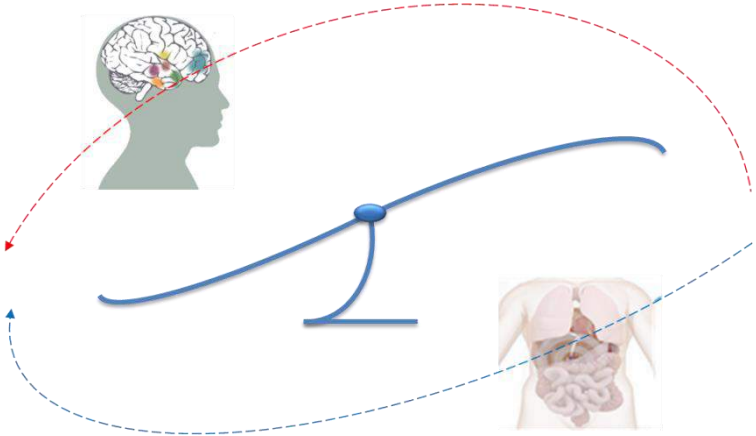
CERON - Nice-Côte d'Azur
CENTRE SPÉCIALISÉ DE L'OBÉSITÉ

Activité physique et prise alimentaire chez les adolescents : bouger mieux pour manger moins ?



Nice, 13 Novembre 2015

Thivel David (PhD, MCU)
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AME2P LABORATORY Physical Activity Metabolism > Health
CRNH CENTRE DE RECHERCHE EN NUTRITION HUMAINE AUVERGNE

Quel rôle pour l'AP?

Condition physique

Profil métabolique

Composition corporelle

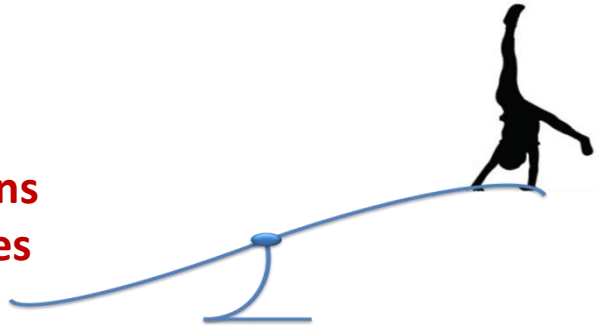
↑ Dépense énergétique

Public Health Nutrition: 12(9A), 1663–1666 doi:10.1017/S1368980009990528

Exercise alone is not enough: weight loss also needs a healthy (Mediterranean) diet?

Phillipa Caudwell[1], Mark Hopkins[2], Neil A King[3], Robert J Stubbs[4] and John E Blundell[1,*]

Compensations nutritionnelles

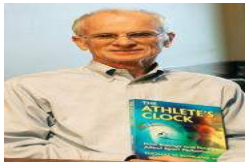


↑ AP-DE

↑ FFM : ↑ BMR

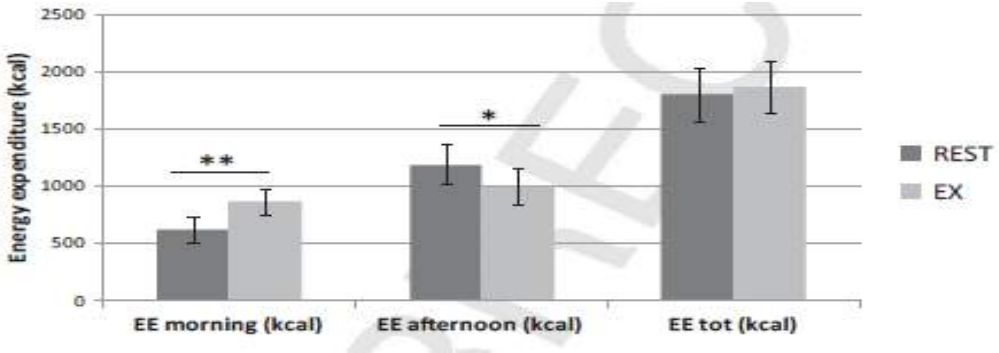
↑ DE totale

Oui mais….

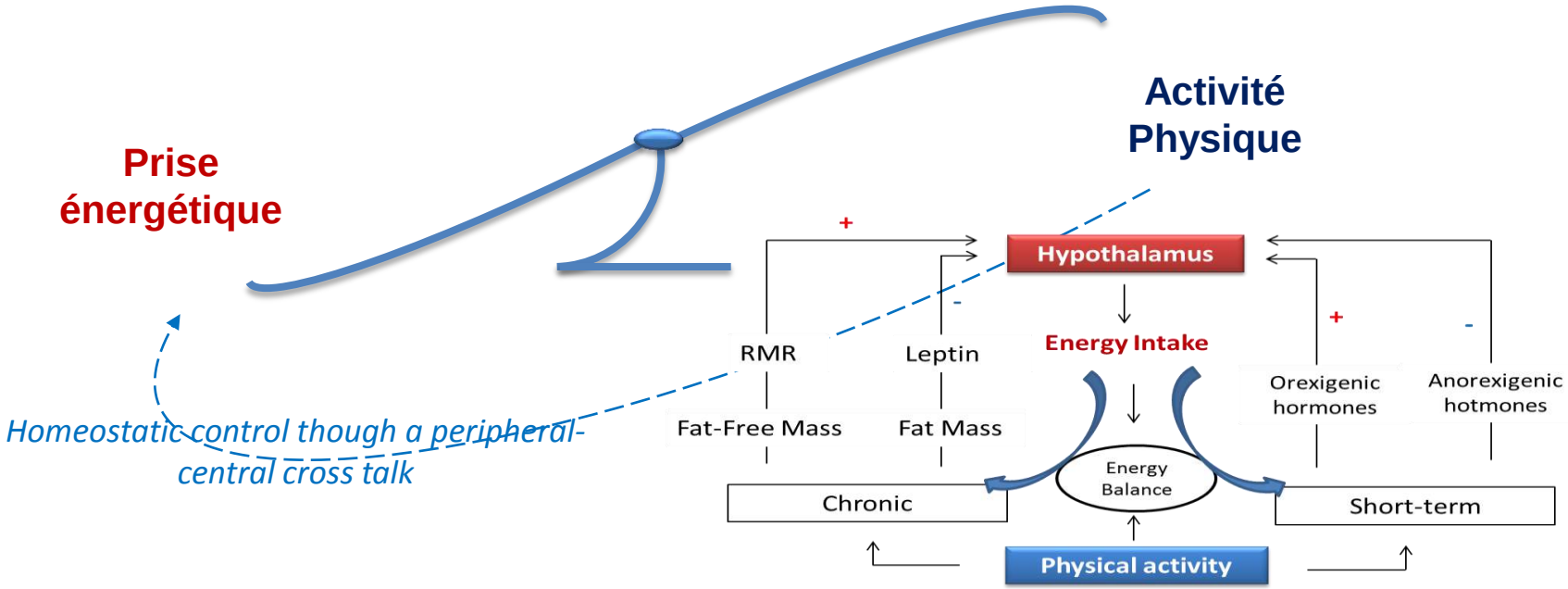


The Activitystat theory (Rowland TW, 1998)

