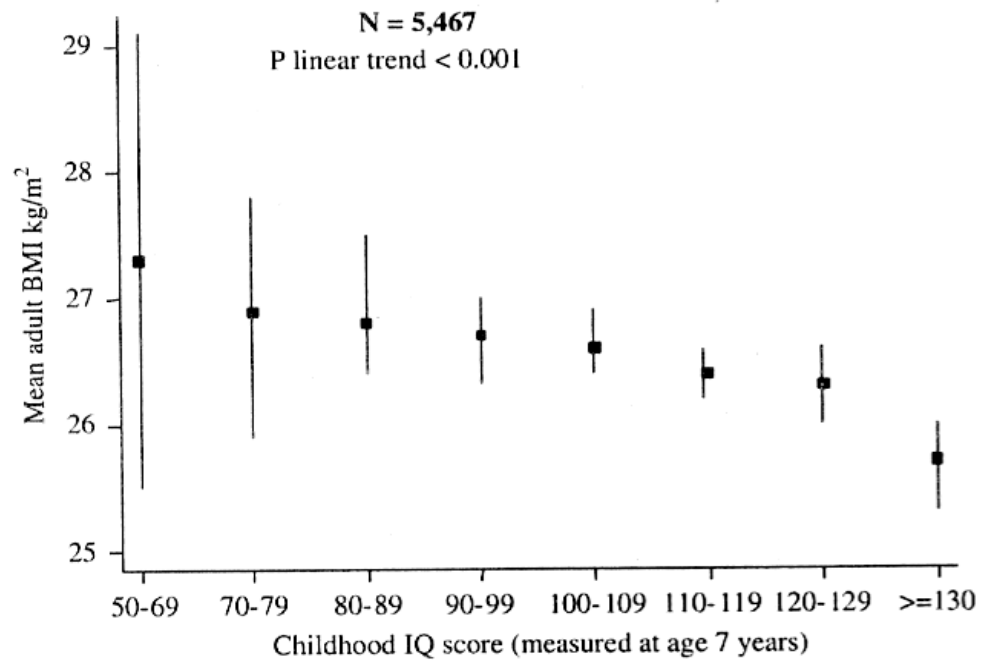


# Mental work, appetite control and energy intake

**ANGELO TREMBLAY**  
**DIVISION OF KINESIOLOGY**



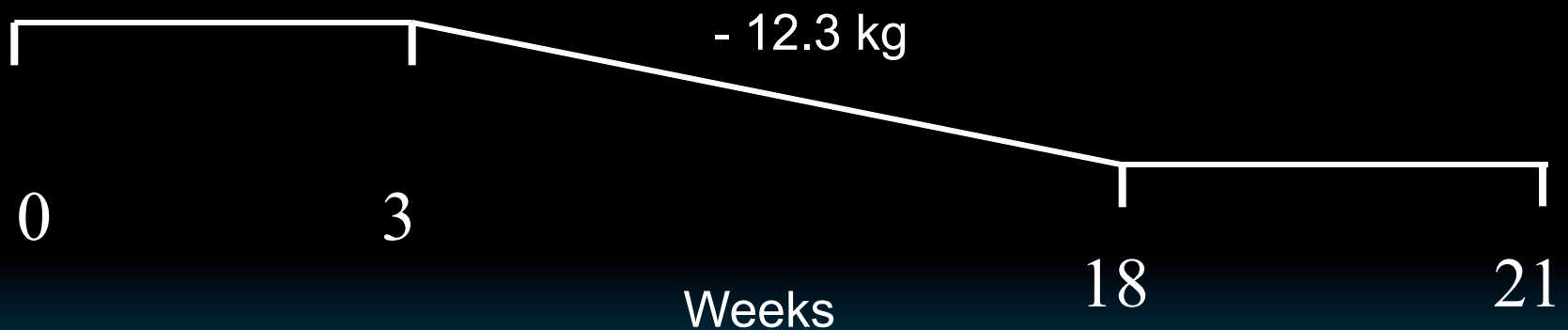
# Preliminary observations



**Figure 2** Age- and sex-adjusted mean body mass index (BMI) by categories of childhood intelligence. *N* = 5467.

From: Lawlor DA et al., *International Journal of Obesity* 2006;30:1758-65

