

---

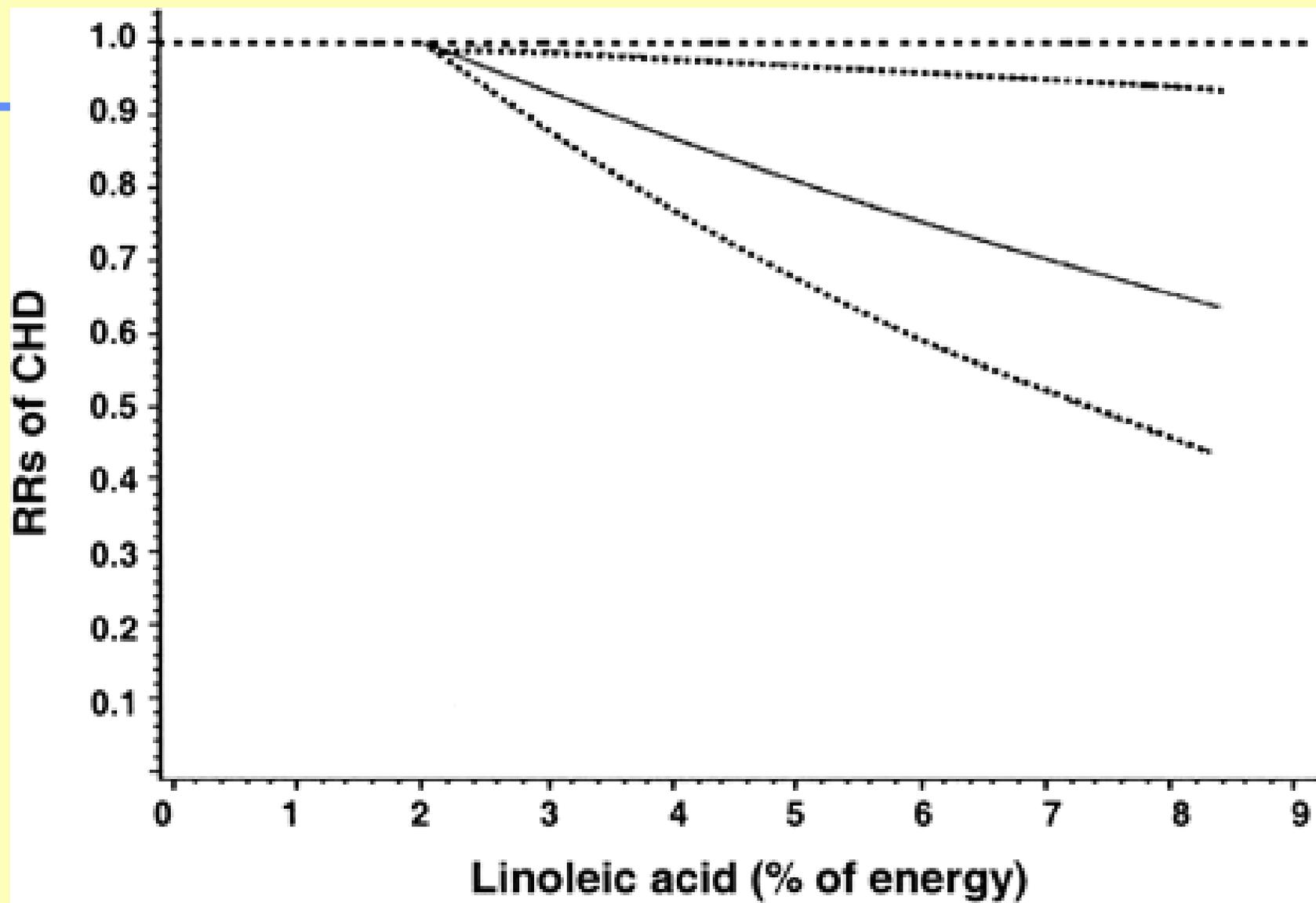
# Margarines and Heart Disease

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

---

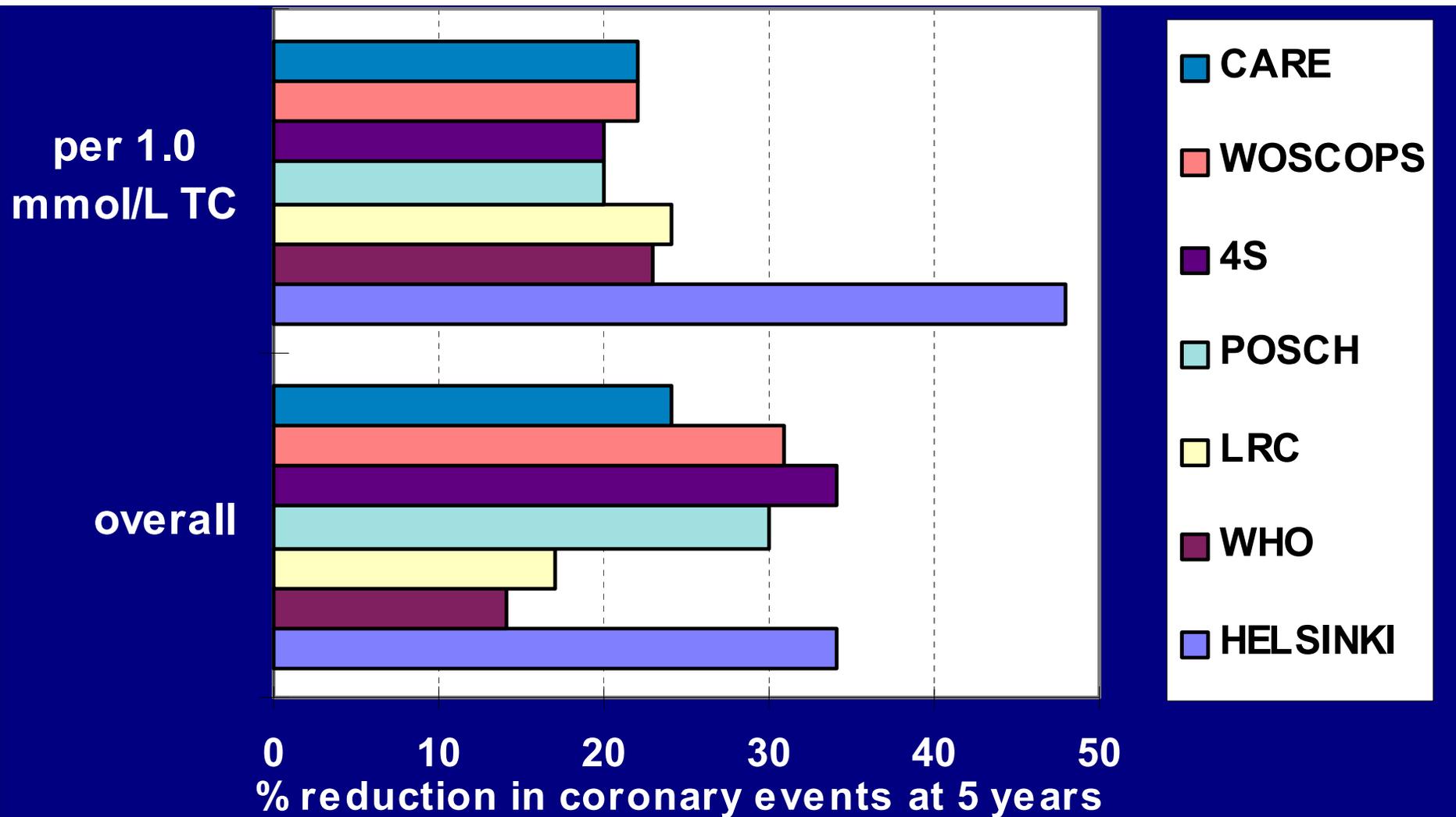
- ◆ Poly intake 37% reduction of heart disease in women with BMI>25 (ie overweight or obese) going from 4.1% to 7.4% of energy.
- ◆ Trans fat 53% increase in disease in women with BMI<25. From 1.3 to 2.8%.
- ◆ Total fat, saturated fat and monounsaturated fat not related to disease

