

Physical Activity and Energy Balance

John R. Speakman

Aberdeen Centre for Energy Regulation and Obesity (ACERO)
Institute of Biological and Environmental Sciences
University of Aberdeen
Aberdeen
Scotland, UK

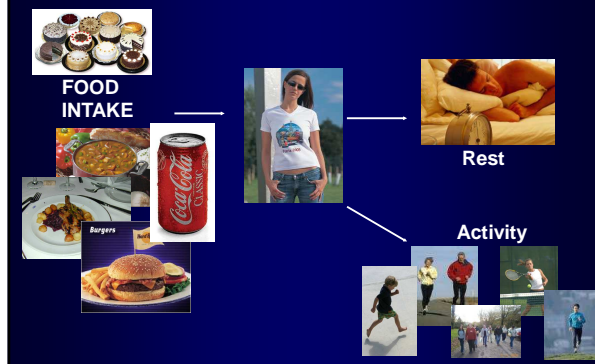
Edinburgh
Oct 2009



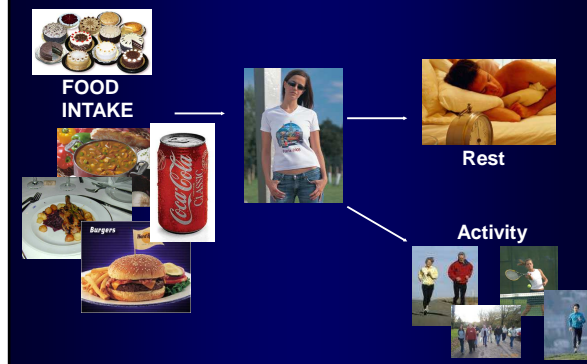
Obesity results from prolonged energy imbalance



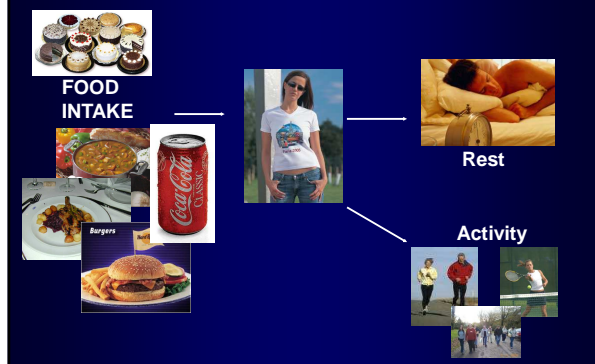
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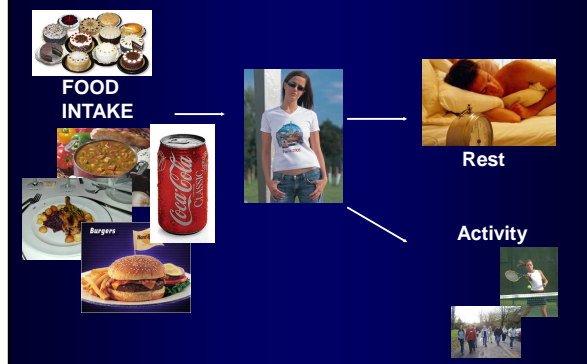
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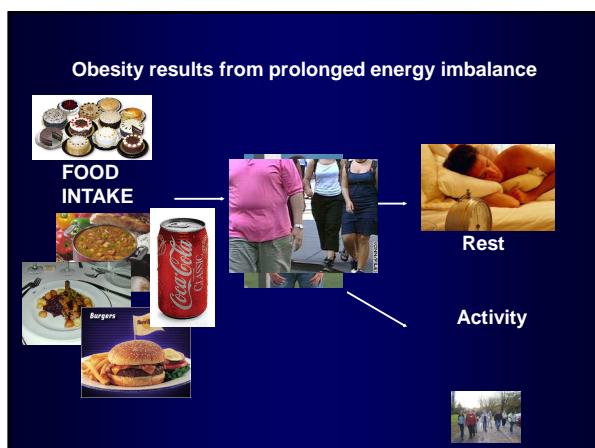


Obesity results from prolonged energy imbalance




Obesity results from prolonged energy imbalance






Why is this important?