# Effects of body loss on cognitive performance



Word memory performance decreases with weight loss

Adapted from Kretsch et al, IJO 10: 513-20, 1997

↓ Cognitive  
capacity

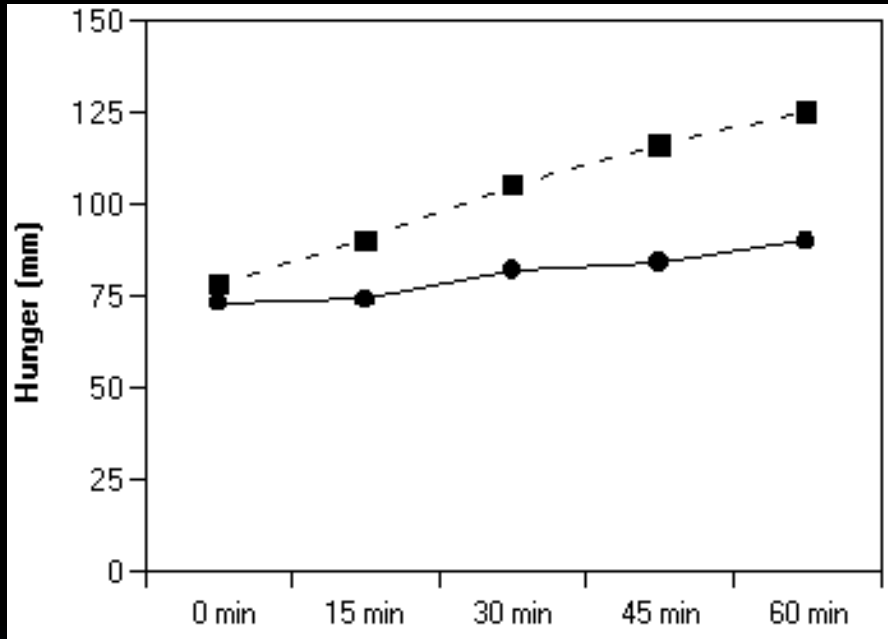
↗ related to ↗ body weight

↘ is induced by weight loss

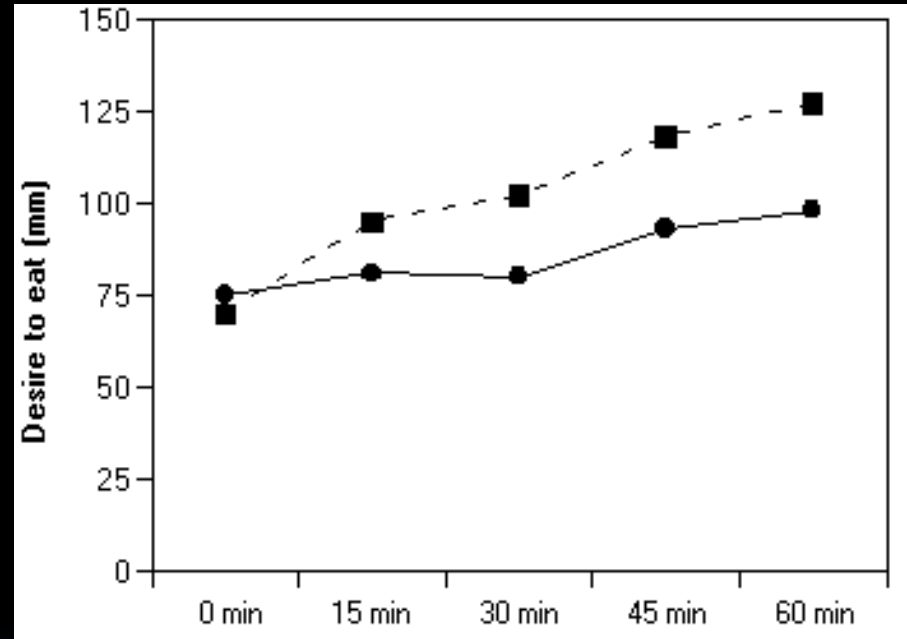
? ! ? ! ?

Have we underestimated the biological demand  
and impact of mental work?

a)



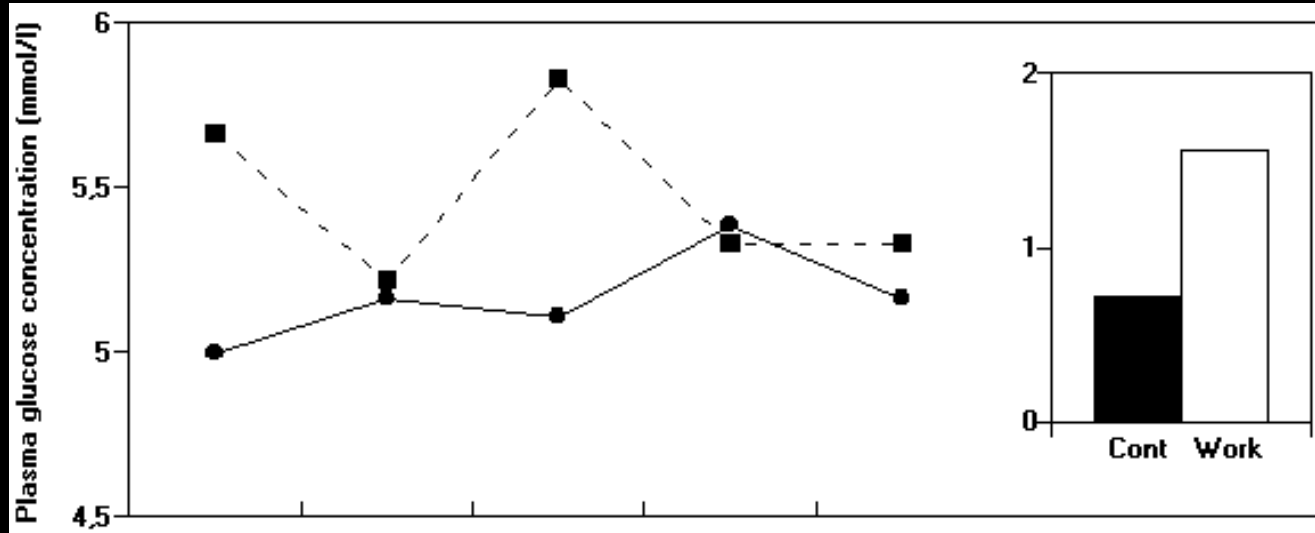
b)



