

**Physical activity energy  
expenditure has not declined  
since the 1980s and matches  
energy expenditure of wild  
mammals**

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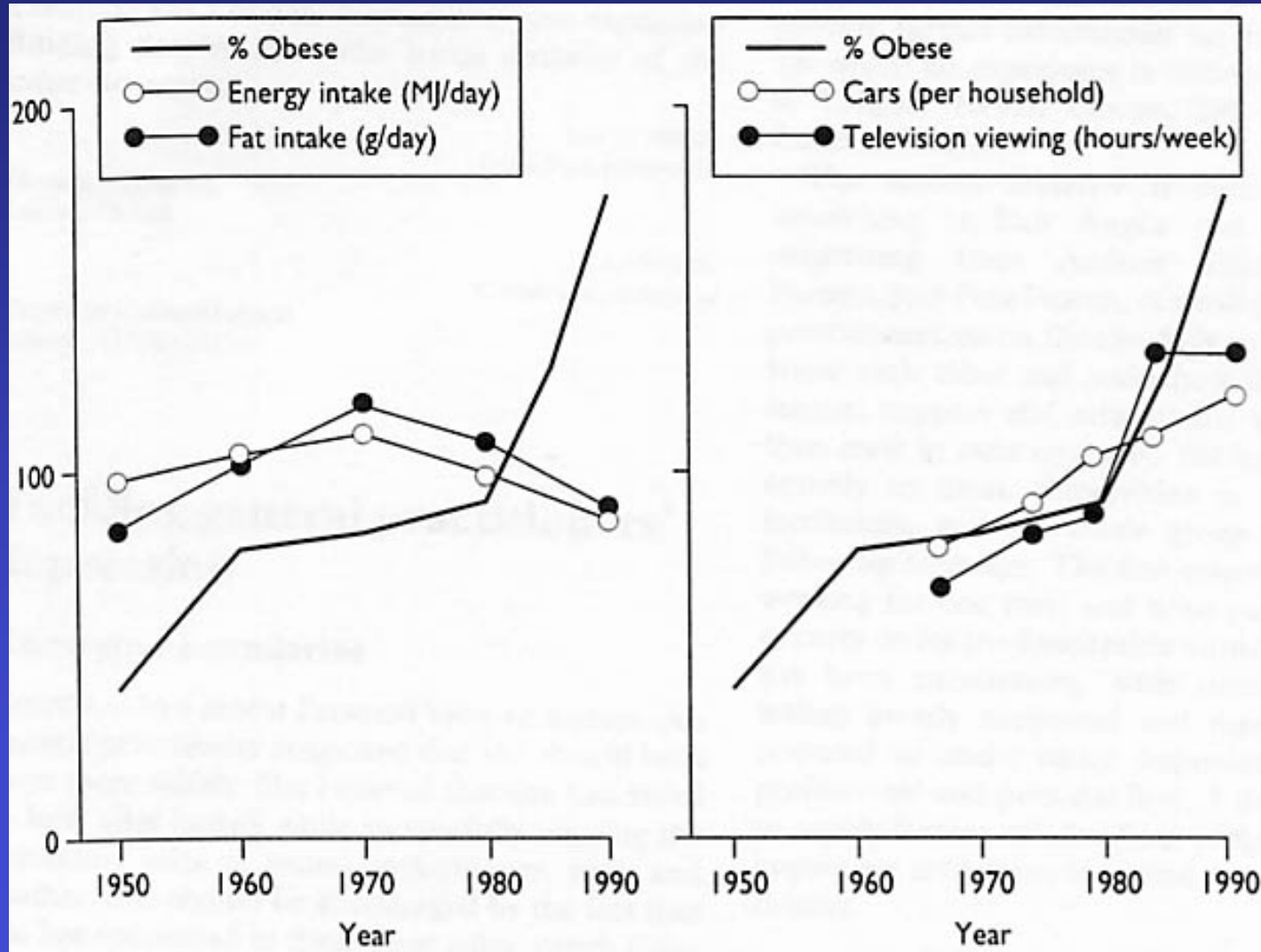
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# Background

Obesity is a recent significant health issue, resulting from a protracted energy imbalance

Whether this comprises excessive energy intake, lowered physical activity, or both, remains disputed

# Gluttony or sloth?



Prentice and Jebb. Br Med J 1995;311:437-9

# Design

Physical activity energy expenditure from daily  
energy expenditure measured with  $^2\text{H}_2^{18}\text{O}$