Physical Activity for Weight Loss in Children: Is There Any Compensatory Mechanism?



Pediatric Obesity, 2013; PES, 2013



Adapted from Blundell et al., 2012, DMM

British Journal of Nutrition (2011), **106**, 1768–1769

Chaput J.P. & Sharma A.

Letter to the Editor

Is physical activity in weight management more about 'calories in' than 'calories out'?

Annals New York Academy of Sciences

REGULATION OF ENERGY INTAKE AND THE BODY WEIGHT: THE GLUCOSTATIC THEORY AND THE LIPOSTATIC HYPOTHESIS*

1954

By Jean Mayer

Department of Nutrition, Harvard School of Public Health, Boston, Mass.

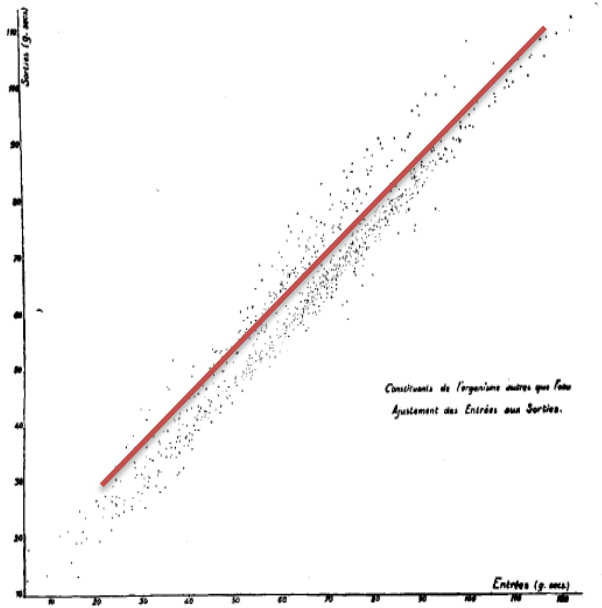


FIGURE 2. Illustrating the adjustment of energy intake to energy output on a 24-hour basis in rabbits under different conditions of heat loss (after Gasnier and A. Mayer[2]).

British Journal of Nutrition (2011), **106**, 1768–1769

Chaput J.P. & Sharma A.

Letter to the Editor

Is physical activity in weight management more about 'calories in' than 'calories out'?

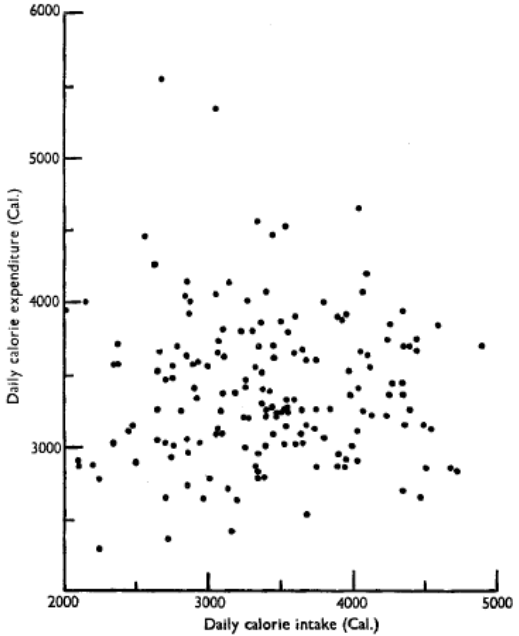


Fig. 2. Individual daily calorie intake and expenditure of the cadets. Daily individual food intake plotted against daily individual expenditure. Note the complete scatter of the results and the absence of any correlation.

The Energy Expenditure and Food Intake of Individual Men

By O. G. EDHOLM and J. G. FLETCHER

Division of Human Physiology, National Institute for Medical Research, London

and ELSIE M. WIDDOWSON and R. A. McCANCE

Medical Research Council Department of Experimental Medicine, University of Cambridge

(*Received* 5 *February* 1955) **1955**

Chez l'enfant ?

Acute Exercise and Subsequent Nutritional Adaptations

What About Obese Youths?

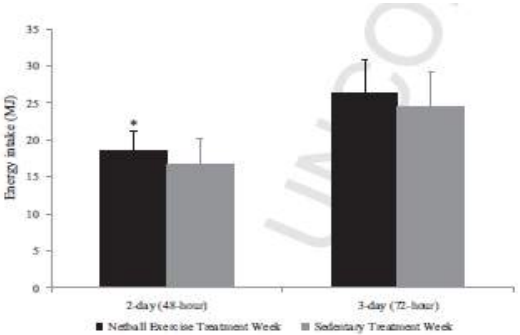
ExEE kcal	Duration (min)	Intensity	Modality	Type	Sample	Induced EI	Authors
343.9	47	Moderate (mean65%VO_2max)	Intermittent	Net ball	NW girls (13-15yo)	↑(*)	Rumbold et al., 2011
358.5	56±7	Low (50%VO_2max)	Intermittent	Cycling	NW girls(9-10 yo)	↓lunch (-162.4)	Moore et al., 2004
218.73	45	Mixed	Intermittent	Resistance	NW (9.4±0.3 yo)	↓(-200.9)	Nemet et al., 2010
256.77	45	Mixed	Intermittent	Swimming	NW (9.4±0.3 yo)	↓(ns,-119.8)	Nemet et al., 2010
323.34	45	Mixed	Intermittent	Aerobic exercises	NW (9.4±0.3 yo)	↓(ns-25.4)	Nemet et al., 2010
358.5	Individually manipulated	High (75%VO_2max)	Continuous	Cycling	NW (11.5yo)	↔	Dodd et al., 2008
358.5	38±5	High (75%VO_2max)	Intermittent	Cycling	NW girls(9-10 yo)	↔	Moore et al., 2004
295.47	45	Mixed	Intermittent	Resistance exercises	OW (9.1±0.6 yo)	↑(ns, 26.5)	Nemet et al., 2010
358.5	Individually manipulated	75%VO_2max	Continuous	Cycling	OB girls (11.5yo)	↔	Dodd et al., 2008
356.44	45	Mixed	Intermittent	Swimming	OW (9.1±0.6 yo)	↑(184,8)	Nemet et al., 2010
450.24	45	Mixed	Intermittent	Aerobic exercises	OW (9.1±0.6 yo)	↑(ns, 129.7)	Nemet et al., 2010