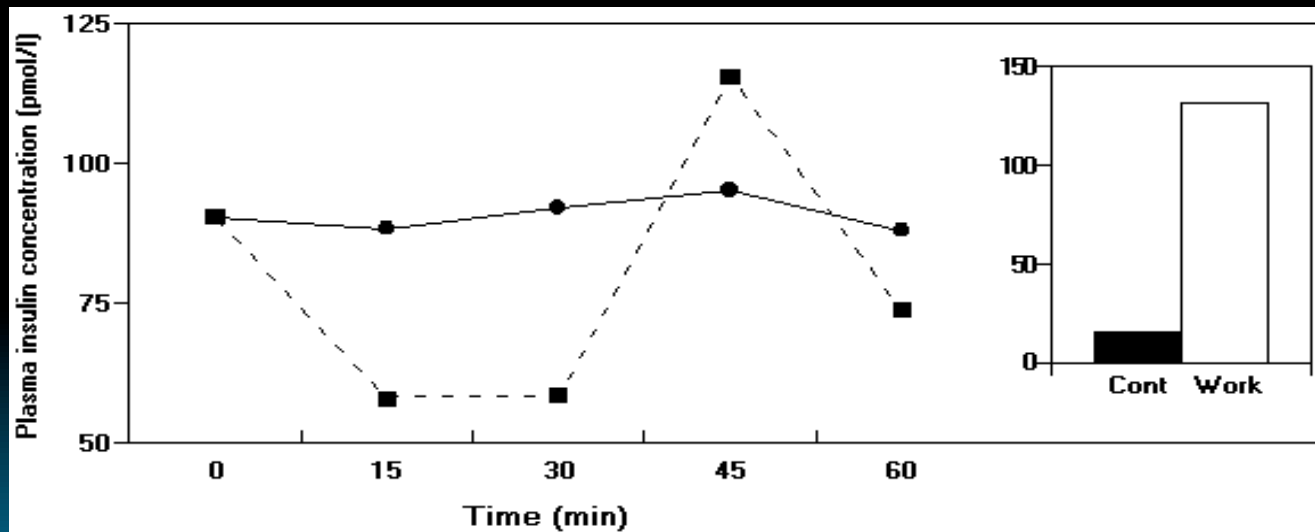
Appetite score for (a) hunger and (b) desire to eat derived with the use of visual analogue scales throughout the control (solid line) and the knowledge-based work (KBW) (dashed line) sessions of a preliminary case study

Tremblay and Therrien, *Can J Physiol Pharmacol* 2006.

a)

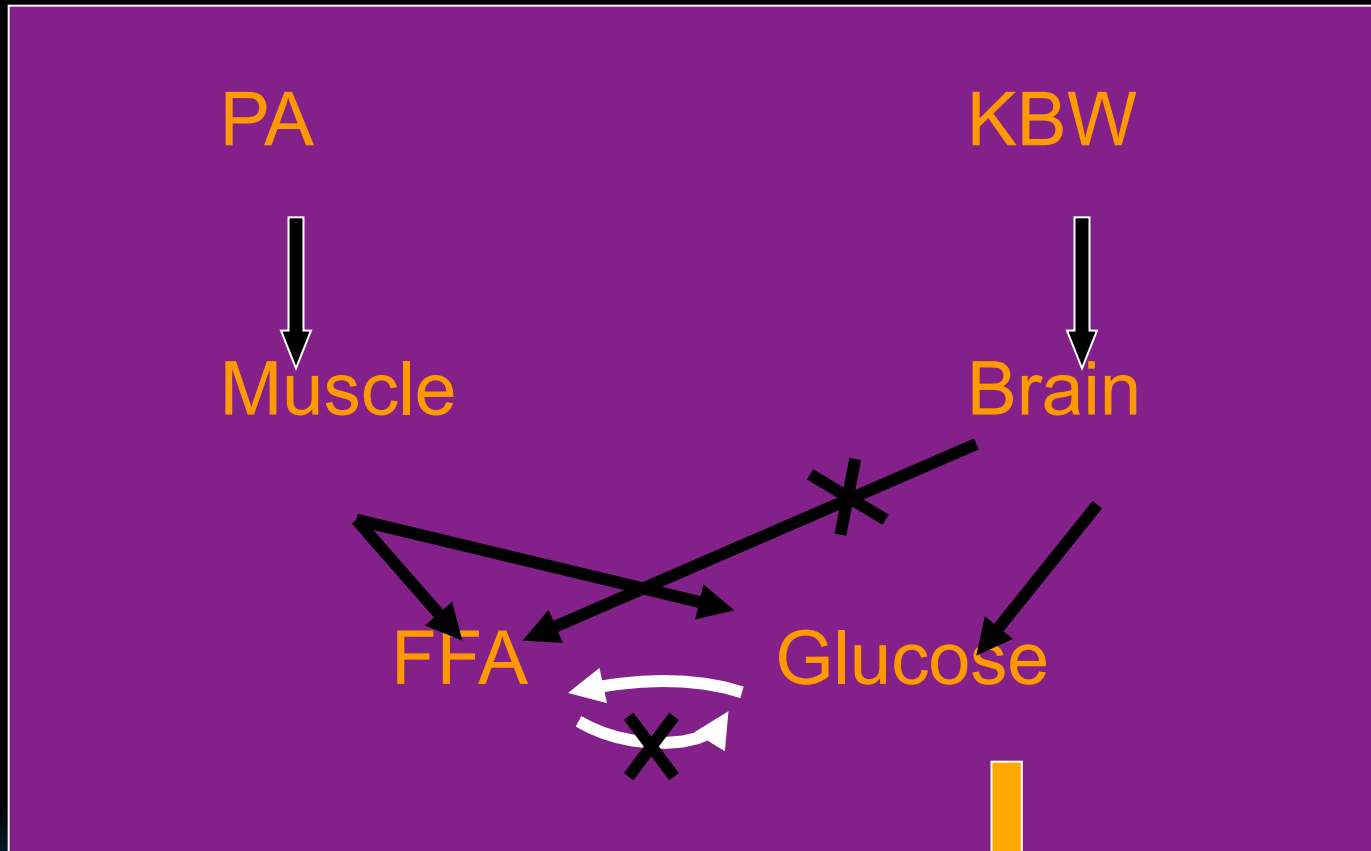


b)



Plasmatic glucose concentrations (a) and insulin (b) during the control session (solid line) and the working session (dashed line).