Trends over time back to the 1980s

Measures made on wild terrestrial mammals

# Subjects Maastricht data base

	Mean	SD	Range
Women (n=167)			
Age (years)	30	9	18-50
Height (m)	1.68	0.06	1.52-1.86
Body mass (kg)	73	18	47-164
BMI (kg/m <sup>2</sup> )	26.3	6.5	16.6-55.3
DEE* (MJ/d)	10.9	1.8	7.0-18.4
Men (n=199)			
Age (years)	33	9	18-50
Height (m)	1.80	0.07	1.64-1.97
Body mass (kg)	83	21	50-216
BMI (kg/m <sup>2</sup> )	25.7	6.0	15.6-61.7
DEE (MJ/d)	14.0	2.6	9.5-22.6

\*DEE, daily energy expenditure

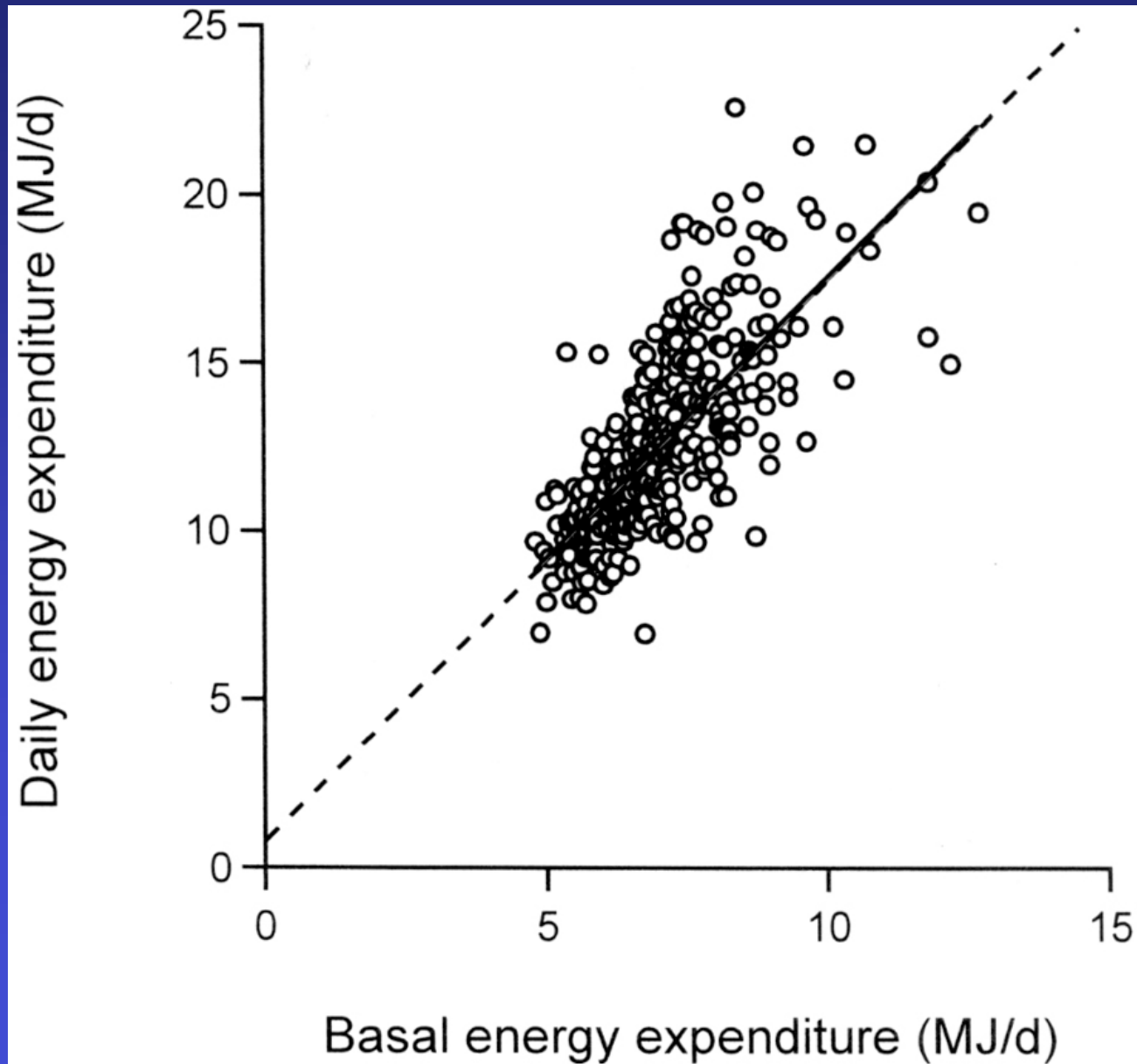
# Assessment of physical activity energy expenditure