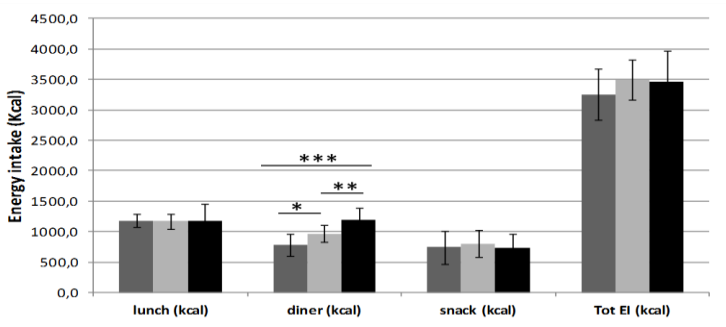
Sports Medicine, 2012

Table 2: Effect of exercise on food and water intake, palatability, EE, and NEB in boys and girls[1]

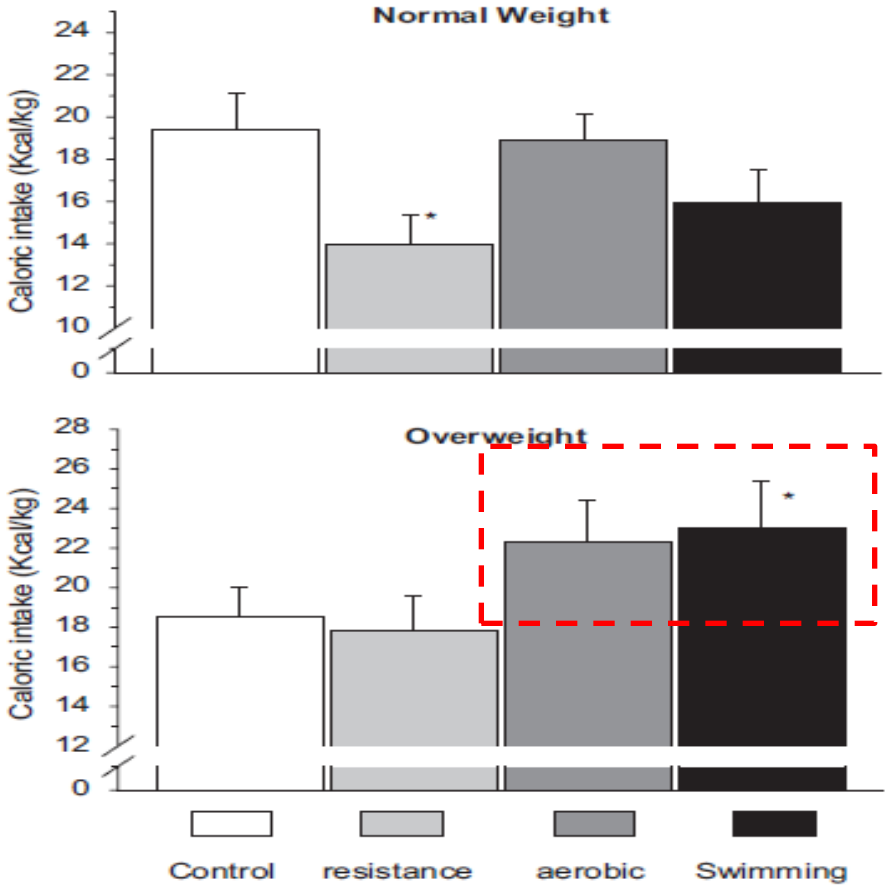
Sex	Boys				Girls			
Treatment	SDRT	SDEX	LDRT	LDEX	SDRT	SDEX	LDRT	LDEX
Food intake[2] (kJ)	5476 ± 527	5342 ± 389	5467 ± 468	5392 ± 443	3645 ± 351	3591 ± 301	3579 ± 350	3876 ± 334
Water intake[3] (g)	253.4 ± 45.8	261.1 ± 46.2	259.8 ± 51.5	354.6 ± 36.6	163.7 ± 44.0	164.1 ± 47.9	137.6 ± 43.0	195.8 ± 43.5
Palatability[4] (mm)	76.5 ± 7.3	75.1 ± 7.5	74.6 ± 7.3	75.4 ± 7.1	76.1 ± 5.2	75.8 ± 5.2	75.3 ± 4.6	75.9 ± 5.4