# Polyunsaturated fat

---

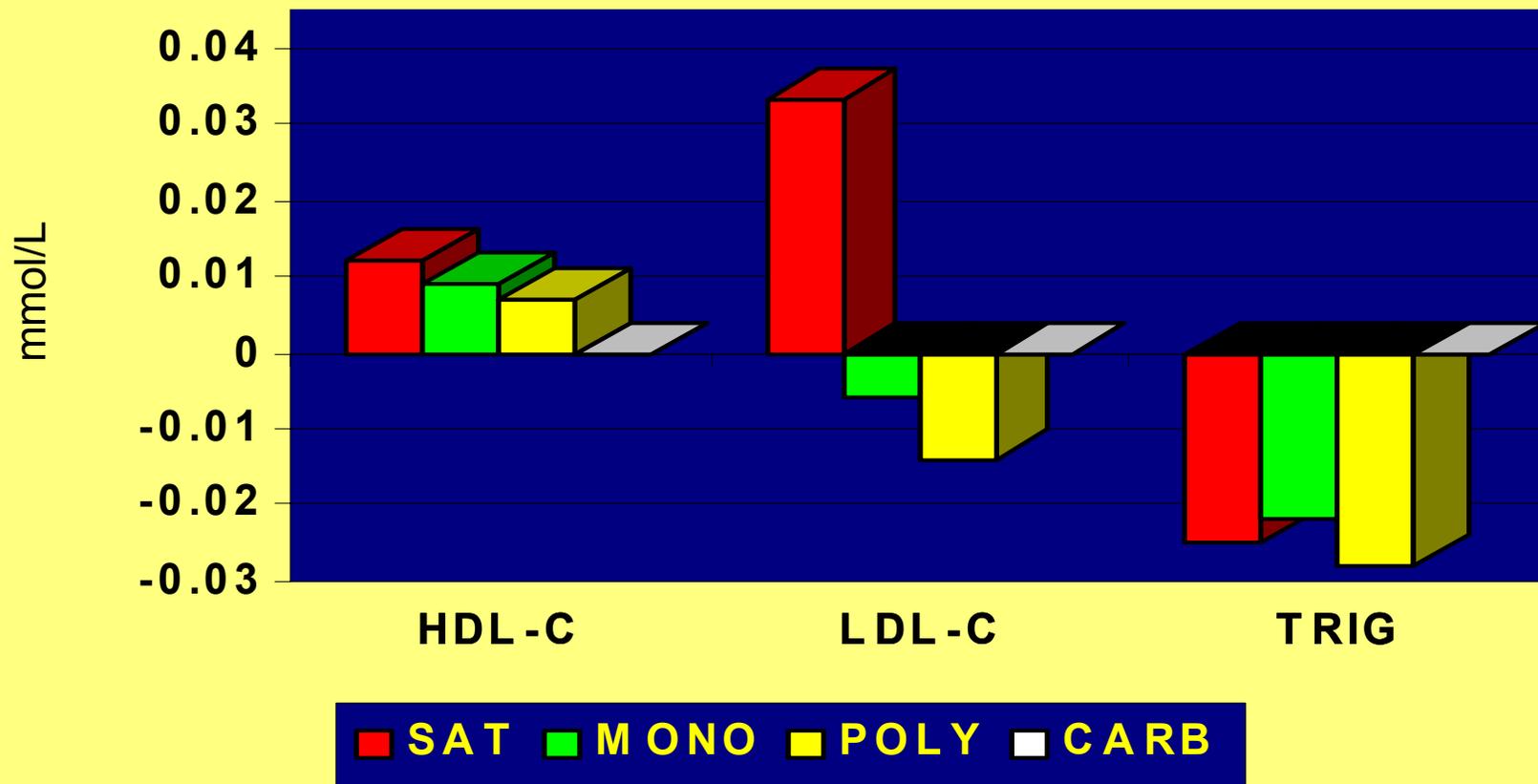
- ◆ Western Electric Study (in men) similar inverse relationship with heart disease.
- ◆ Slight inverse relationship seen in 2 studies (Oslo Diet Heart Study and MRFIT), none seen in 2 small interventions.
- ◆ Mechanism: lowers cholesterol slightly, antiarrhythmic, stops platelets sticking
- ◆ Monounsaturated 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**