# Theoretical considerations



**KBW depends on glucose availability and intake**

# Mental work and energy intake in Laval University students

# Impact of mental work on energy intake

---

15 female students at university

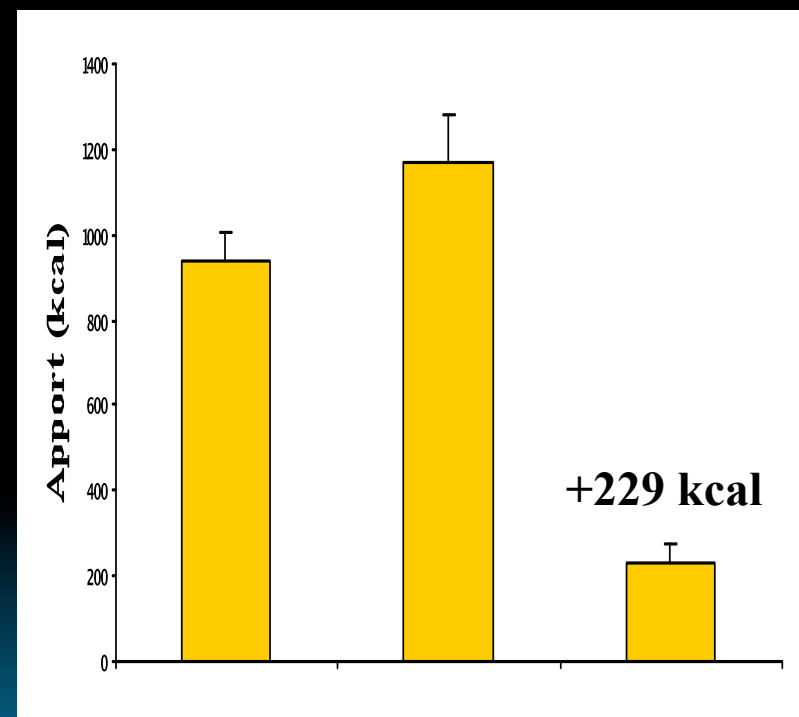
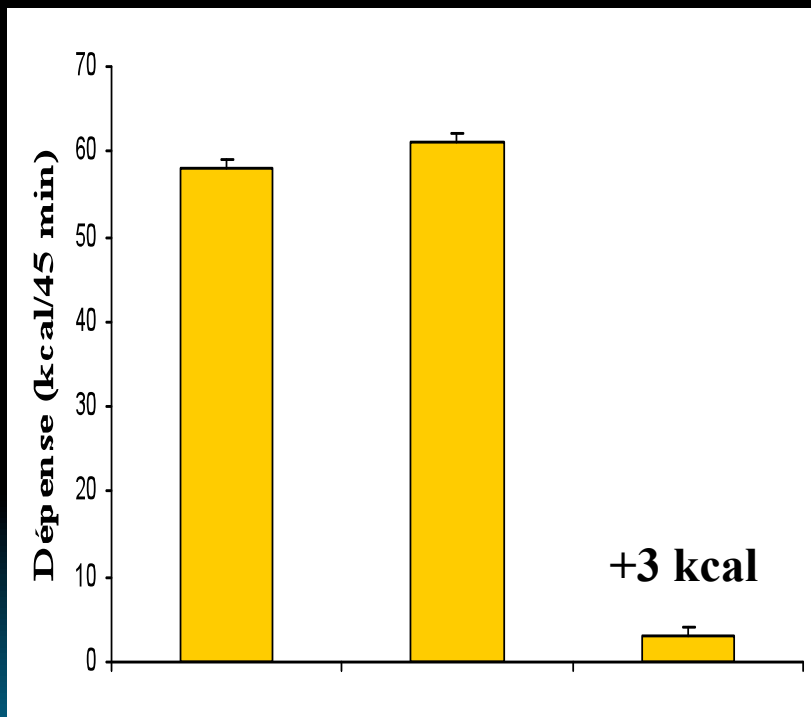
2 tasks: read an article and write an abstract of 350 words or rest

45 minutes for each task

*Ad libitum* buffet after the task






- Anthropometric measurements, energy expenditure, heart rate, blood pressure, daily food intake, analog visual scales, TFEQ, STAI