Bozinovski et al., 2009; IJBNPA

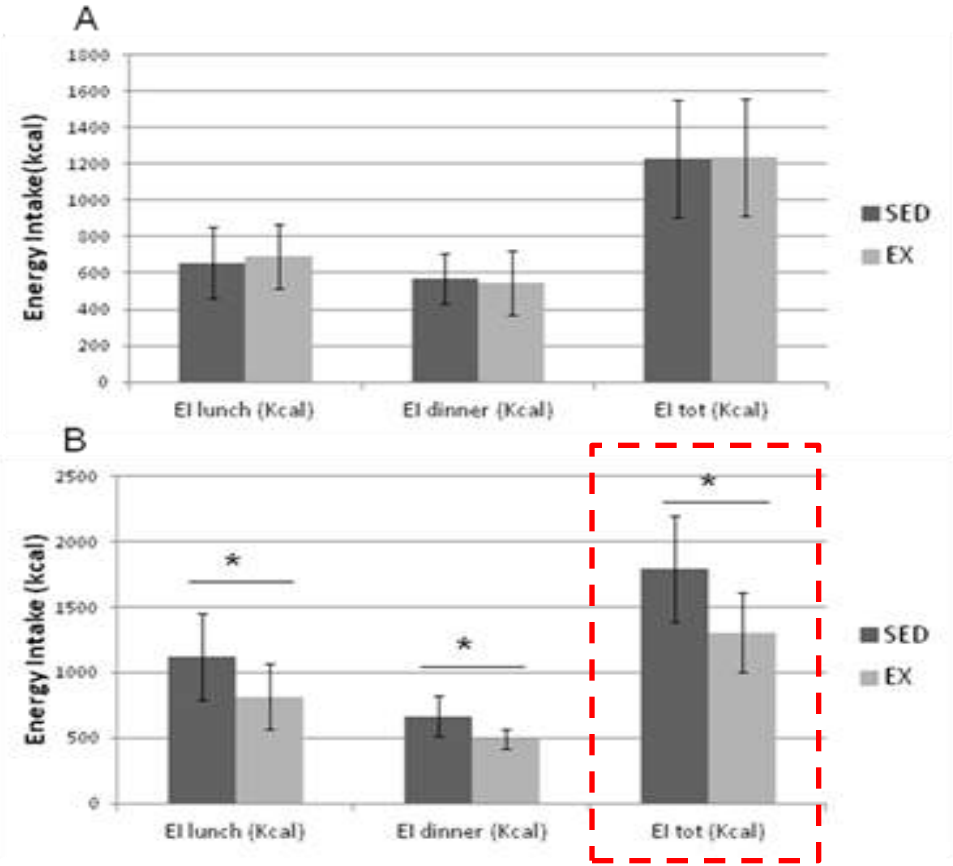




Rumbold et al., 2009; Appetite



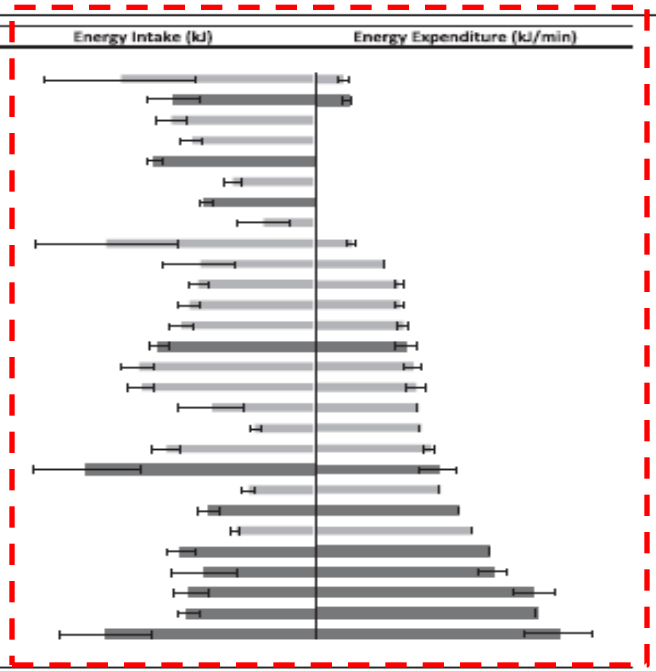
Nemet et al., 2009; IJPO



Physiology and Behavior , 2011; 2014

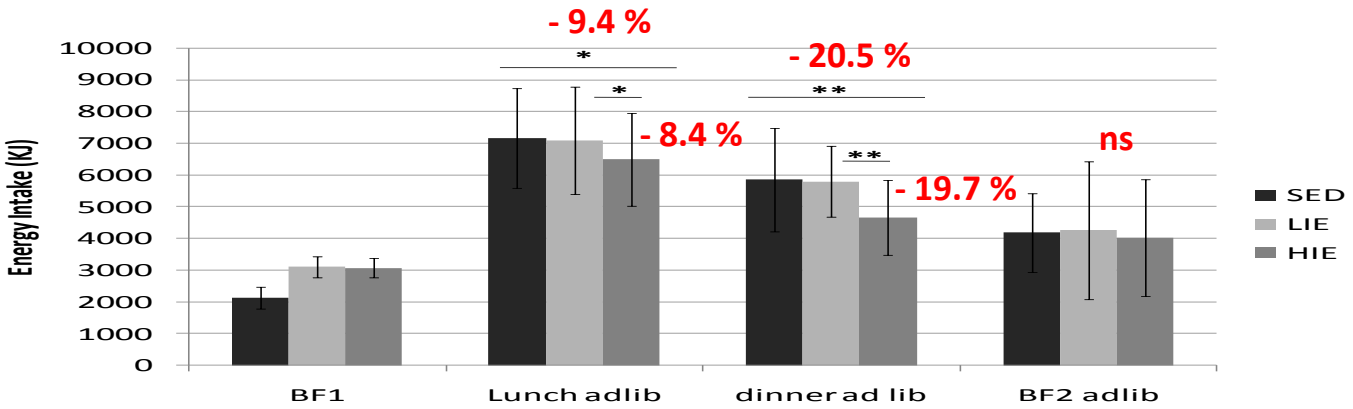
Daily energy balance in children and adolescents. Does energy expenditure predict subsequent energy intake? ☆

