

# Dietary Fat Saturation in Rhesus Monkeys Affects LDL Concentrations by Modulating the Independent Production of LDL Apolipoprotein B

Khosla P and Hayes KC (1991). Dietary fat saturation in rhesus monkeys affects LDL concentrations by modulating the independent production of LDL apolipoprotein B. *Biochim Biophys Acta*. **1083**(1):46-56.

**ABSTRACT:** In a recent study from this laboratory, rhesus monkeys fed a 90% palm oil/10% soybean oil-containing diet (PS), rich in 16:0 and 18:1 fatty acids, had decreased total and LDL cholesterol concentrations compared to monkeys fed a 90% coconut oil/10% soybean oil-containing diet (CS), rich in 12:0 and 14:0 fatty acids. To investigate the metabolic basis of these changes, homologous <sup>125</sup>I-VLDL and <sup>131</sup>I-LDL were injected simultaneously into eight monkeys (four per dietary group). Analysis of apo B specific activity curves revealed that PS monkeys had an increased pool size of VLDL apo B (P less than 0.02), a 3-fold increase in the total VLDL apo B transport rate (P less than 0.001), a decreased pool size of LDL apo B (P less than 0.01) and a 2-fold decrease in the total transport rate of LDL apo B (P less than 0.001), while the irreversible FCR for VLDL apo B and LDL apo B was similar between dietary groups. PS monkeys derived a greater percentage of LDL apo B from VLDL catabolism resulting in a greater transport rate of LDL apo B from VLDL catabolism (P less than 0.055), in comparison to CS monkeys. For CS monkeys the proportion as well as the amount of LDL apo B derived from VLDL-independent catabolism (i.e., LDL apo B derived from sources other than VLDL catabolism) was higher (P less than 0.001) than the values obtained in PS monkeys. In both dietary groups the proportion of VLDL apo B converted to LDL apo B was similar, although the absolute amount was higher for the PS monkeys (P less than 0.06). The proportion of VLDL apo B directly removed from the circulation was similar for both dietary groups, with the absolute amount being higher for the PS monkeys (P less than 0.001). Consistent with the lower pool size of LDL apo B and the higher pool size of VLDL apo B observed in PS monkeys, plasma and LDL cholesterol concentrations tended to be lower, whereas plasma triacylglycerol and VLDL cholesterol concentrations tended to be higher, but these changes were not statistically significant. Although total apo B and VLDL apo B transport rates were increased 2-3-fold in PS monkeys, LDL apo B concentration was reduced by 40% (P less than 0.02) attributed to a significant reduction in the mass and proportion of LDL apo B derived independent of VLDL catabolism.

# Study Design

- Eight rhesus monkeys, four of each sex (body weight 6-10kg).
- Monkeys raised from birth for 14-16 years with purified diets containing 31% calories as either corn oil or edible coconut oil.
- The monkeys were randomly assigned to either a diet containing:
  - 90% coconut oil /10 % soybean oil (CS diet; 4 monkeys, 2 males and 2 females)
  - 90% palm oil /10% soybean oil (PS diet; 4 monkeys, 2 males and 2 females)