---

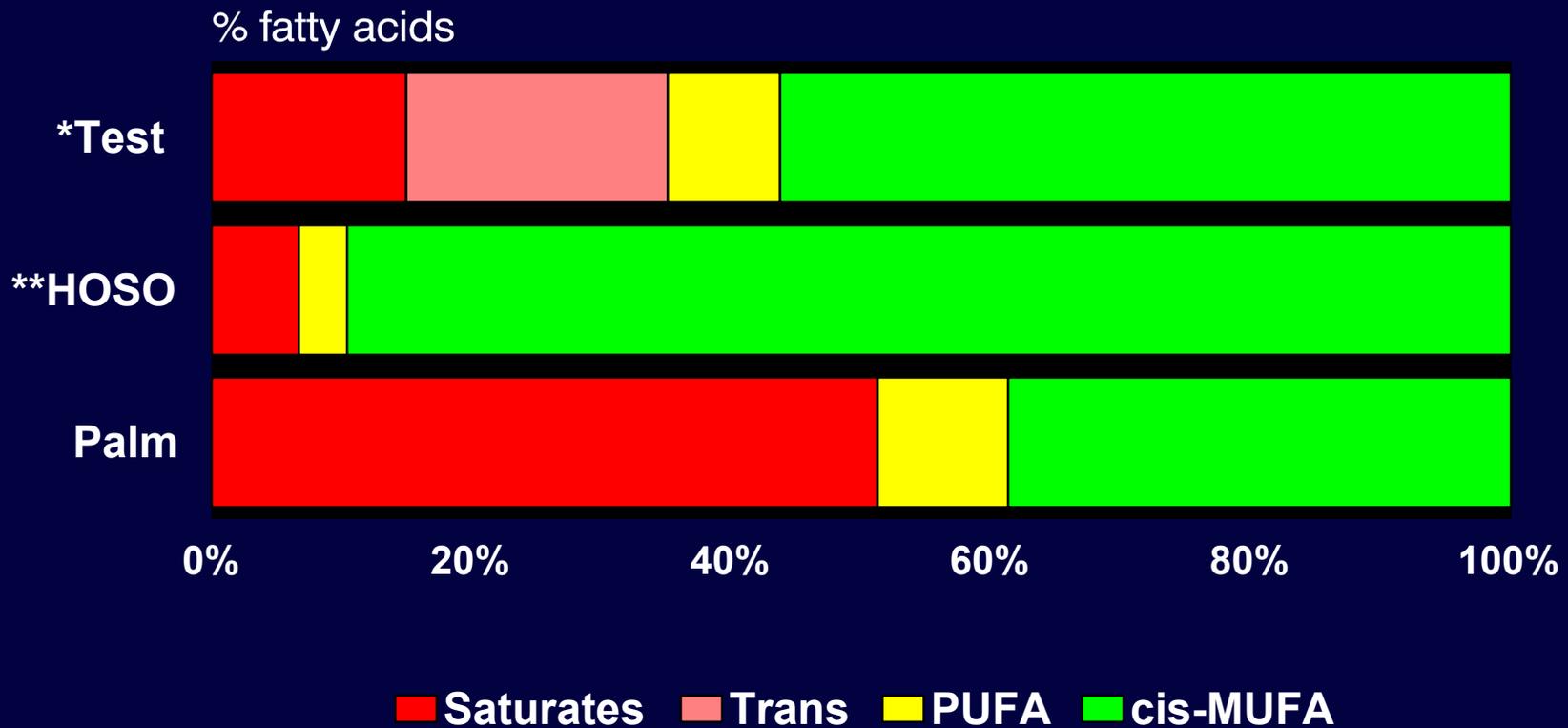
## **Aim**

**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

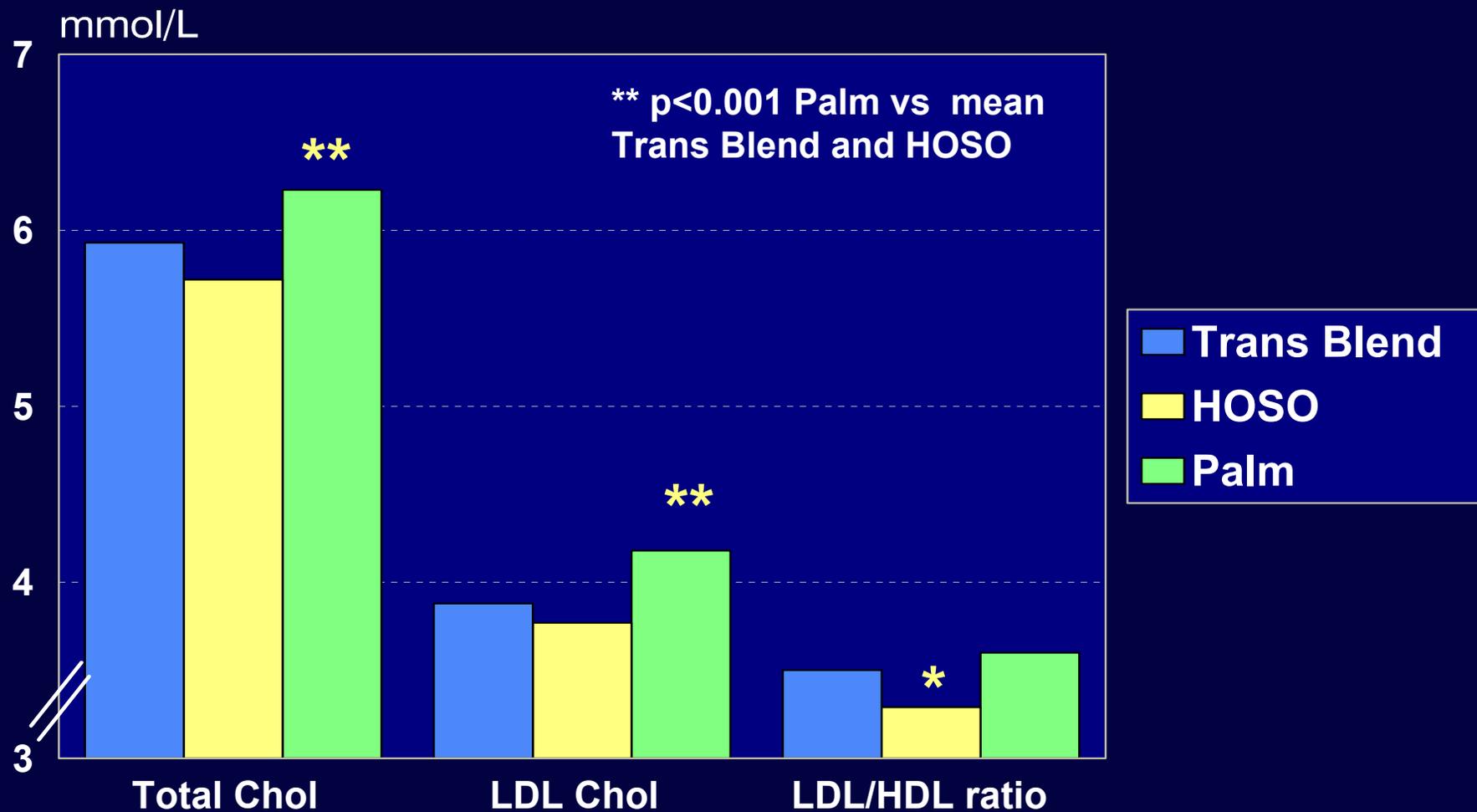
20% Fat energy

Provided as margarine and muffins containing the test fats