Authors	Weight status	Activity	Duration (min)	EE kJ/min (SD)	EI kJ (SD)
Chaput et al., 2011	lean	Sitting	60	5.73 (0.96)	6057 (2368)
Thivel et al., 2012	obese	Bed rest	210	6.53 (0.8)	4396.5 (826)
Taman et al., 2012	lean	Board games	15	.	4454.7 (481.4)
Taman et al., 2012	lean	Board games	15	.	3809.9 (347.5)
Taman et al., 2012	obese	Board games	15	.	4948.8 (276.3)
Nemet et al., 2010	lean	TV	45	.	2531.7 (270)
Nemet et al., 2010	overweight	TV	45	.	3372.8 (212.3)
Mellecker et ak. 2010	lean	Passive VG	60	.	1565.8 (803.8)
Chaput et al., 2011	lean	Passive VG	60	7.24 (1)	6492.8 (2222.7)
Moore et al., 2004	lean	Exercise	56	13.35 (.)	3549.9 (1149.9)
Bozinovski et al., 2009	lean	Exercise	15	16.11 (0.8)	3590.6 (300.6)
Bozinovski et al., 2009	lean	Exercise	45	16.2 (0.8)	3875.7 (333.7)
Taman et al., 2012	lean	Exercise	15	16.9 (1.1)	4149.1 (406.1)
Taman et al., 2012	obese	Exercise	15	17.6 (1.9)	4810.6 (322.4)
Bozinovski et al., 2009	lean	Exercise	15	18.9 (1.6)	5475.5 (526.7)
Bozinovski et al., 2009	lean	Exercise	45	19.4 (1.71)	5391.7 (442.9)
Moore et al., 2004	lean	Exercise	38	19.7 (.)	3179.8 (1059.7)
Nemet et al., 2010	lean	Exercise	45	20.3 (.)	1825 (175)
Taman et al., 2012	lean	Exercise	15	22 (1.1)	4618 (414.5)
Thivel et al., 2012	obese	Exercise	60	23.4 (3.5)	7080.3 (1684.8)
Nemet et al., 2010	lean	Exercise	45	23.9 (.)	2030.2 (185.9)
Nemet et al., 2010	overweight	Exercise	45	27.5 (.)	3261.9 (352.9)
Nemet et al., 2010	lean	Exercise	45	30.1 (.)	2425.4 (142.8)
Nemet et al., 2010	overweight	Exercise	45	33.1 (.)	4146.6 (442.5)
Thivel et al., 2012	obese	Exercise	30	33.9 (2.5)	3410.9 (1042.5)
Thivel et al., 2011	obese	Exercise	30	41.6 (3.9)	3842.2 (553.1)
Nemet et al., 2010	overweight	Exercise	45	42.1 (.)	3915.9 (341.2)
Thivel et al., 2012	obese	Exercise	30	46.2 (6.6)	6492.1 (1465.4)



Abbreviations: SD = standard deviations; TV = television; EE = energy expenditure and EI = energy intake; VG = video games.