Residual regression DEE on BEE

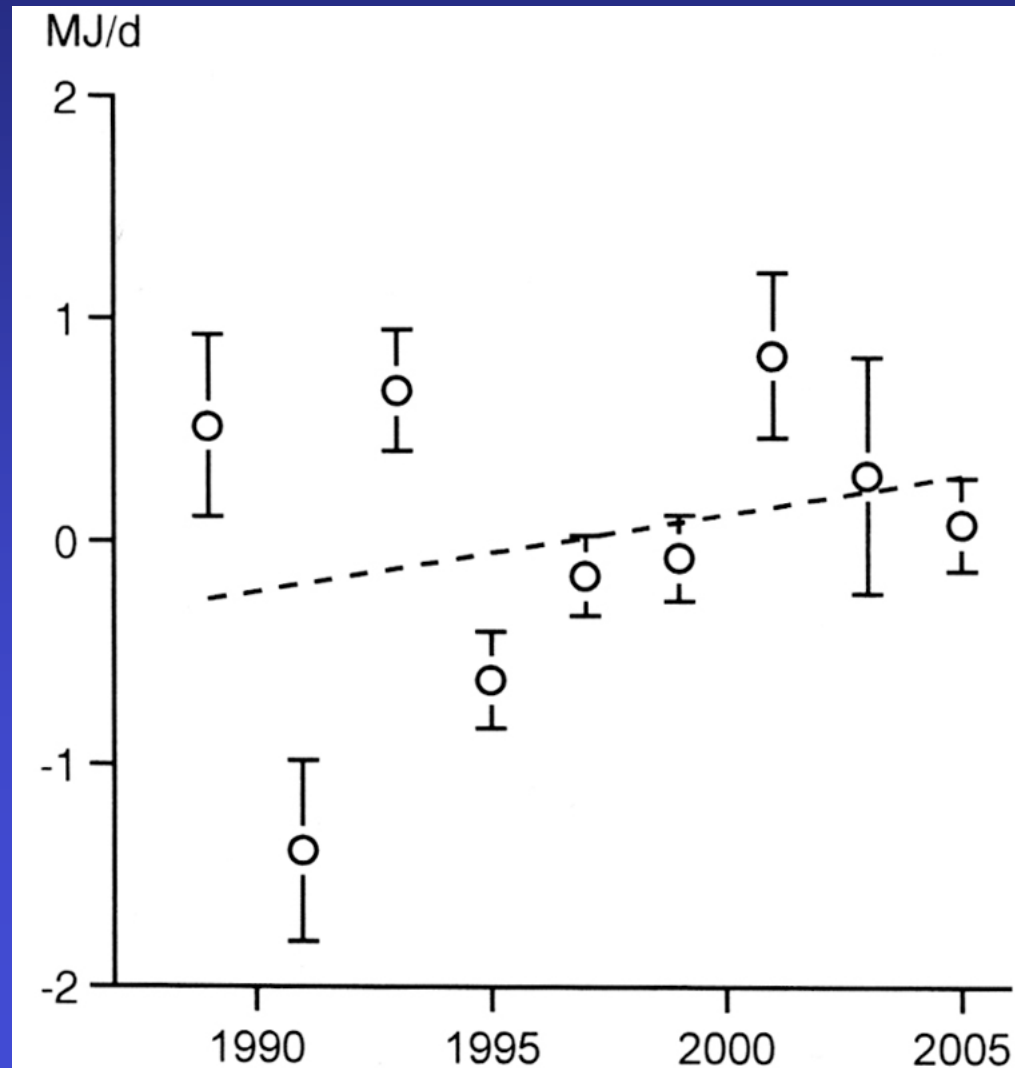
Ratio of DEE to BEE (PAL)

Residual regression DEE on body mass and sex  
(if BEE not available)

