

# Associations among Organochlorine Pesticides, *Methanobacteriales*, and Obesity in Korean Women

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# Origin of Idea

- This research was the idea of Duk-Hee Lee.
- While searching for ways to reduce body burden of POPs, she learned that some microorganisms increase biodegradation of POPs in the environment.
- She considered that a similar thing might happen in the gut and performed a small study to test this.

# Background

- Methanogens are microbes that produce methane gas from various substrates such as  $H_2$  and  $CO_2$ , acetate, and methylamine.
- They were identified as belonging to the domain archaea in the 1970s
- Removal of  $H_2$  by methanogens could promote obesity by improving fermentation efficiency of dietary polysaccharides.
- Methanogens reportedly biodegrade petroleum hydrocarbons in polluted environments and increase in the presence of petroleum contamination and are used to remove petroleum-based pollutants in environments.
- Therefore, we hypothesized that increased body burden of petroleum-based man-made chemicals such as OCPs would promote methanogens in human gut, which in turn would promote adiposity. OCPs are persistent organic pollutants (POPS)

# Study Design

- 83 Korean women, community health service center routine health checkup
- Quantitative real-time PCR (qPCR) quantify Methanobacteriales in feces.
- Nine OCPs were measured in both serum and feces of 16 women.

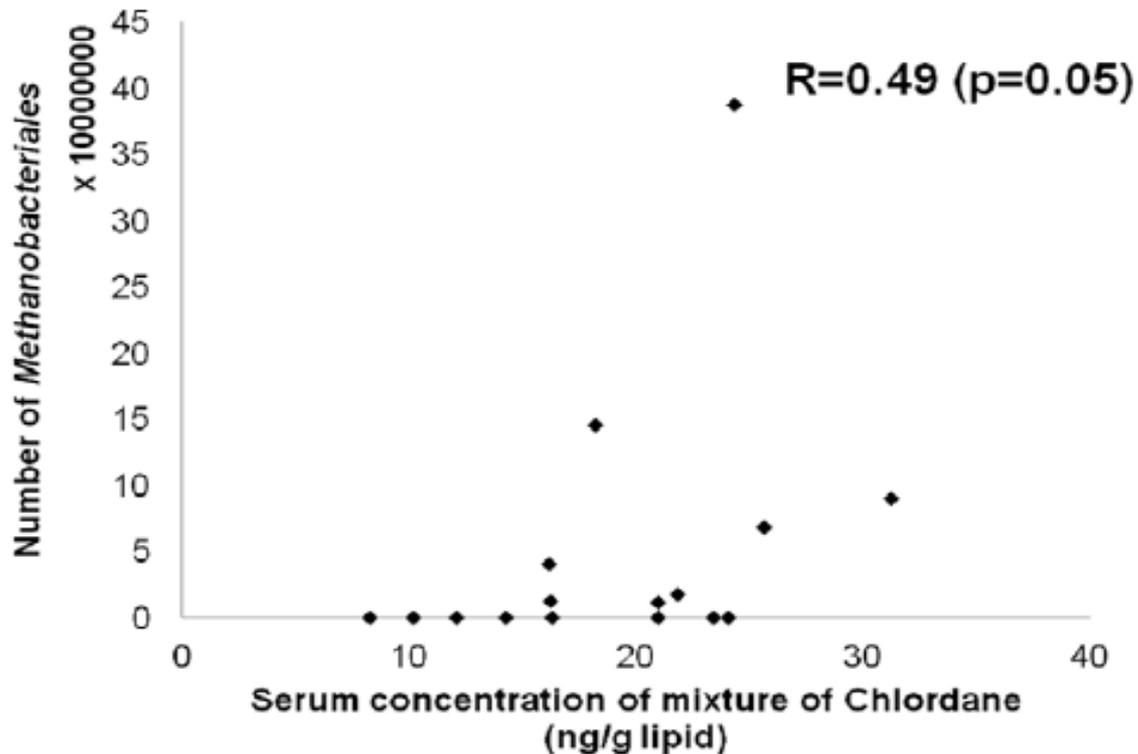
**Table 1.** General characteristics by presence of *Methanobacteriales* (n = 83).