IF the obesity epidemic has been caused by reduced **PHYSICAL ACTIVITY**



The obvious solution to the problem will be to attempt to reverse that by increasing levels of exercise

However, **IF** the major cause of the epidemic is increased **FOOD INTAKE**



Reversing the epidemic by increasing physical Activity will be much more difficult

Trends in food intake over time (11-18 year olds)

Nutrient	1965	1977	1989-1991	1994-1996
Energy (megajoules)	9.92 (0.16) ^{††}	8.78 (0.09) ^{††}	8.77 (0.18) [#]	9.58 (0.18)
Total fat, % of energy	38.7 (0.2) ^{††#}	37 (0.2) ^{§††}	34.3 (0.4) [#]	32.7 (0.2)
Saturated fat, % of energy	15 (0.1) ^{††#}	14.1 (0.1) ^{§††}	12.9 (0.2) [#]	11.6 (0.1)

Cavadini, C., Siega-Riz, A. M. & Popkin, B. M. *Western Journal of Medicine* 173, 378-383 (2000)

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UK Office of National Statistics (2007 online)

"There is no evidence that the average caloric intake or consumption of foods rich in fat and added sugar has increased in the UK since the mid 1980s."

	Energy intake		%fat intake	
	Men	Women	Men	Women
1986	2462	1691	38	39
2001	2323	1642	34	34

Trends in food intake over time



Over the time-course of the epidemic

We are eating less total calories per day (down by 3 to 6%)

Less of these calories come from fat (down by about 5%)

Trends in physical activity over time

1940-50s

1960s

1990s

Changing pattern of domestic chores

Handwashing
Mangle dryingTwin-tub
Washing machines

Automatic

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Changes in physical activity over time

1950-60s

1990s

Shopping in many
small local shops'One stop' supermarket
shopping

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Changes in physical activity over time

1950-60s

1990s



1951 No car 86%
1 car 13%
2 cars 1%

2000 No car 27%
1 car 45%
2 cars 23%
> 2 cars 5%

(Dept transport statistics HMSO 2000)

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Changes in physical activity over time

TELEVISION

1950-60s



In 1955 only 30% of
households owned a
TV set

TV was only broadcast
for about 5 hours per day

1990s

TV ownership now
almost universal

60% of homes have
multiple TV sets

Viewing hours peaked in
the late 1990s

20% of 9 year old kids in the USA
watch more than 6h TV each day



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Too much of a good thing?

Remote controls



Electric Tooth brushes



Electric carving/bread knives



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How sedentary can we get?



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How sedentary can we get?



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How sedentary can we get?



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Problem

The 'data' on changed physical activity is not necessarily equal to changed energy expenditure

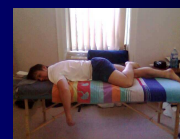
- a) We may compensate our expenditure



Problem

The data pertaining to changed physical activity is not necessarily equal to changed energy expenditure

- a) We may compensate our expenditure



Sleep up from 7h/day to 12h/day

Problem

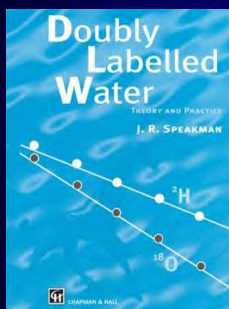
The data pertaining to changed physical activity is not necessarily equal to changed energy expenditure

- a) We may compensate our expenditure
- b) We may replace one activity with an activity of equal demand



Can we measure energy demands directly to test the hypothesis that declining demands have contributed to the epidemic?





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DEE = TOTAL

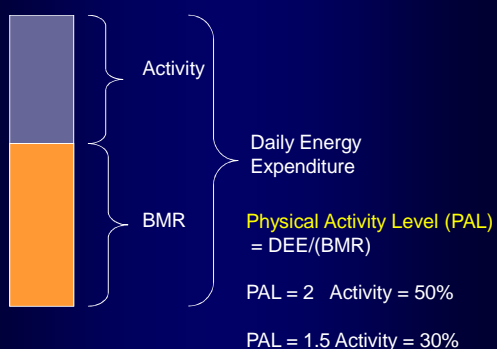


Rest

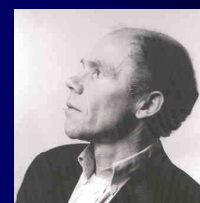
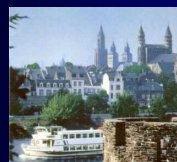


Activity

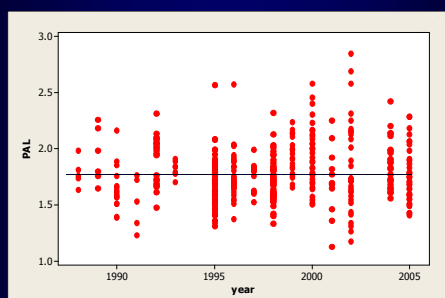
Components of Daily Energy Expenditure



Maastricht The Netherlands



Klaas Westerterp



PAL against year of publication
(not significant – $p > .05$)