# Energy cost of the two tasks and spontaneous energy intake

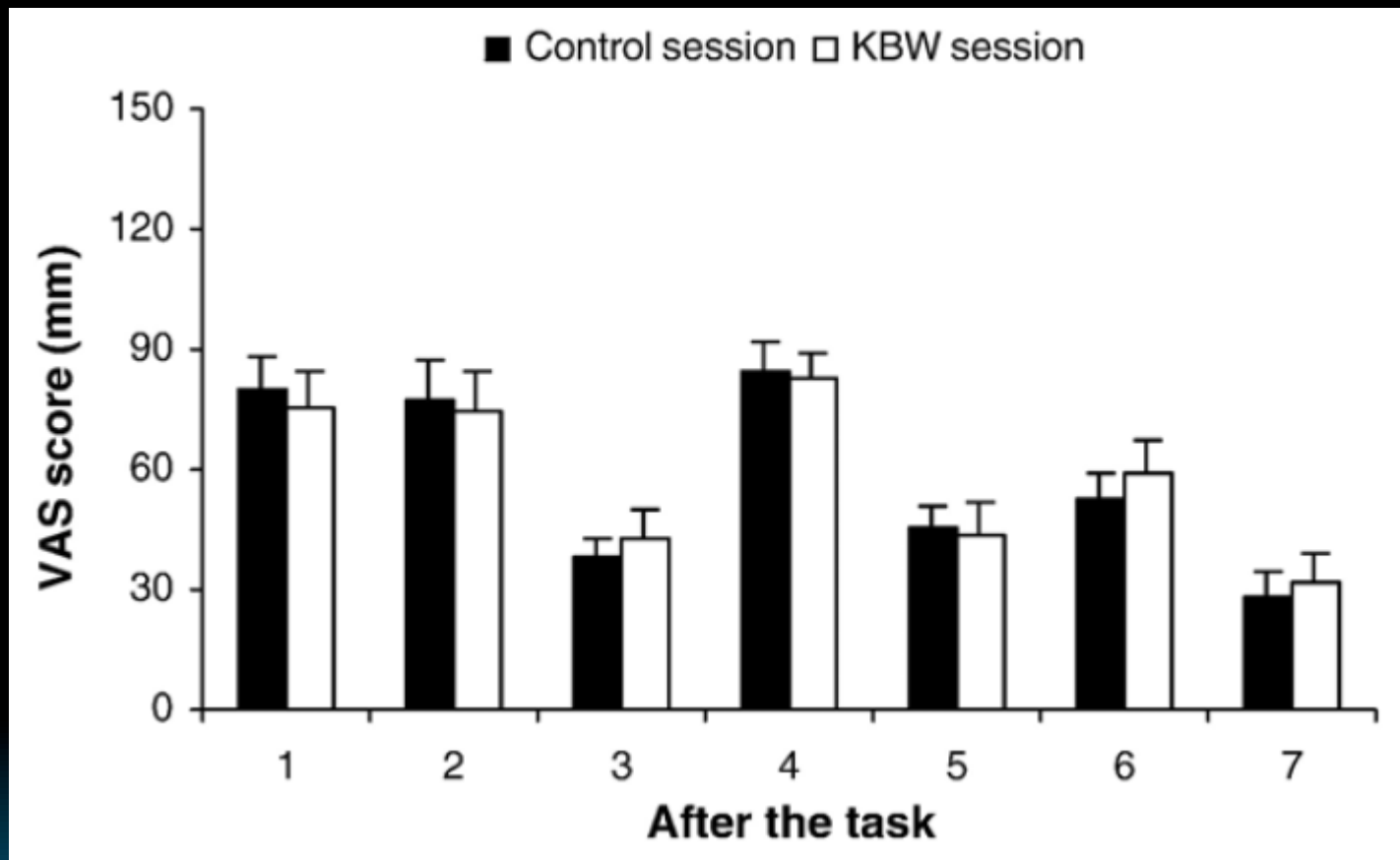


Energy balance:  $\Delta$  intake –  $\Delta$  expenditure = **+226 kcal**

## Association between NIH grant application deadline and food intake

- 2 conditions: high vs. low workload periods
- Results:  self-reported stress  
 plasma total cholesterol  
 dietary intake of calories  
 dietary intake of total fat  
 % of calories from fat

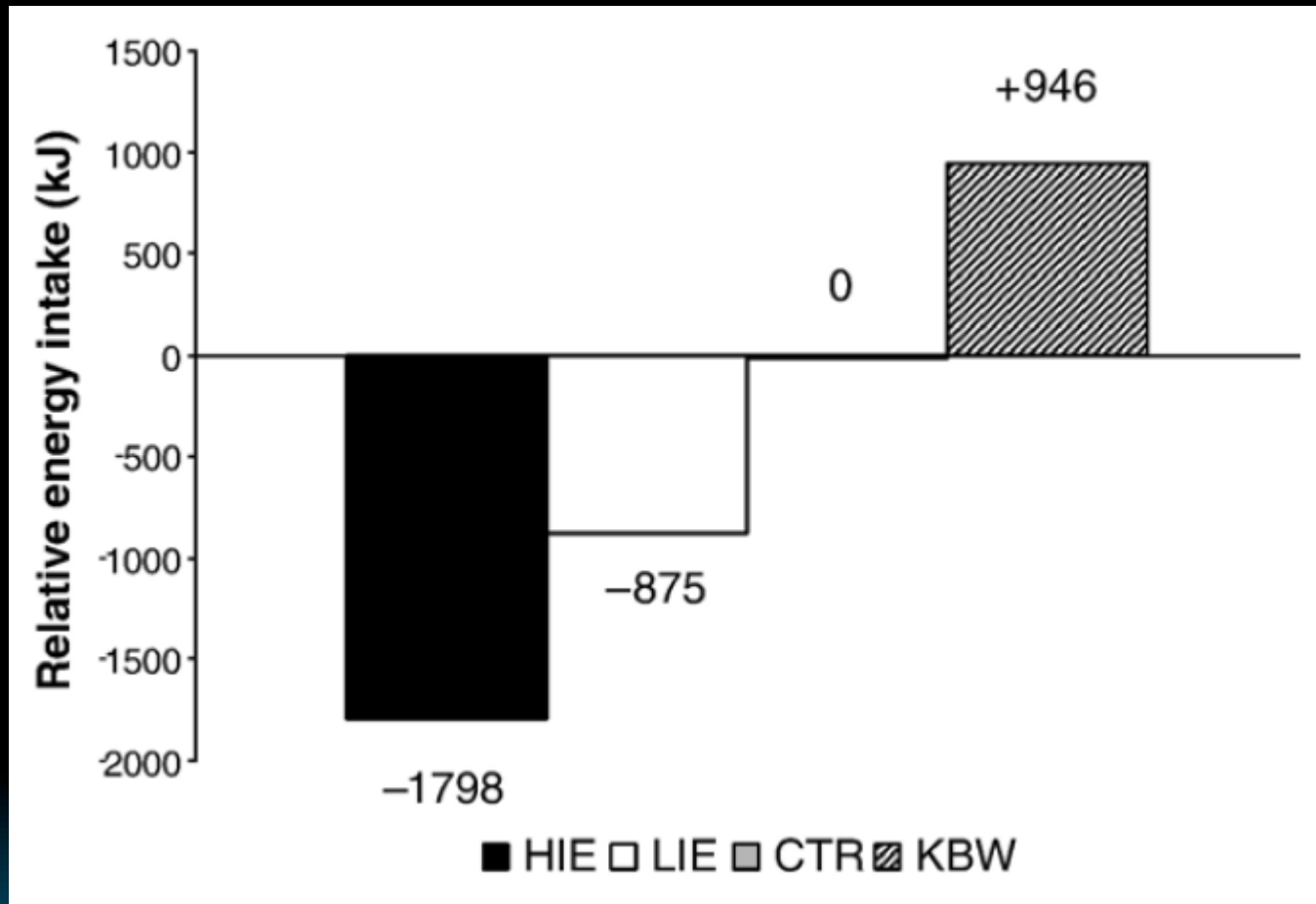
## Appetite sensation markers measured after each testing session



1) Desire to eat; 2) Hunger; 3) Fullness; 4) PFC; 5) Desire to eat salty foods;  
6) Desire to eat sweet foods; 7) Desire to eat fatty foods

*Chaput and Tremblay, Physiol. Behav.*  
90: 66-72, 2007.