Appetite, 2013



40%

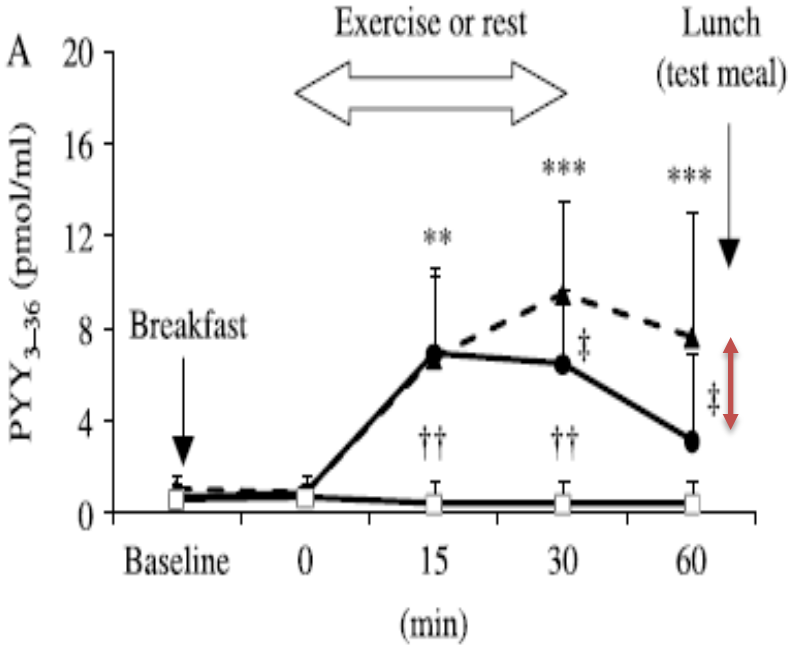
75%

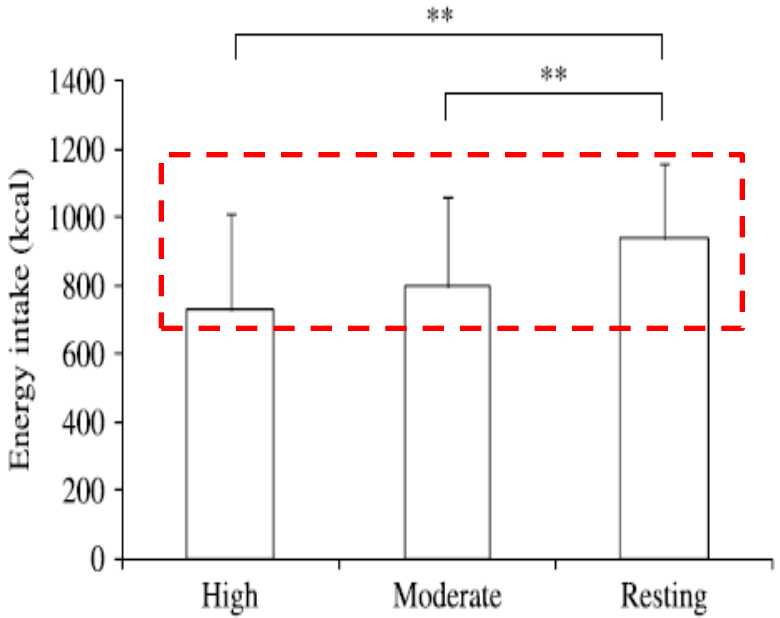
CON

Thermes de Brides les Bains
la référence pour maigrir

Institut Pasteur

PlosOne, 2012

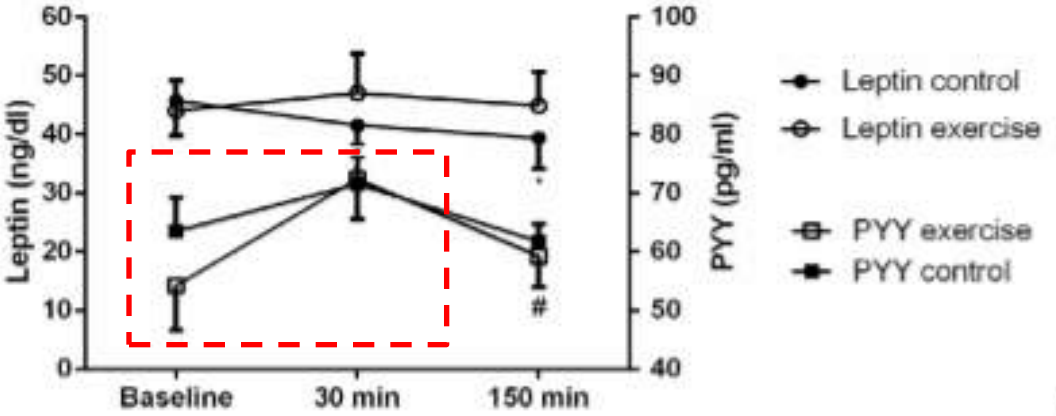


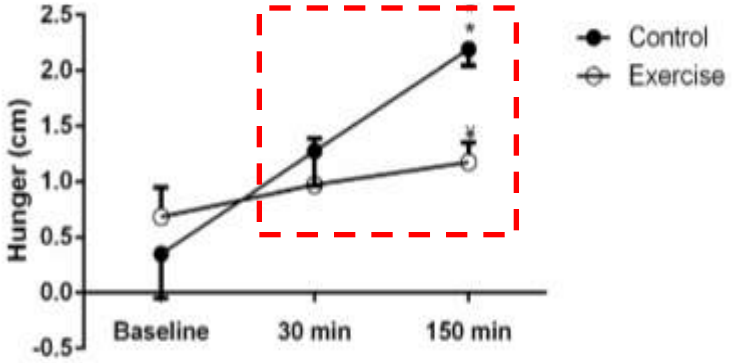


Ueda et al., 2009, J Endocrinol

Effect of Aerobic Exercise on Hunger Feelings and Satiety Regulating Hormones in Obese Teenage Girls

Prado et al., 2014, Pediatric Exercise Science





Timing of moderate-to-vigorous exercise and its impact on subsequent energy intake in young males

Physiology & Behavior 151 (2015) 557–562

Marie-Helene Albert [a,b], Vicky Drapeau [c,d], Marie-Eve Mathieu [a,b,*]

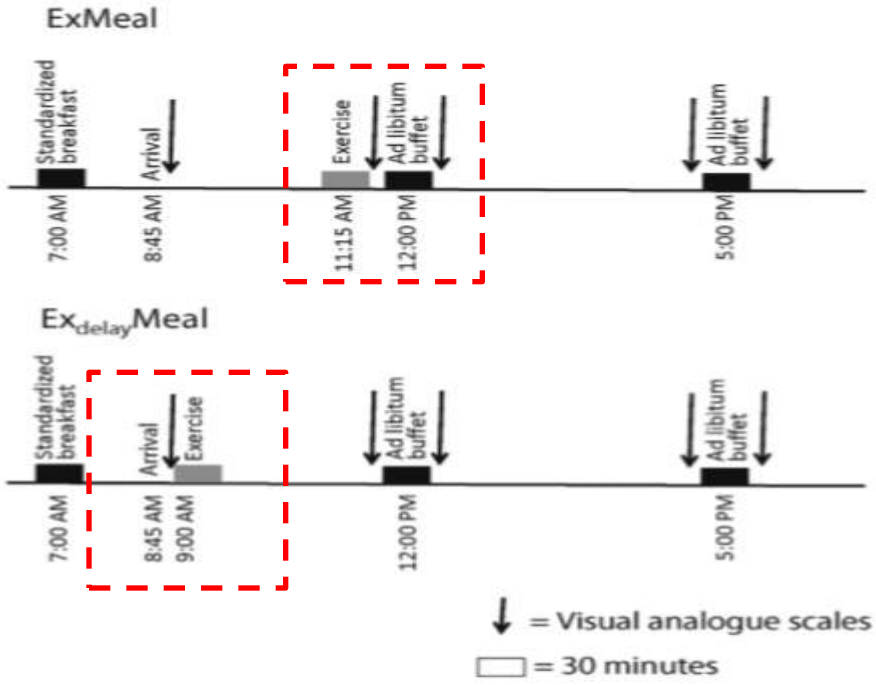
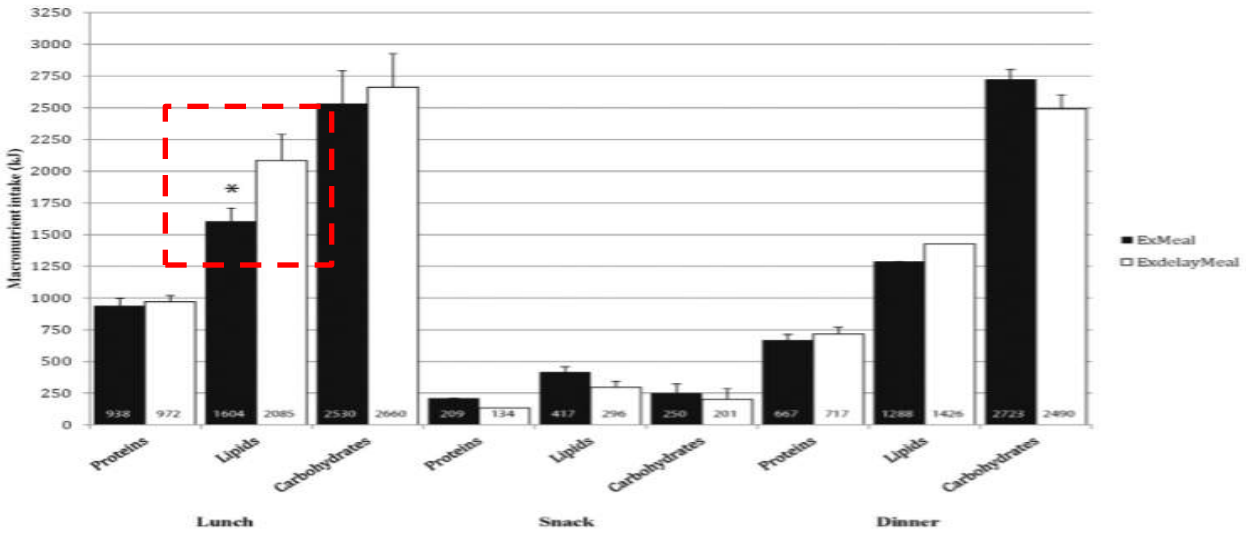
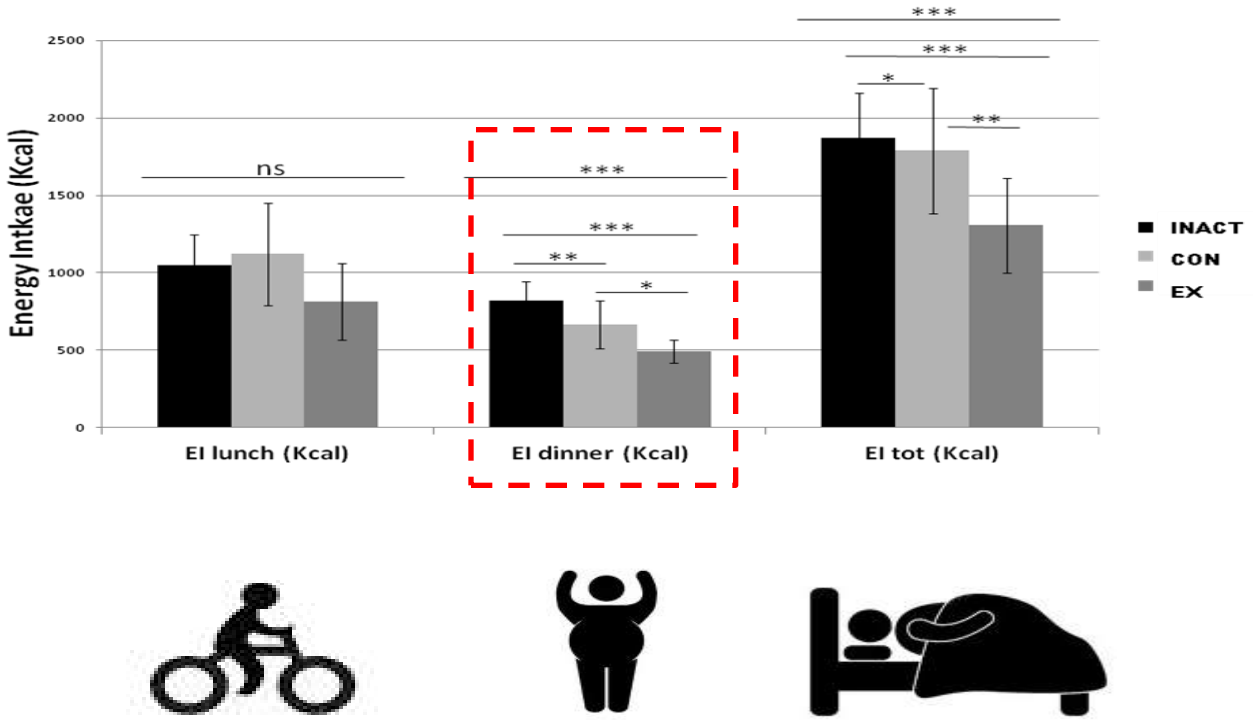