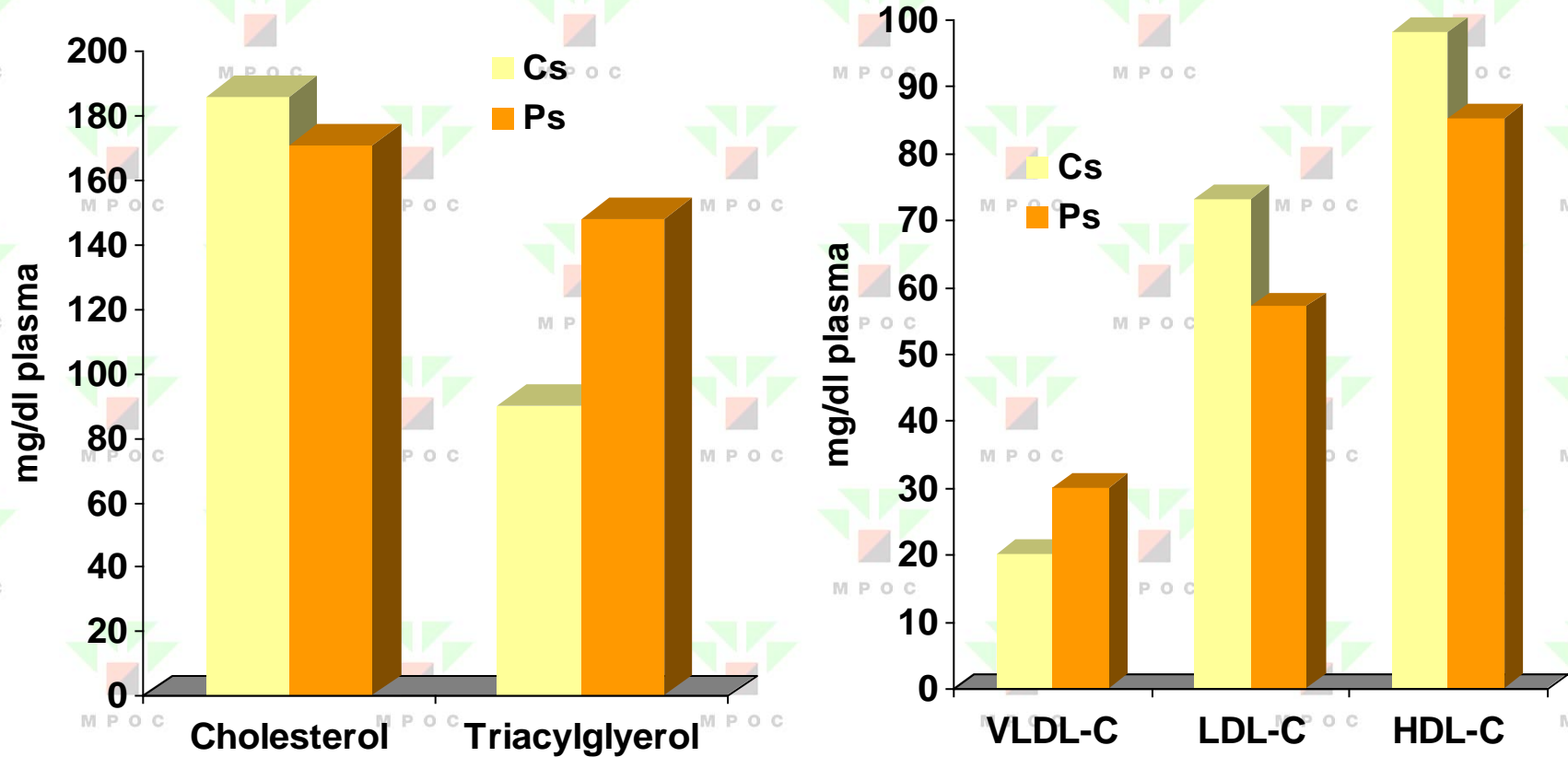
M P O C

# Fatty Acid Analysis

Saturated fatty acid	12:0	14:0	16:0
Cs (%)	31.6	20.0	15.7
Ps (%)	0.3	0.9	37.5
Unsaturated fatty acid	18:0	18:1	18:2
Cs (%)	5.8	14.8	12.2
Ps (%)	5.3	40.4	15.5