## Short-term effects of exercise of different intensities and of KBW on relative energy intake



Relative energy intake = difference between ad libitum energy intake after each task and energy expenditure of the task above RMR

*Chaput and Tremblay, Physiol. Behav. 90: 66-72, 2007.*

# Methods

- Repeated measures/within-subjects design.
- 3 conditions: 1) resting in a sitting position, 2) reading-writing and 3) performing a comprehensive battery of computerized tests.
- Conditions randomly assigned to subjects.
- 45 minutes for each condition.
- Blood sampling at every 8 minutes.
- Ad libitum buffet after each condition.

# Mental workload quantification

	Control	Reading-writing	Test-battery
<i>NASA-Task Load Index</i> <sup>1</sup>	18.5 ± 12.8	59.2 ± 15.4**	63.3 ± 16.2**
Reaction time (ms) <sup>2</sup>	617 ± 84	857 ± 193**	883 ± 136**

\*\*p < 0.01 versus control values.

<sup>1</sup>Questionnaire assessing the overall perceived workload.

<sup>2</sup>Secondary task assessing the degree of mental solicitation.

Adapted from Chaput et al, Psychosomatic Med 70: 797-804, 2008

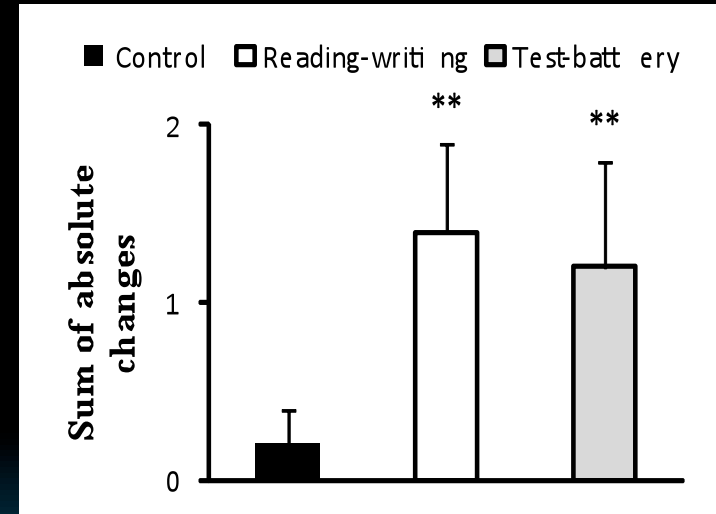
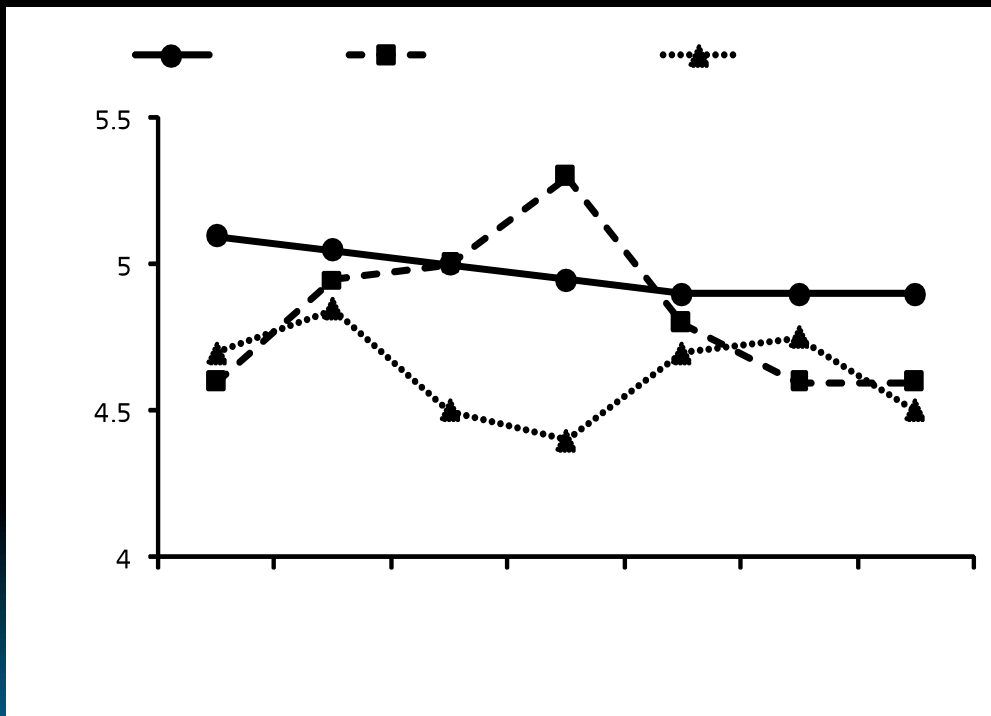
# Mean energy intake in the buffet-type meal

	Control	Reading-writing	Test-battery
Total energy intake 1113* (kcal)	860	1063*	
Energy intake from 299* desserts (kcal)	180	288*	