Table 1
Energy expenditure, energy intake and macronutrient profile of the meals.

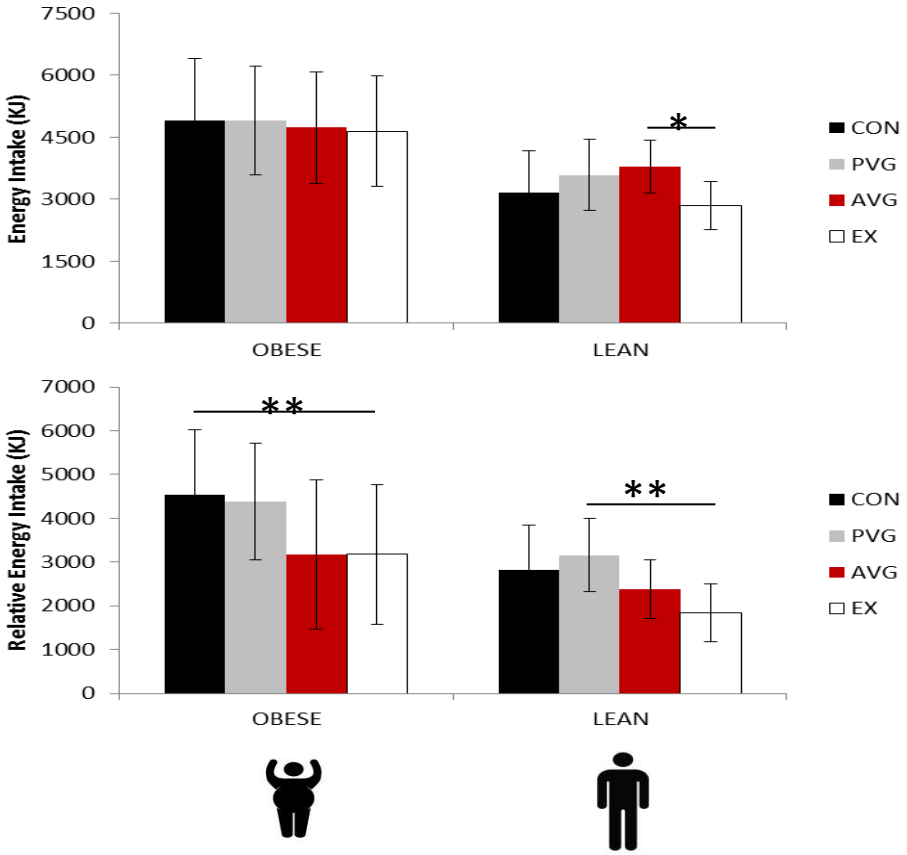
	ExMeal	Ex_{delay}Meal	*P*-value
Energy expenditure of the exercise session, kJ	1643 (211)	1657 (173)	0.836
# Steps	4557 (2394)	4823 (2427)	0.627
Energy intake, kJ			
Lunch	5072 (1033)	5718 (1343)	0.043
Snack	955 (413)	1084 (347)	0.236
Dinner	4678 (1490)	4632 (1950)	0.925
Macronutrient profile, %			