M P O C

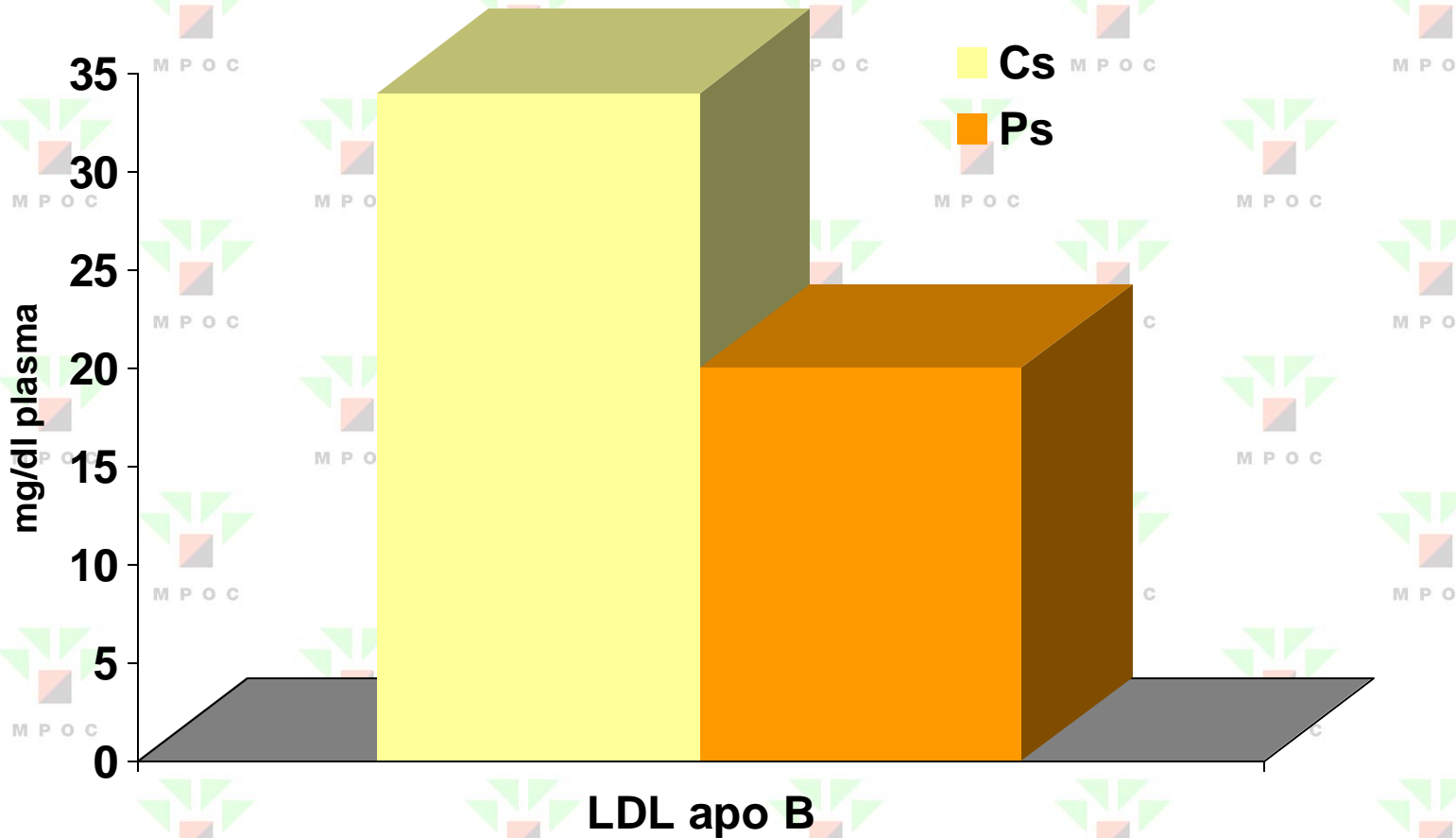
# Plasma Lipid and Lipoprotein Cholesterol in the Two Groups of Monkeys



PS monkey have decrease total cholesterol, LDL-C and HDL-C but elevated in triacylglycerol and VLDL-C.