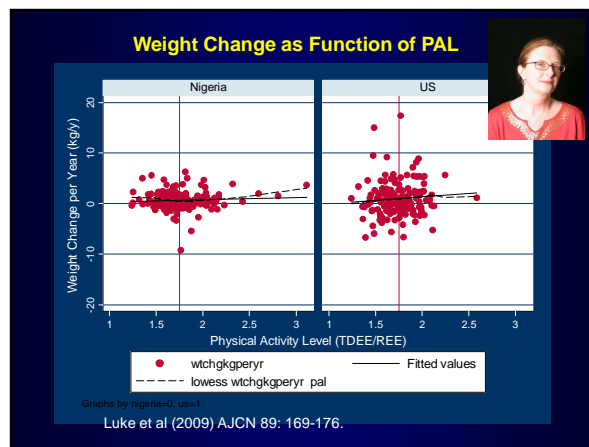
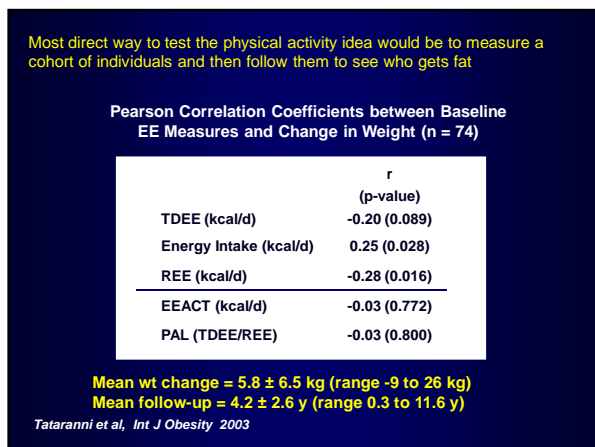
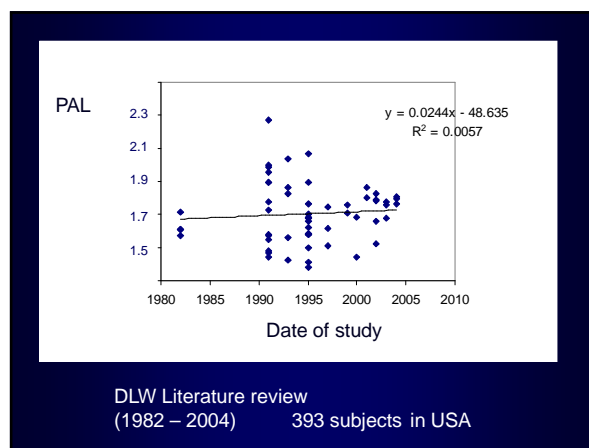
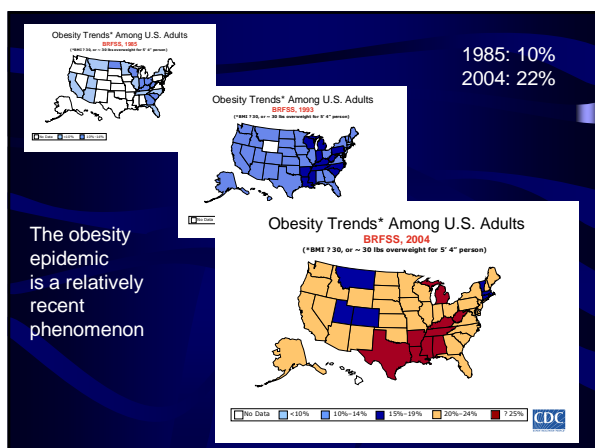
Westerterp &
Speakman (2008)
Int J. Obesity 32: 1256-1263

But.....

This is European data



Over interval 1985 to 2004 obesity (BMI > 30)
increased from 5 to 10% in the Netherlands



CONCLUSION

The obesity epidemic has likely been caused more by increases in food intake than decreases in physical activity

This doesn't mean physical activity inventions won't work. just they will be much harder to perform

Thanks....

Dutch cohort
Klaas Westerterp

African Americans
Amy Luke

Pdfs of all my papers are at
www.abdn.ac.uk/ibes

Or e-mail me

j.speakman@abdn.ac.uk

Energy expenditures (PAL) of African tribes peoples
subsistence farming/hunter gathering

Population	Males	Females
Gambia	2.02	1.97
Burkina Faso	1.89	1.80
Cameroon	1.87	
Cameroon	1.71	1.67
Botswana	1.71	1.51
Ivory Coast	1.68	
Uganda	1.63	
Cameroon	1.60	1.72
Cameroon	1.41	1.56
Kenya	1.29	1.37
Ethiopia		1.47
Swaziland		1.35
MEAN	1.68	1.60