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

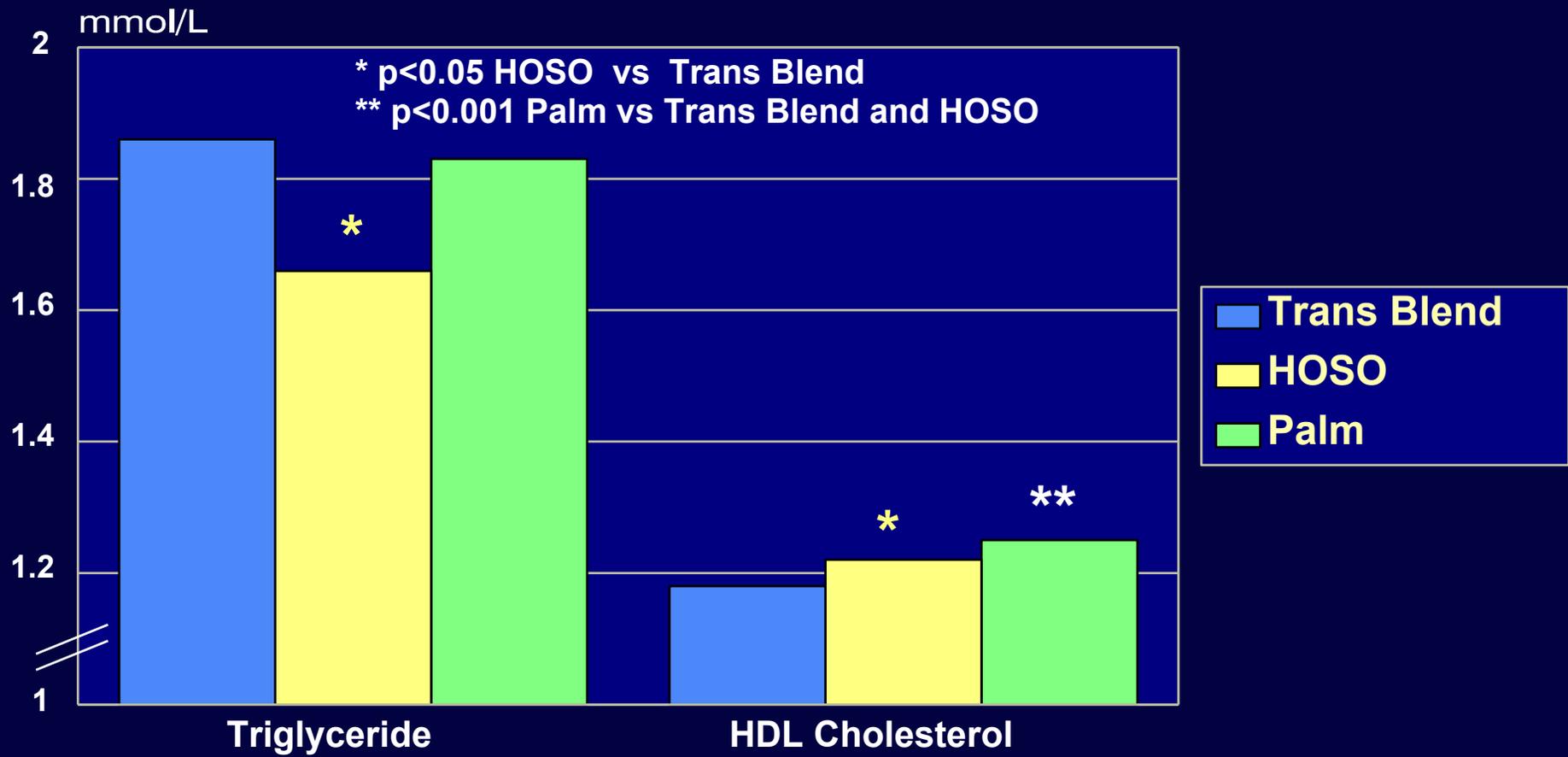
# Palm oil, high oleic sunflower and partially hydrogenated fats and plasma lipids