# Regression DEE on BEE

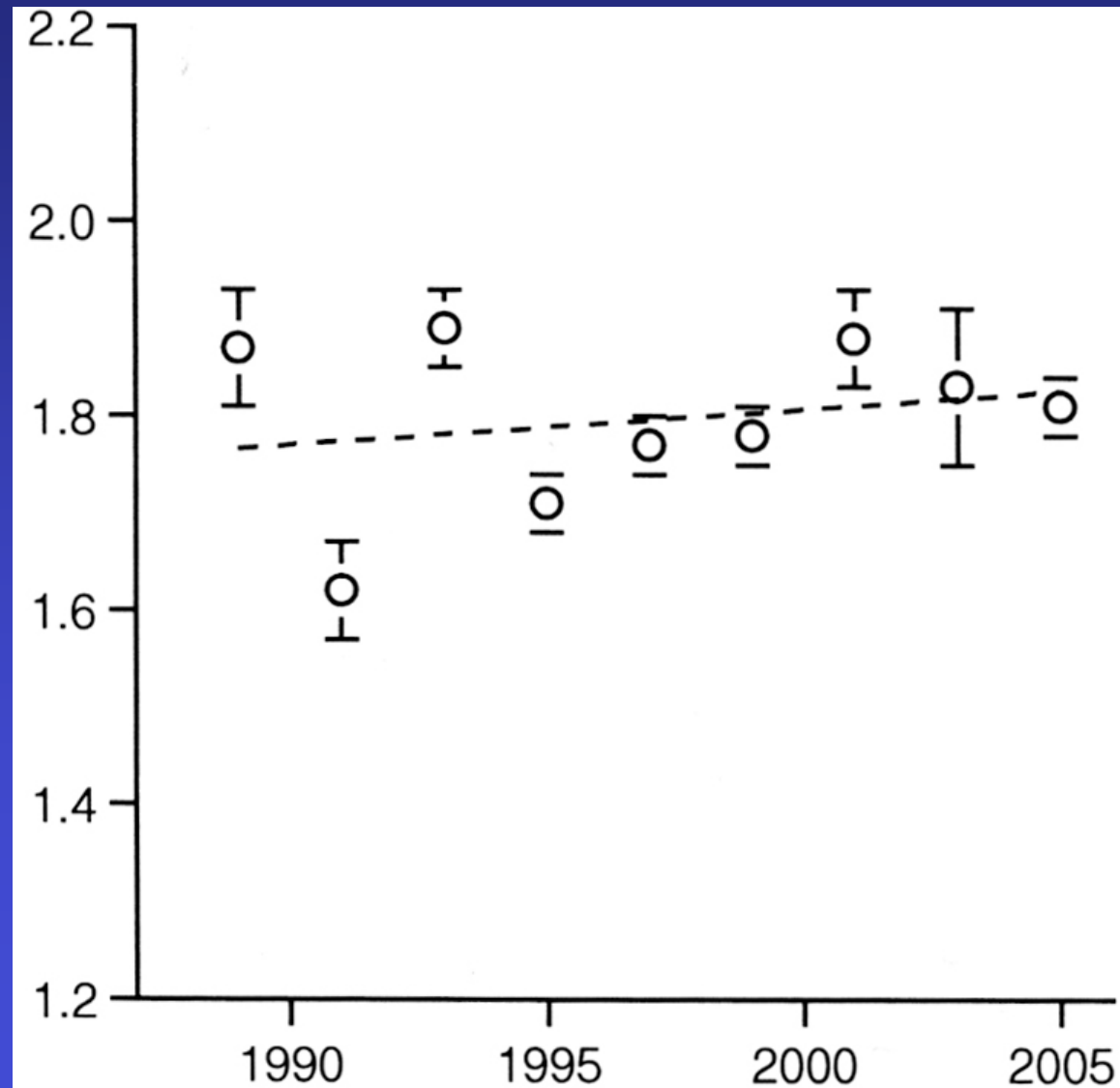


# Significant trend for increase of residual DEE-BEE in time

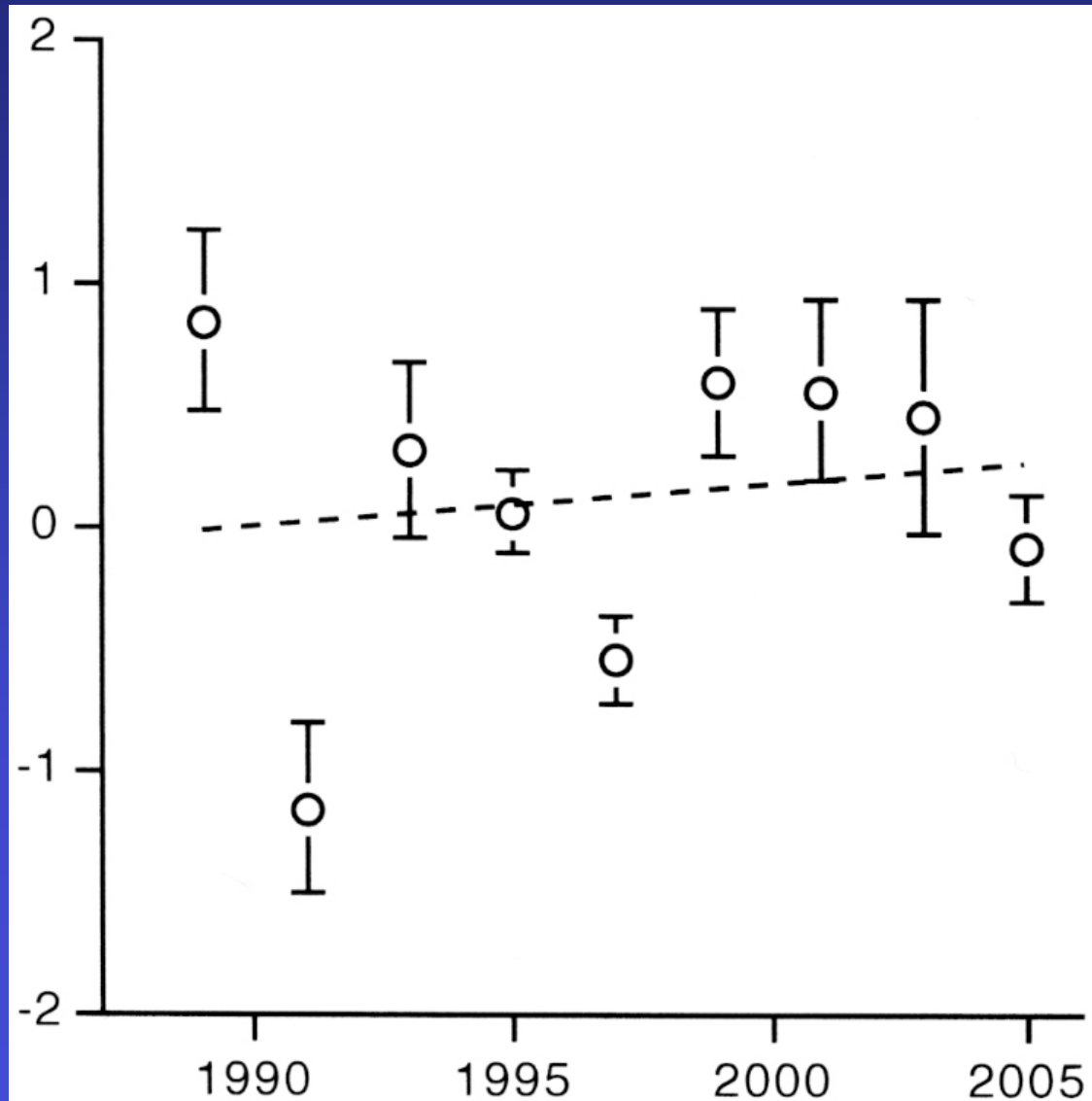




# No significant change in PAL over time



# No significant time trend of residual DEE-(weight,gender,age)



# Data from North America

433 Subjects

Body weight and gender dominant factors  
explaining DEE

Significant positive effect of date of  
measurement on DEE after adjustment for body  
weight, gender and age

# Data from 3<sup>rd</sup> world countries

149 Subjects

The data lie on the expected line determined by body mass, gender and age for individuals in western societies

# Conclusion

There is no indication that energy expenditure on physical activity or total energy expenditure have declined over the past 2 decades