\*  $p < 0.05$  versus control values

Adapted from Chaput et al, Psychosomatic Med 70: 797-804, 2008

# Glycemia over 45 minutes

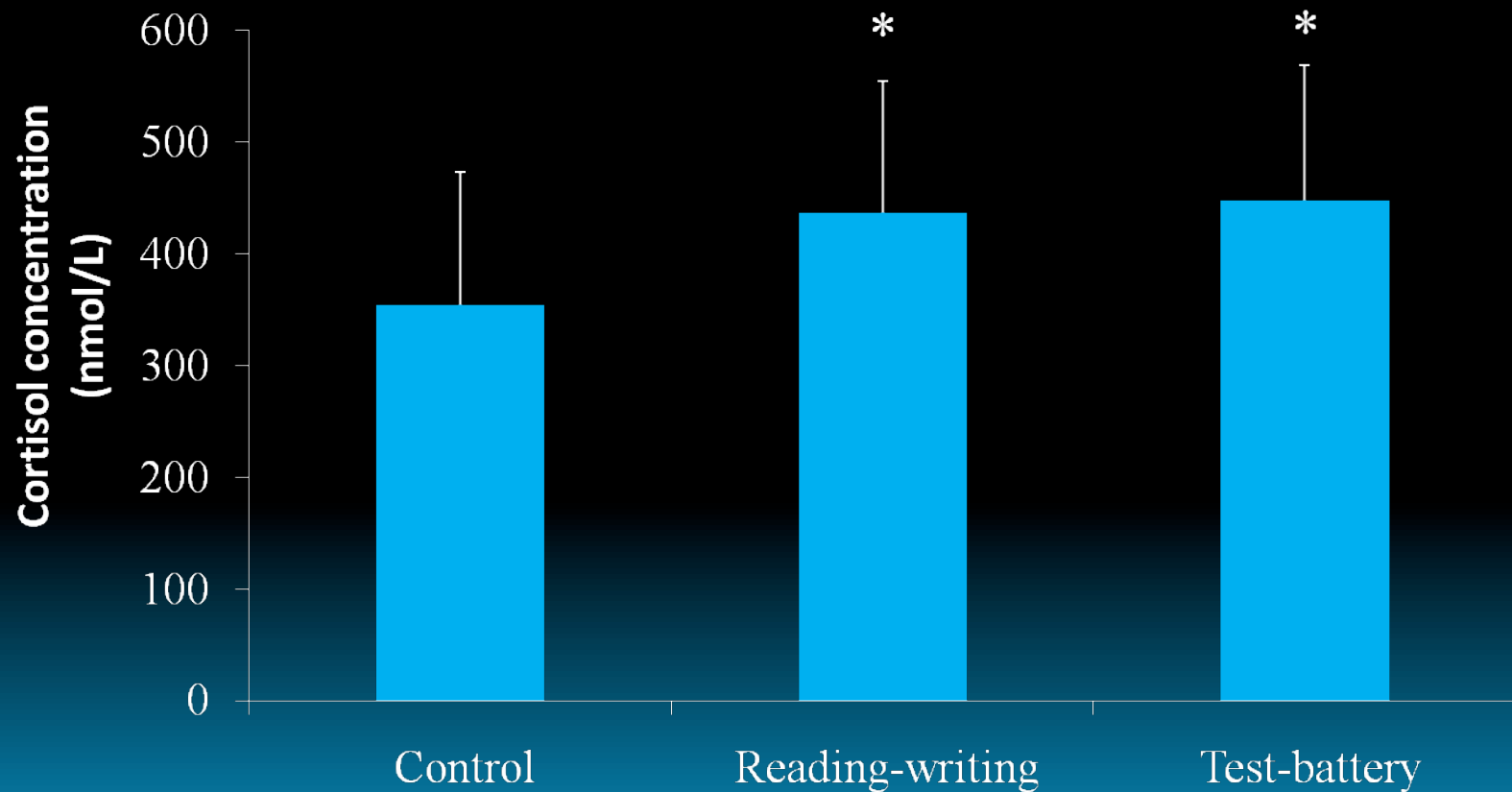


\*\*p < 0.01 vs. control values

Glucose instability = sum of absolute changes between each time of blood collection.

Adapted from Chaput et al, Psychosomatic Med 70: 797-804, 2008

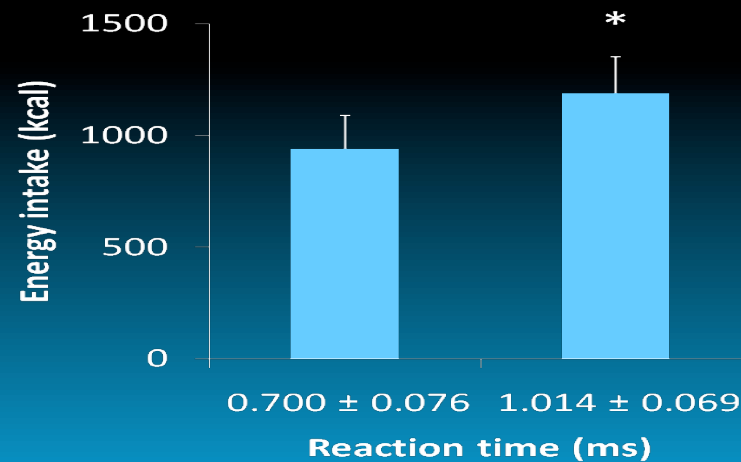
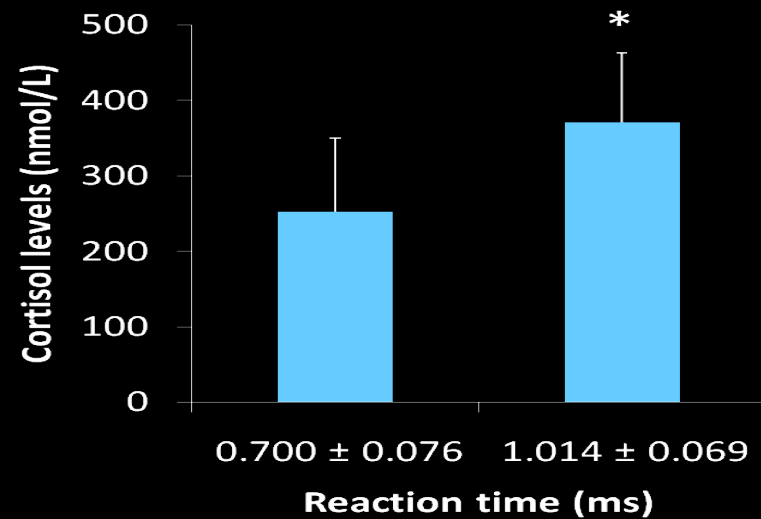
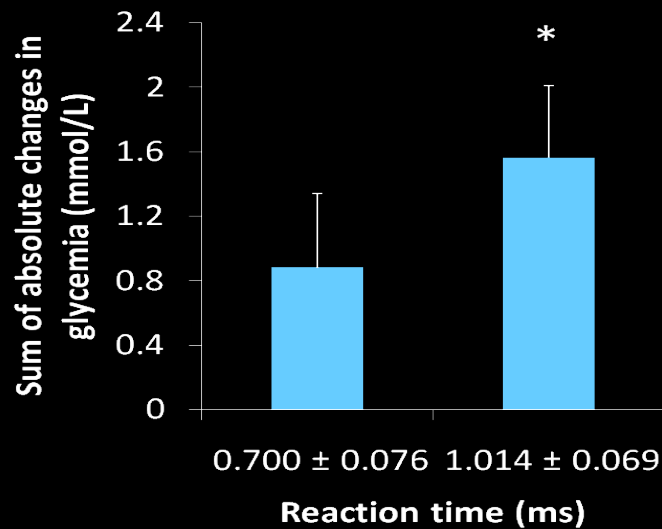
# Cortisolemia over 45 minutes