## 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

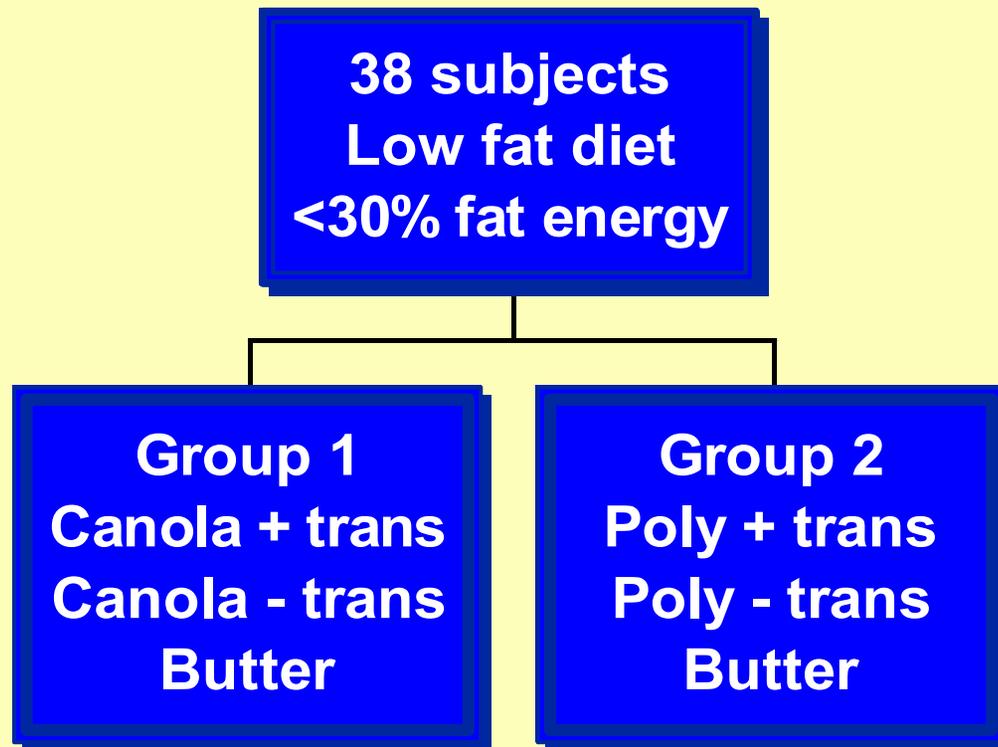
To establish whether *trans* fatty acid free margarines containing an *interesterified* hard fraction (from primarily saturated fatty acids) are at least as effective in lowering LDL cholesterol as those containing a *partially hydrogenated* fraction.