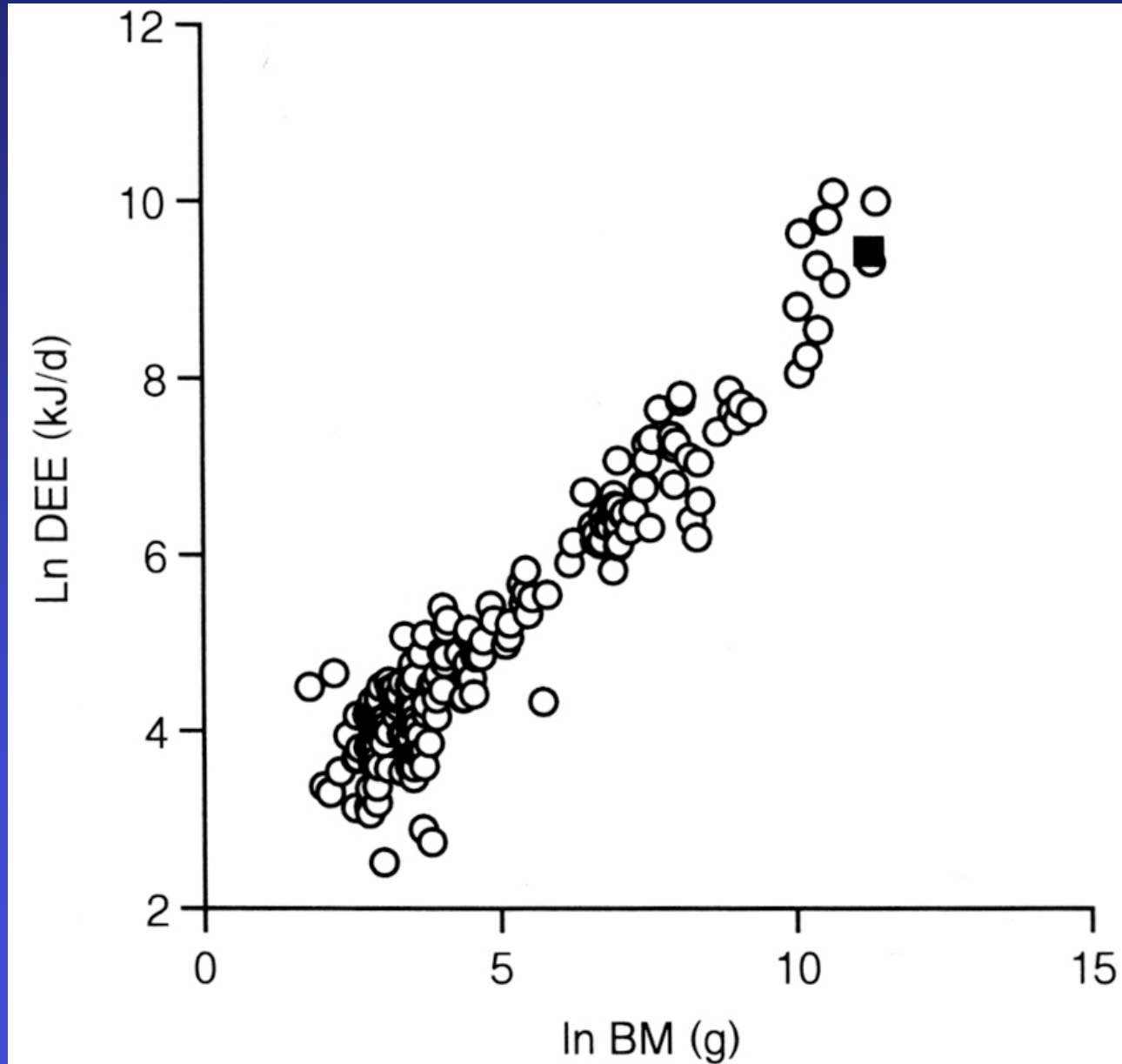
# Data terrestrial mammals

Literature 1970-2005

90 species, 207 measurements

163 measurements with estimates of BEE in the  
thermoneutral zone

# DEE and body mass



# Best-fit regression equation

$$\text{Ln DEE (kJ/day)} = 2.353 + 0.948 \text{ Ln}(\text{body mass g}) - 0.026 \text{ Temp}(^{\circ}\text{C})$$

Prediction DEE modern humans (78.6 kg):