\* $p < 0.05$  versus control values.

Adapted from Chaput et al, Psychosomatic Med 70: 797-804, 2008

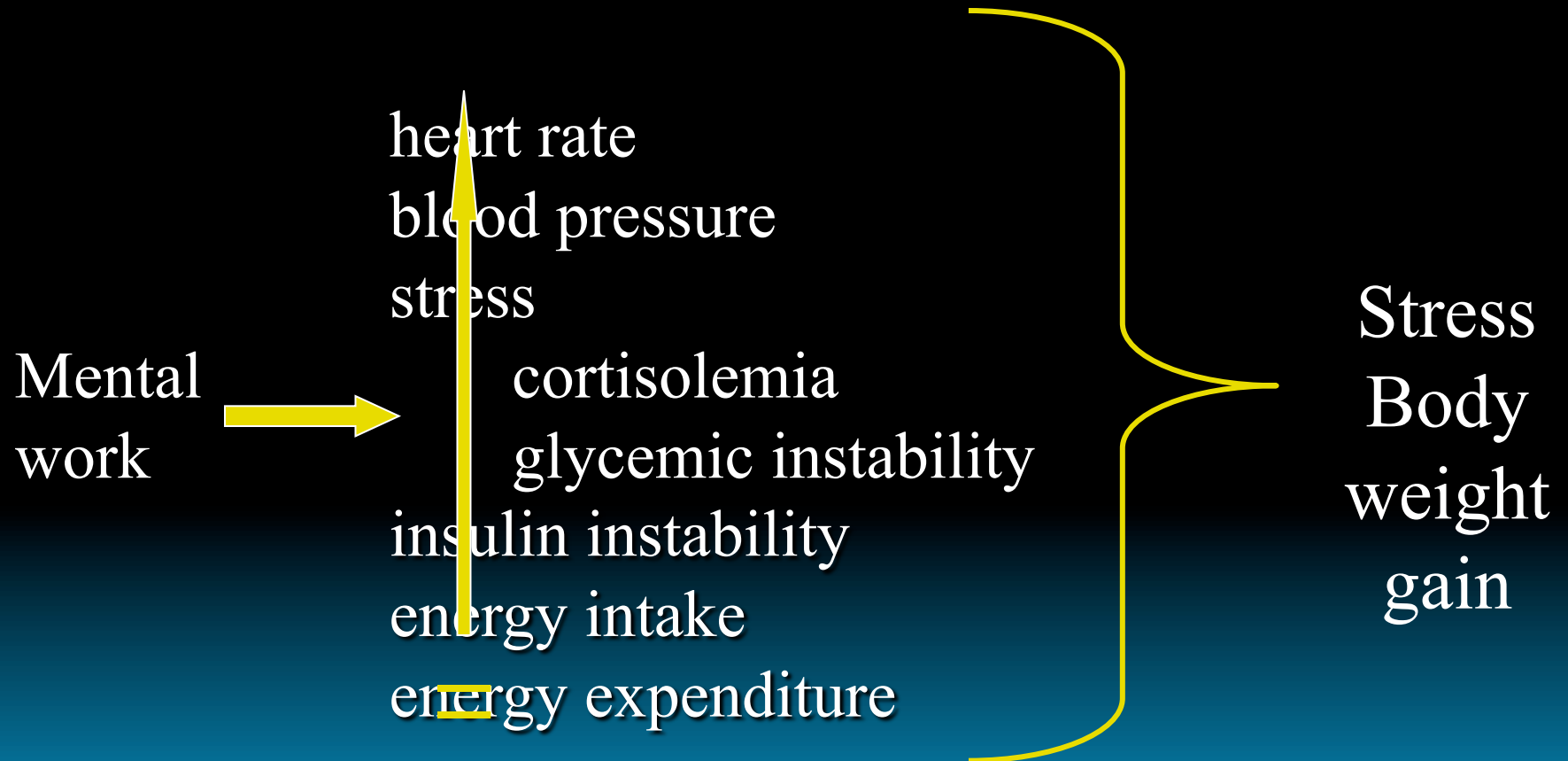
# Impact of KBW on glucose instability, cortisolemia and ad libitum energy intake as assessed by the reaction time



\*p < 0.05.

Adapted from  
Chaput and  
Tremblay, IJO 2009;  
Obes Facts 2009

# Summary



Is methylphenidate (Ritalin) the  
solution?

## Whole brain metabolism when the cognitive task was given with:

- Placebo increased 21%
- Methylphenidate increased 11% (50% less)

From Volkow N.D. et al, PLoS ONE 2008

Evolution of man...