**PS: 90% Palm oil + 10% Soybean oil;**  
**CS: 90% Coconut oil + 10% Soybean oil**

# LDL Apo B Concentration in the Two Groups of Monkeys

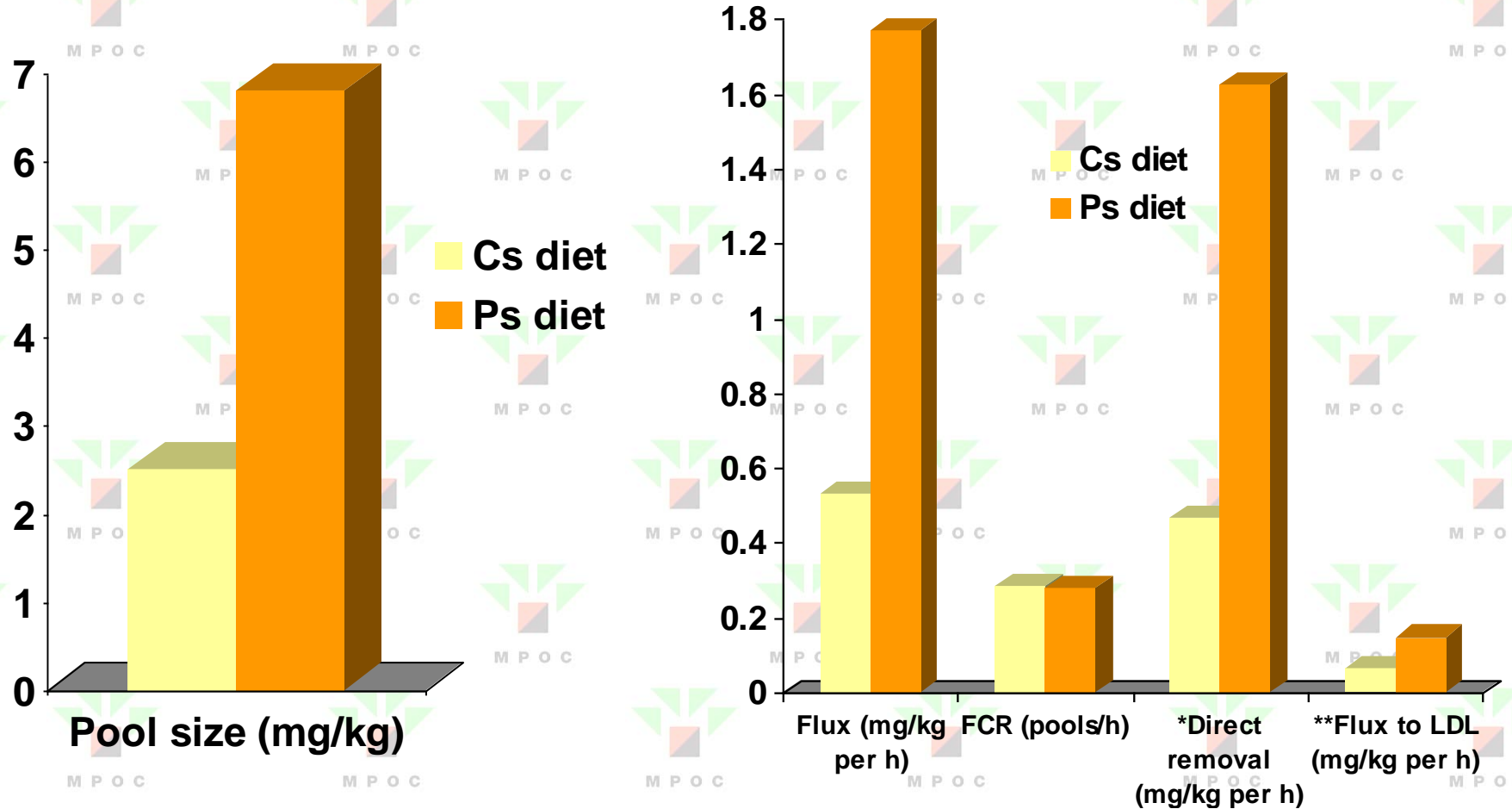


**Significantly lower LDL ApoB on the PS diet compared to CS diet**

PS: 90% Palm oil + 10% Soybean oil;  
CS: 90% Coconut oil + 10% Soybean oil

*Credit: Dr. K. Sundram, 2013*

# VLDL Apo B Kinetic Parameters in Rhesus Monkeys Fed CS or PS Diets



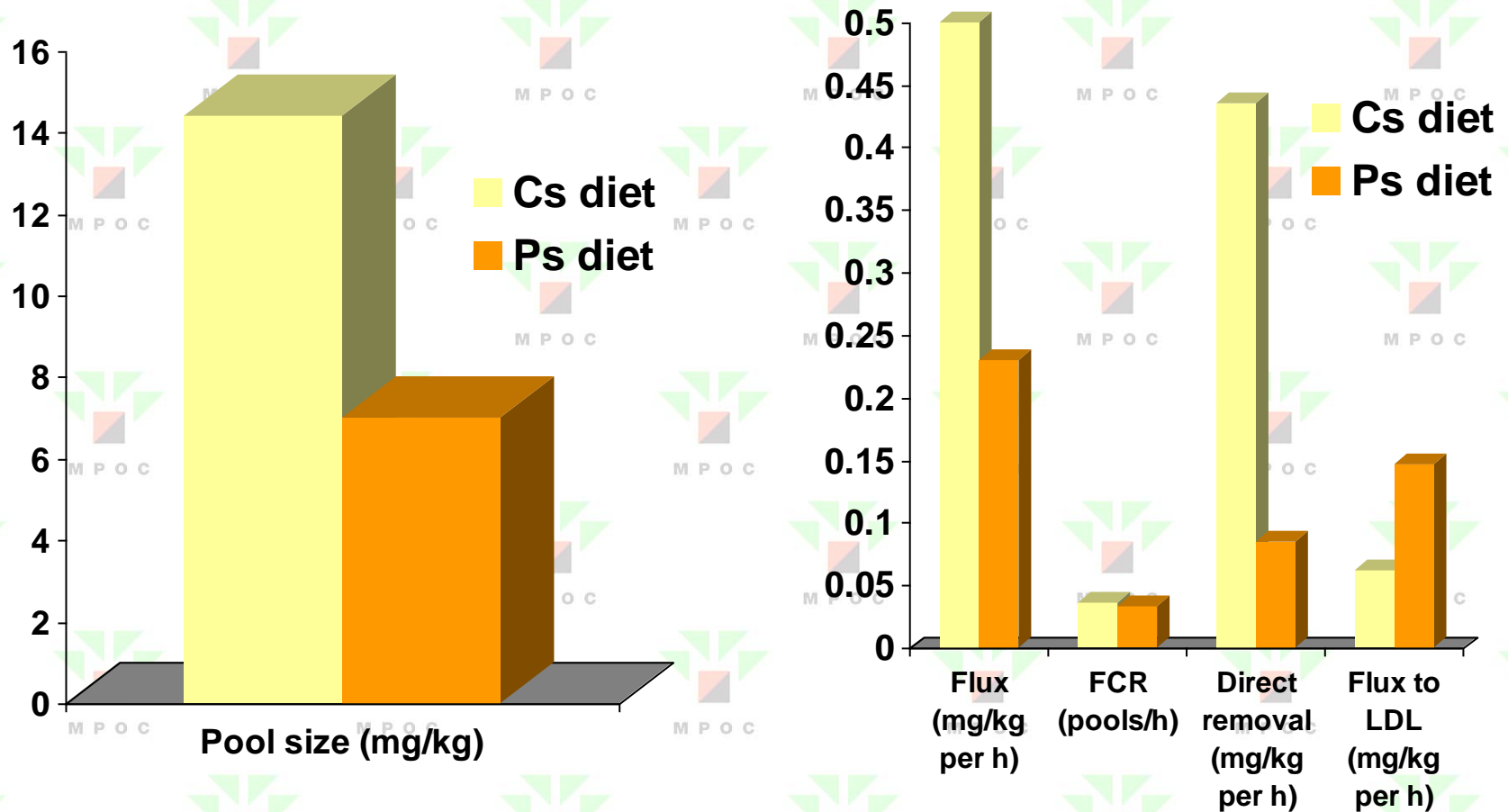
\*Direct removal refers to VLDL which is not converted to LDL, but is removed directly from the circulation.

\*\*Flux to LDL refers to VLDL converted to LDL.

Ps monkey had an increased pool size of VLDL apo B, 3 fold increase in the total VLDL apo B transport rate and derived a greater percentage of LDL apo B from VLDL catabolism resulting in a greater transport rate of LDL apo B from VLDL catabolism compared to CS diet.

Credit: Dr. K. Sundram, 2013

# LDL Apo B Kinetic Parameters in Rhesus Monkeys Fed CS or PS Diets



PS monkeys had a decreased pool size of LDL apo B, 2 fold decrease in the total LDL apo B transport rate. In CS monkeys, the proportion as well as the amount of LDL apo B derived from VLDL independent catabolism was higher than the values obtained in PS monkey.

Credit: Dr. K. Sundram, 2013

## Conclusion

Combination diet of palm oil (major component, 90%) and soybean (minor component, 10%) resulted in a lower production of LDL apo B.



M P O C