9.4 MJ/d (95% CI = 7.9-12.9 MJ/d)



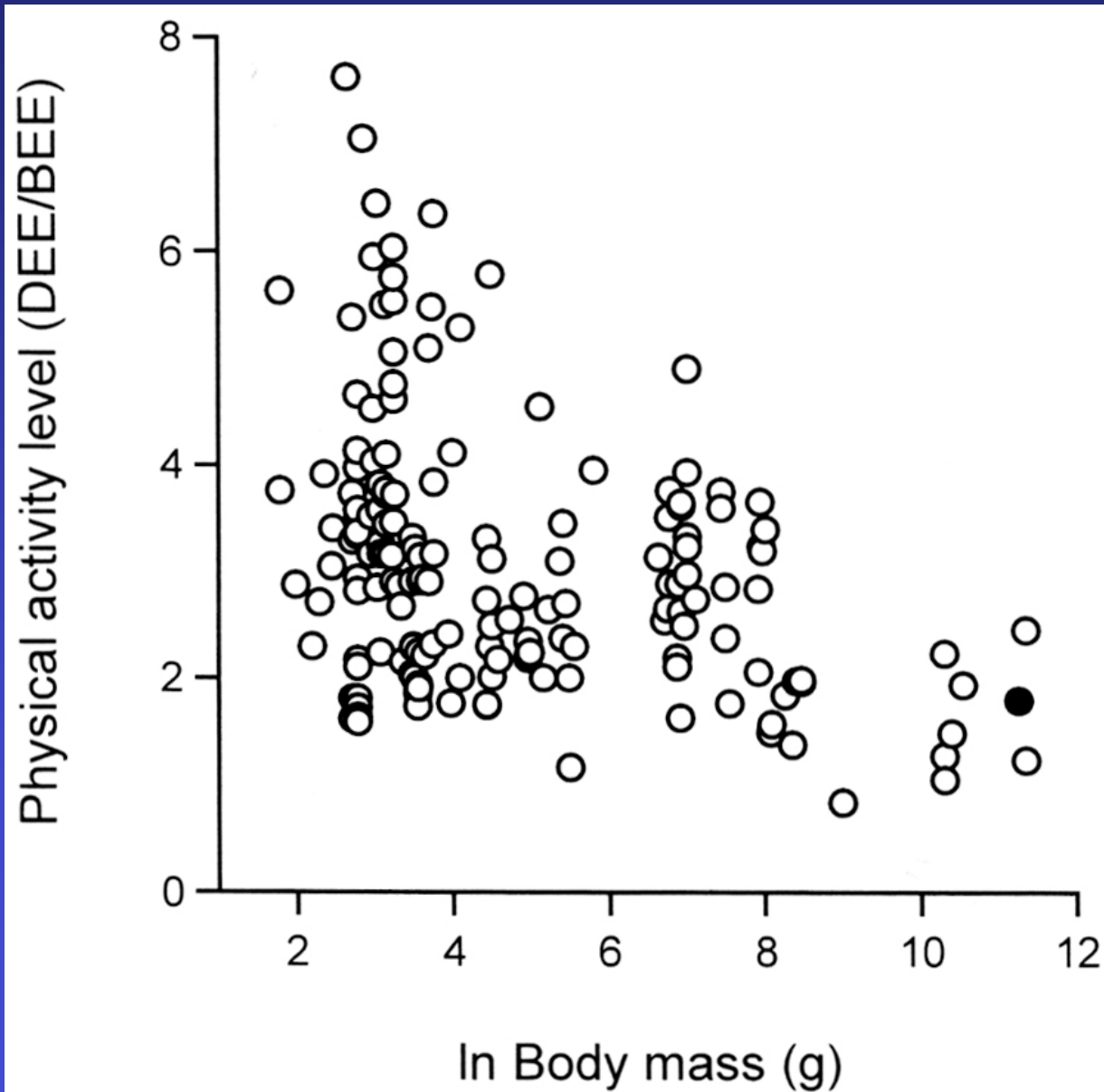
# Conclusion

Daily energy expenditure of modern humans in Westernised societies is completely in line with the prediction from an equation derived from measurements of wild terrestrial mammals

# Discussion

Many wild mammals live at ambient temperatures below the thermoneutral zone, hence PAL reflects the combination of activity metabolism and energy spent on thermoregulation

# PAL and body mass



# Conclusion

Daily energy expenditure has not declined over the duration of the obesity epidemic

Modern humans do not have exceptionally low rates of energy expenditure compared with wild mammals

# Conclusion

Reduced energy expenditure due to lowered physical activity is unlikely to have fuelled the obesity epidemic