# 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

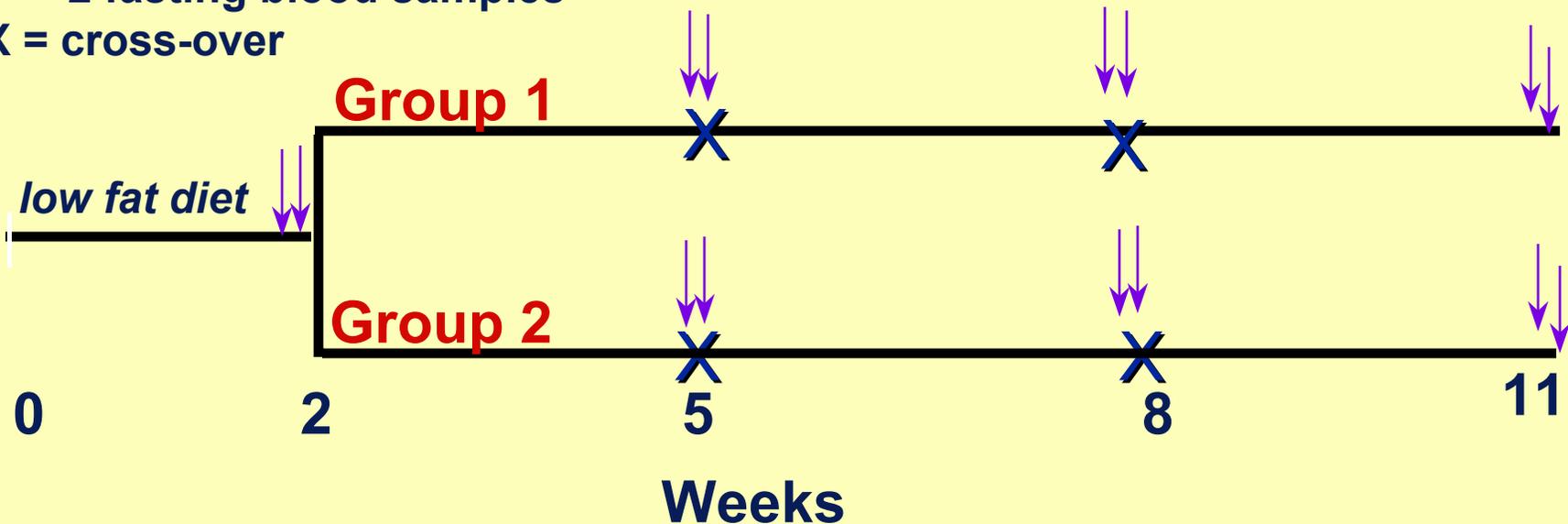
Schematic representation of the dietary phases

*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

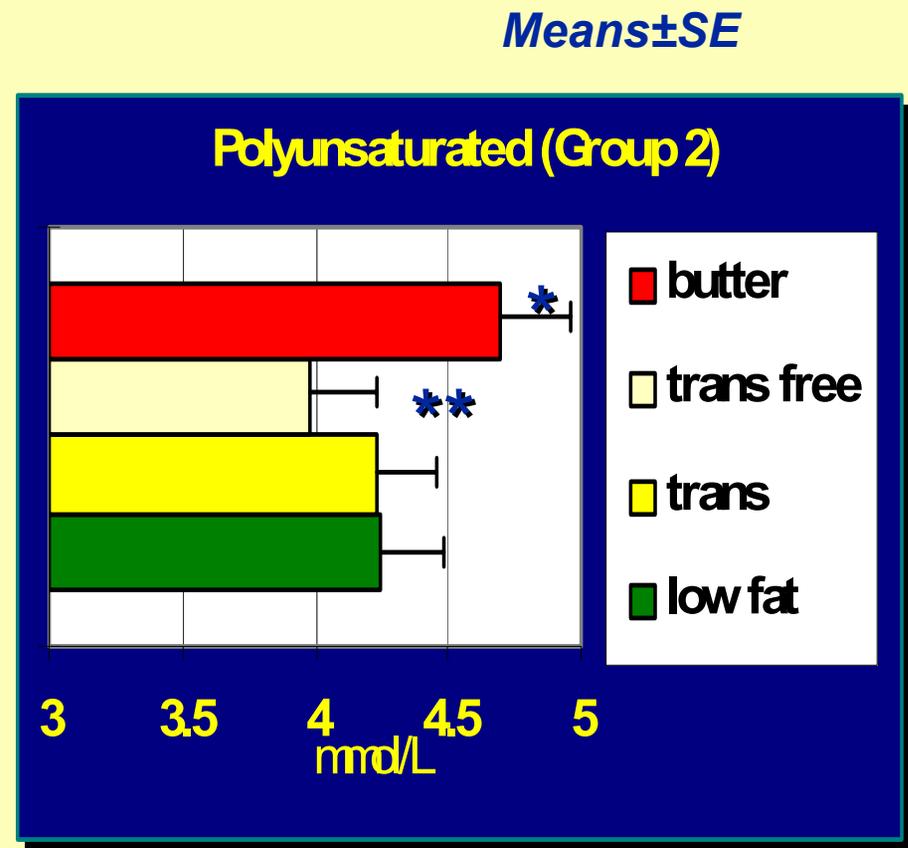
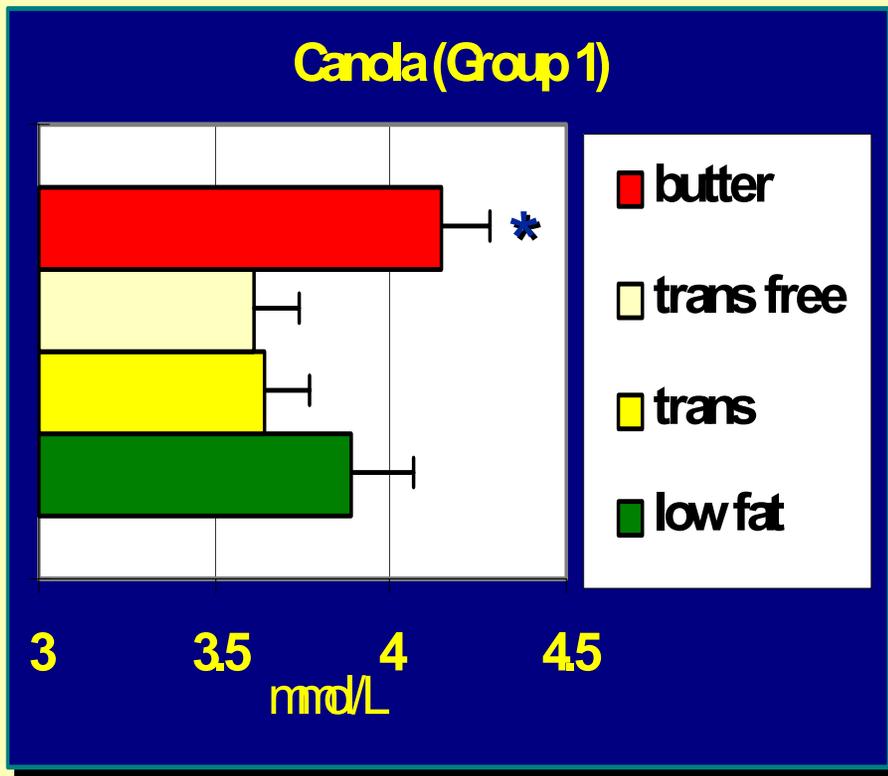
| Fatty Acids<br>% total   | BUTTER     | CANOLA<br>+trans* | CANOLA<br>trans free** | POLY<br>+trans | POLY<br>trans free |
|--------------------------|------------|-------------------|------------------------|----------------|--------------------|
| 12:0                     | 3.3        | 0.1               | 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               |
| <b>18:1 <i>trans</i></b> | <b>3.4</b> | <b>10.40</b>      | <b>0</b>               | <b>10.30</b>   | <b>0</b>           |
| 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

