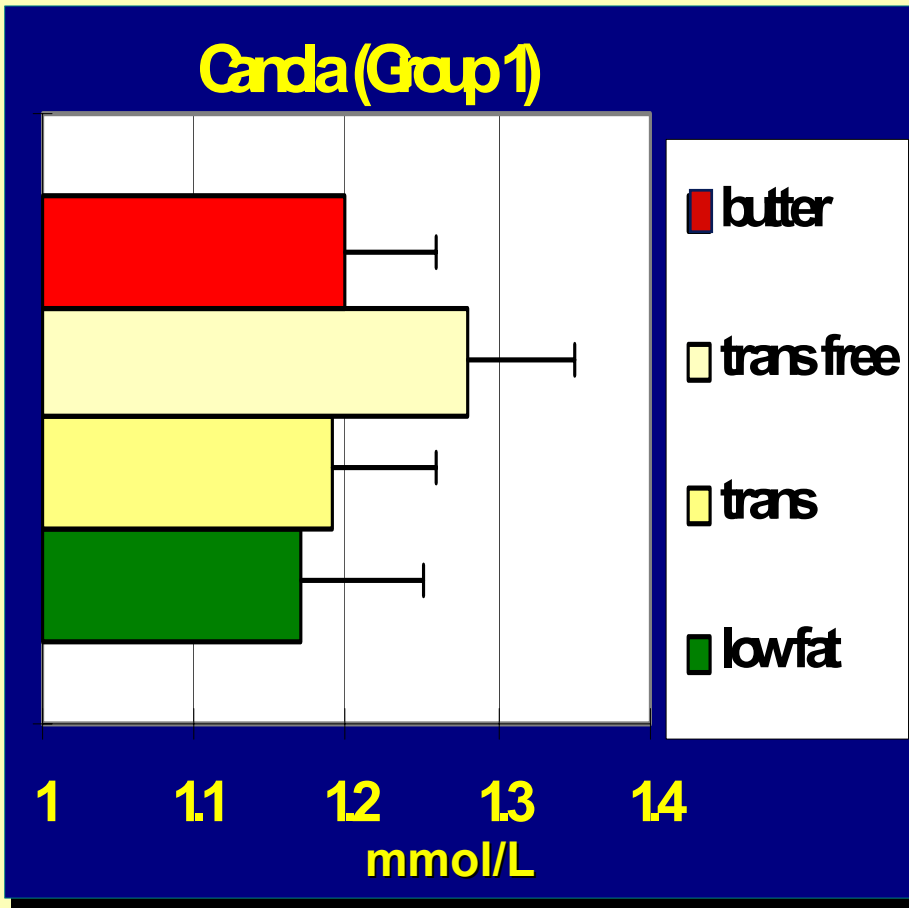


* $P < 0.001$ butter vs *trans*, *trans free*

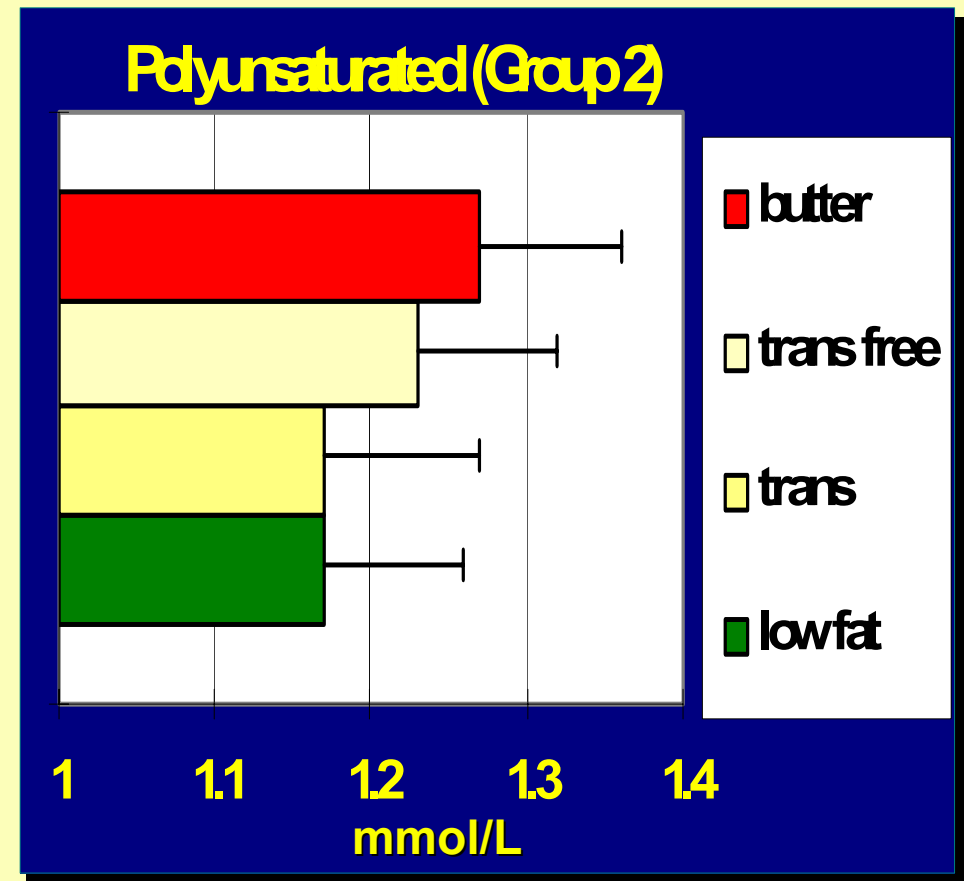
** $P < 0.001$ *trans free* vs *trans*

Margarines containing *trans* or zero *trans* fatty acids: differential effects on plasma lipids