Characteristics	<i>Methanobacteriales</i>		P value
	Present (n = 27)	Absent (n = 56)	
Mean $\pm$ standard deviation			
Age (years)	58.6 $\pm$ 7.3	59.3 $\pm$ 7.8	0.71
Body mass index (kg/m <sup>2</sup> )	26.4 $\pm$ 3.2	24.7 $\pm$ 3.5	0.04
Waist circumference (cm)	88.8 $\pm$ 7.3	83.6 $\pm$ 9.0	0.01
Percentages (%)			
Body mass index $\geq$ 25 kg/m <sup>2</sup>	66.7%	46.4%	0.08

# Findings

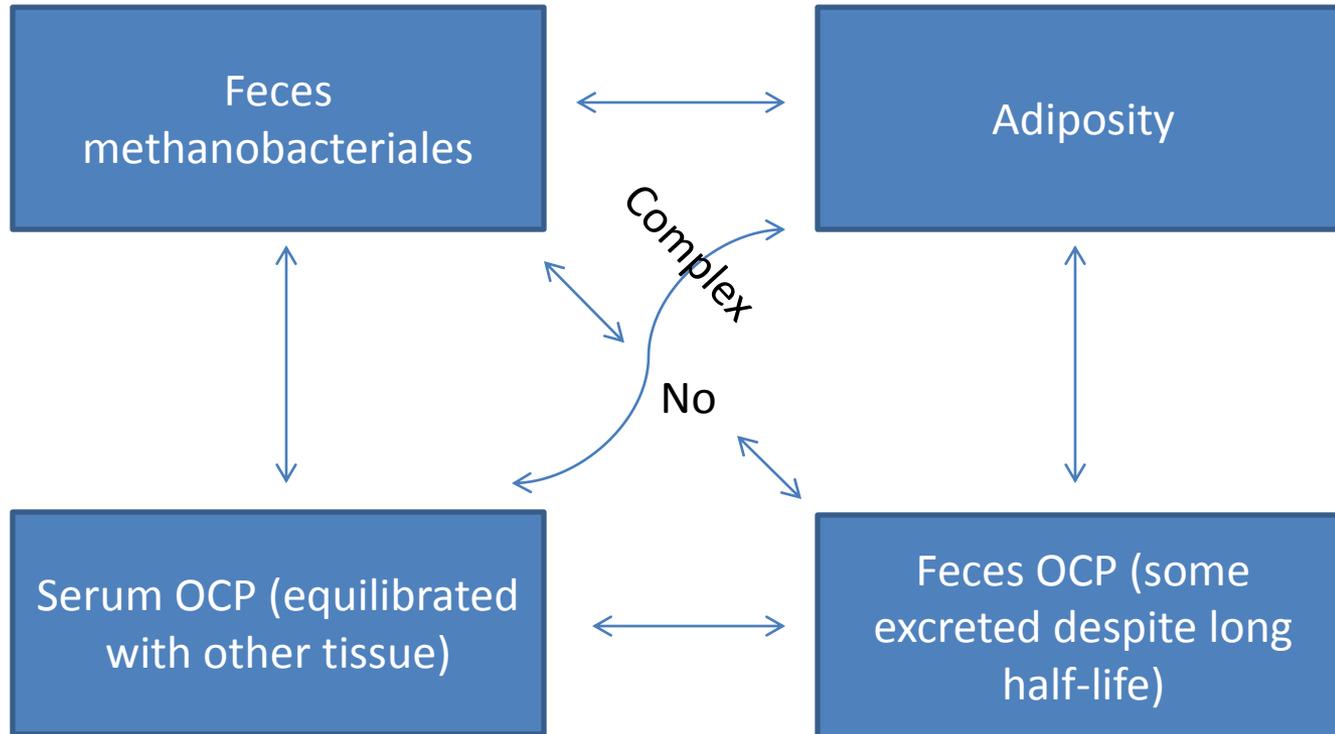
- **Methanobacteriales detected:**  
32.5% (27/83 women)
- **Methanobacteriales and adiposity:**  
Levels in feces correlated with BMI and waist circumference ( $r = +0.23$  and  $P=0.03$  for both).
- **Methanobacteriales and serum OCPs (body burden):**  
Methanobacteriales correlated with most serum OCPs  
cis-nonachlor ( $r = +0.53$ ,  $P=0.05$ )  
oxychlorodane ( $r = +0.46$ ,  $P=0.1$ )  
trans-nonachlor ( $r = +0.43$ ,  $P=0.1$ )
- **Methanobacteriales generally uncorrelated with feces OCPs**

# Methanobacteriales and sum of POPs



**Figure 2. Scatter plot between serum concentrations of mixture of organochlorine pesticides belonging to Chlordane (oxy-chlordane, *trans*-Nonachlor, *cis*-Nonachlor, Heptachlor epoxide) and number of *Methanobacteriales* (n = 16). When one subjects with the highest number of *Methanobacteriales* ( $38.7 \times 10^7$ ) was excluded, the correlation coefficient was 0.45 (p = 0.09). doi:10.1371/journal.pone.0027773.g002**

# Conclusions



The results are consistent with our hypotheses that body burden of OCPs may determine the levels of Methanobacteriales in the human gut, and that this process can finally lead to increased body weight and waist circumference.