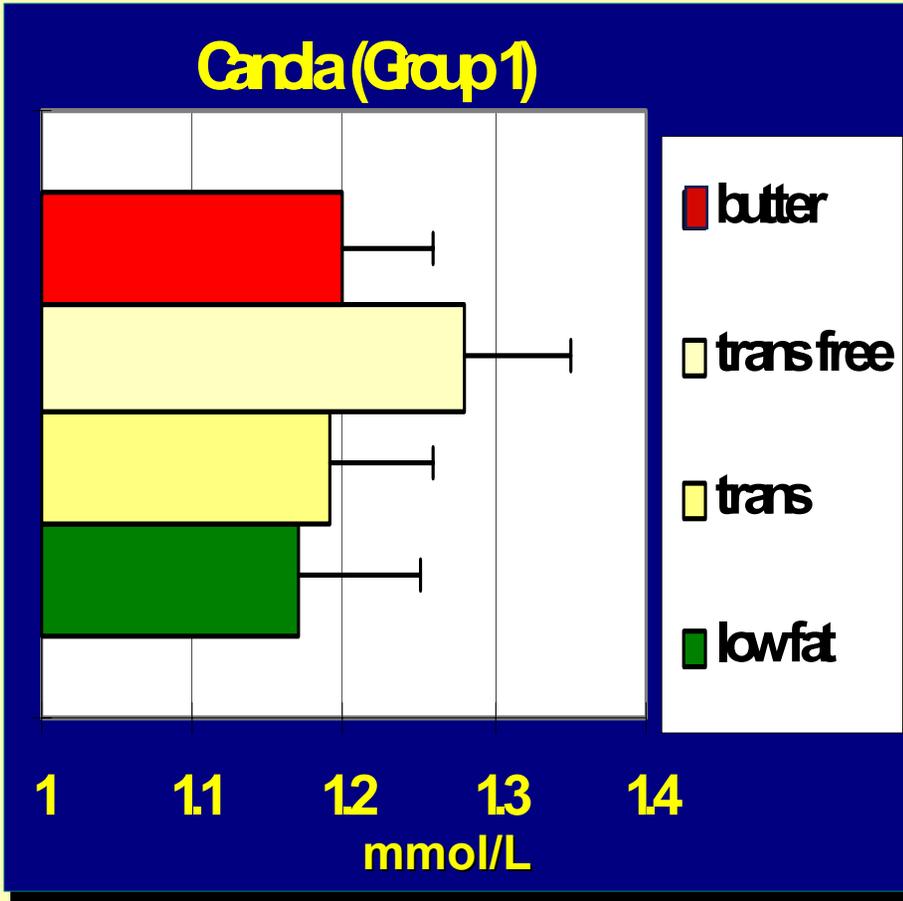


\*  $P < 0.001$  butter vs *trans*, *trans free*

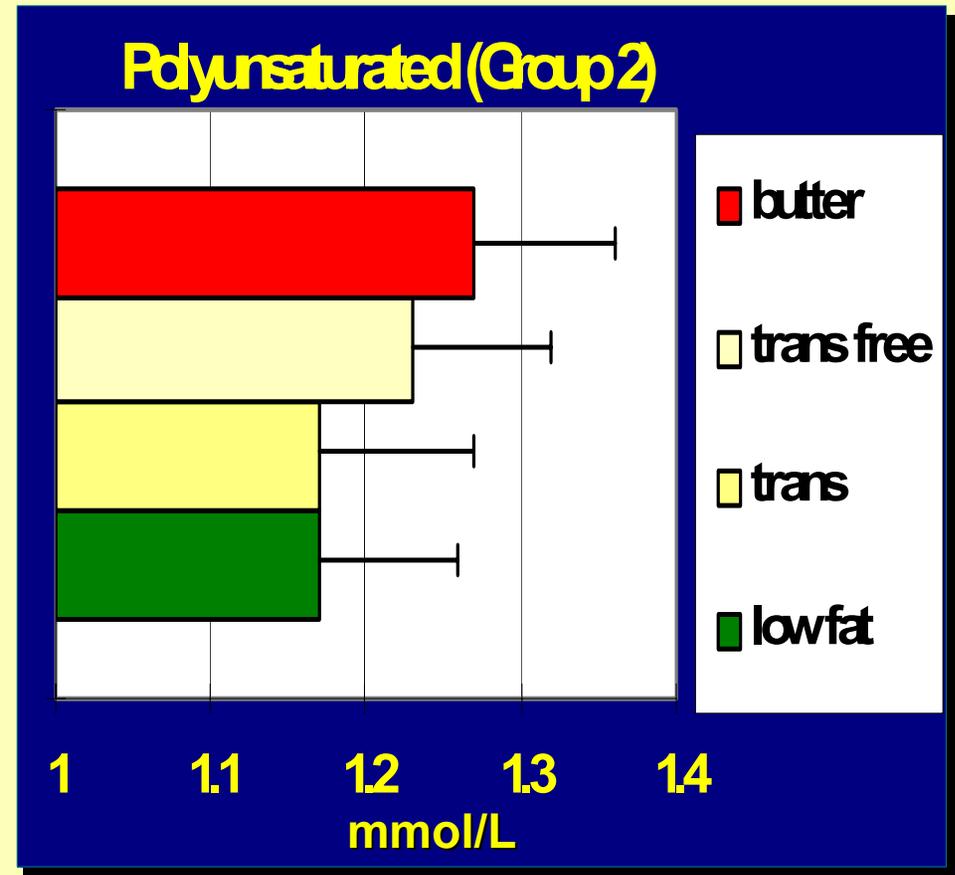
\*\*  $P < 0.001$  *trans free* vs *trans*

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