HDL Cholesterol



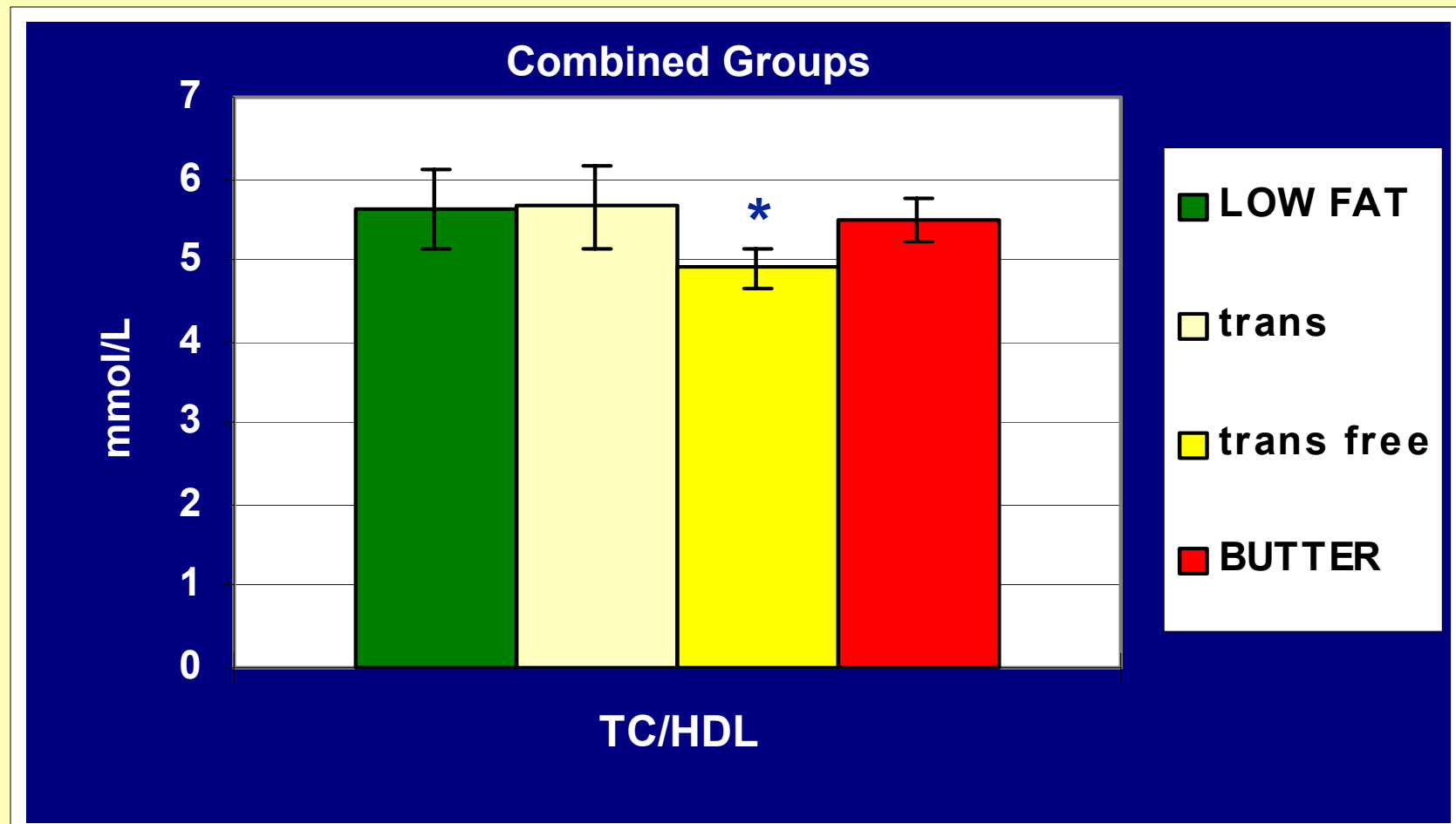
All NS



Margarines containing *trans* or zero *trans* fatty acids: differential effects on plasma lipids

TC/HDL Ratio

Means ± SE



Margarines containing *trans* or zero *trans* fatty acids: differential effects on plasma lipids

SUMMARY

- ✧ *Plasma total and LDL cholesterol on all margarines were similar to the low fat diet.*
- ✧ *The low fat and margarine diets lowered LDL-C 9-15% compared to butter ($P < 0.001$).*
- ✧ *The trans free poly blend resulted in a significant 0.25mmol/L (6%) reduction in LDL cholesterol compared to the blend containing trans ($P = 0.006$) although the 95% CI was large (-0.08 to -0.42mmol/L).*
- ✧ *Collectively, the trans free blends had TC/HDL ratios that were significantly lower than butter ($P < 0.001$).*

Conclusions

- ◆ Low fat diets not proven to be helpful
- ◆ Need either high poly or high mono margarines with no trans.
- ◆ BMI and exercise probably more important though than diet.