## HDL Cholesterol



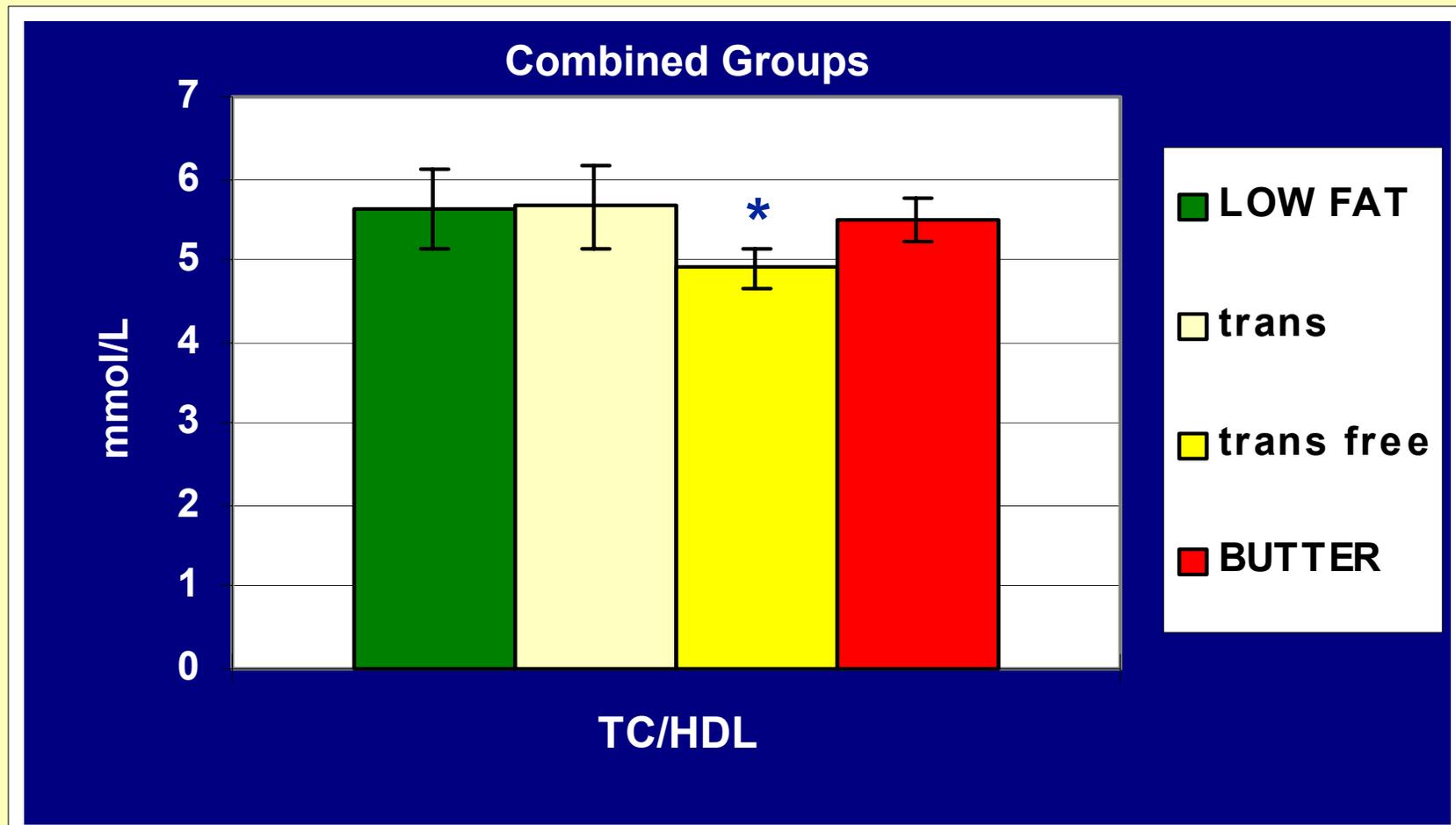
All NS



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

## TC/HDL Ratio

Means $\pm$ 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.