SFN
Société Française de Nutrition

JDBP, 2013

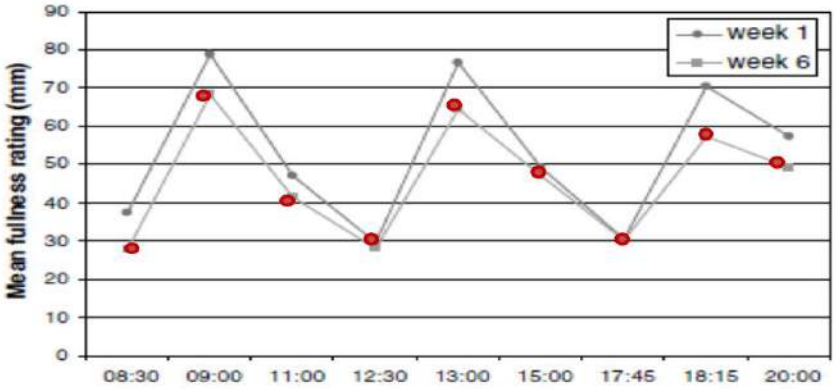


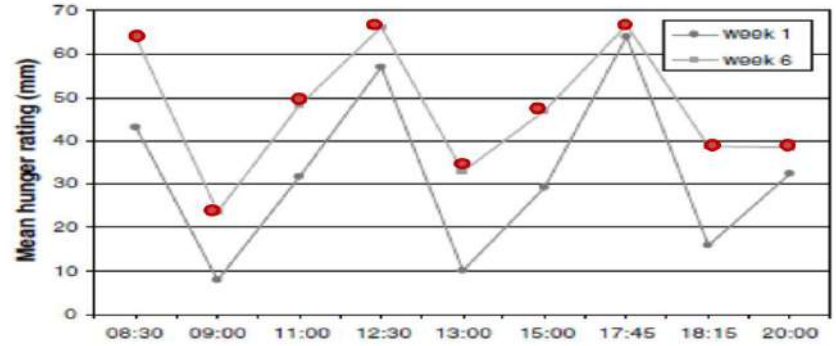
CHEO Research Institute
Healthy Active Living and Obesity Research
Institut de recherche
Recherche sur les saines habitudes de vie et l'obésité

DANONE INSTITUTE
Nutrition for Health

EJCN, 2015; BJN, 2015

Effet chronique ?





6 semaines d'AP

↓ de la satiété
↑ de la faim

Aucune évaluation des marqueurs physiologiques et de la prise alimentaire effective

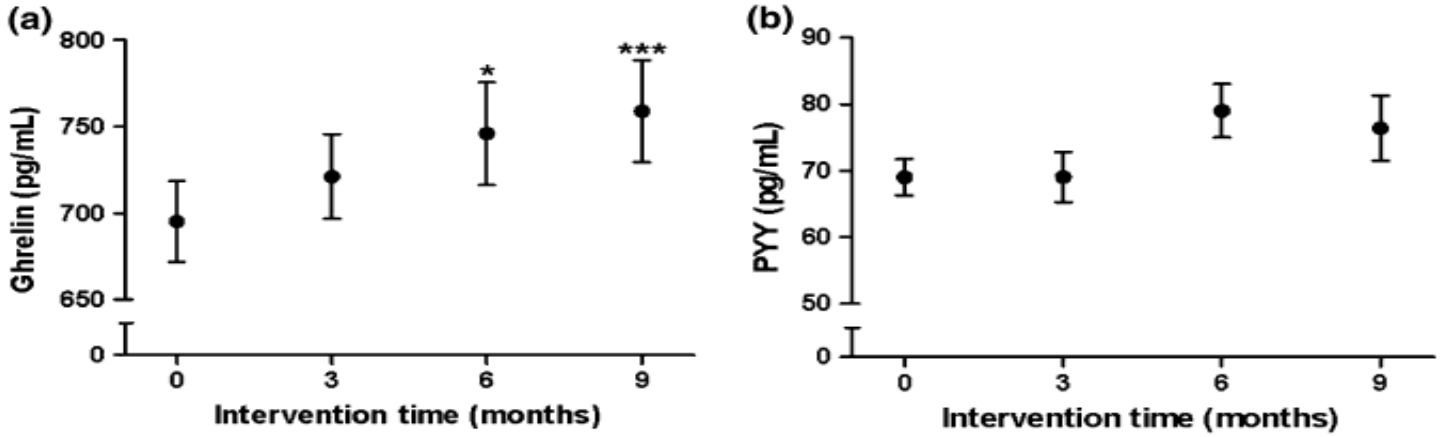
King et al., 2007, IJO

9 mois d'AP

↑ ghréline

↔ PYY

Aucune évaluation des marqueurs physiologiques
et de la prise alimentaire effective



Gueugnon et al., 2011, EJAP

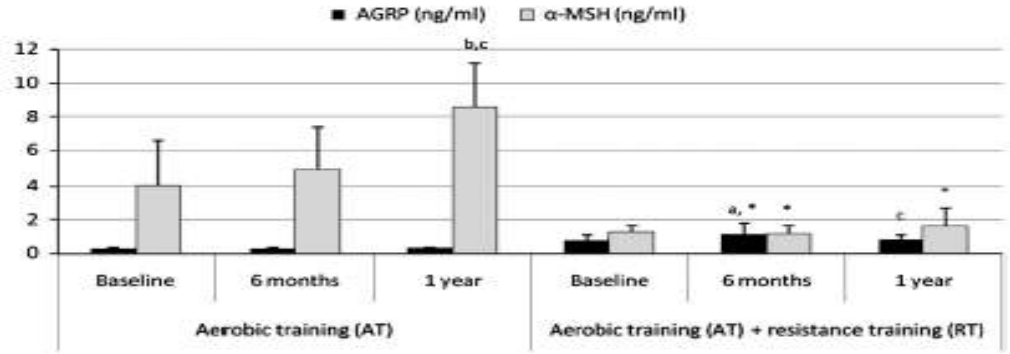
Table 3. Baseline and post-intervention energy intake and macronutrient intake.

	Pre-intervention		Post-intervention		
	Mean	SD	Mean	SD	
Energy intake (kJ/day)	7440	1744	6740	2124	
Fat intake (gr/day)	63.9	21.5	51.6	19.4	**
CHO intake (gr/day)	233.4	52.6	221.6	78.1	
Protein intake (gr/day)	75.7	26.2	68.7	34.3	

≈ 10% ↓

Data are presented as mean ± standard deviation; CHO: Carbohydrate; **p<0.01.

Physiology & Behavior, 2014



a: Baseline ≠ 6 months; b: Baseline ≠1 year; c: 6 months ≠ 1 year.

*difference between AT and AT + RT groups at the same time.

Data are presented as Mean ± SD.

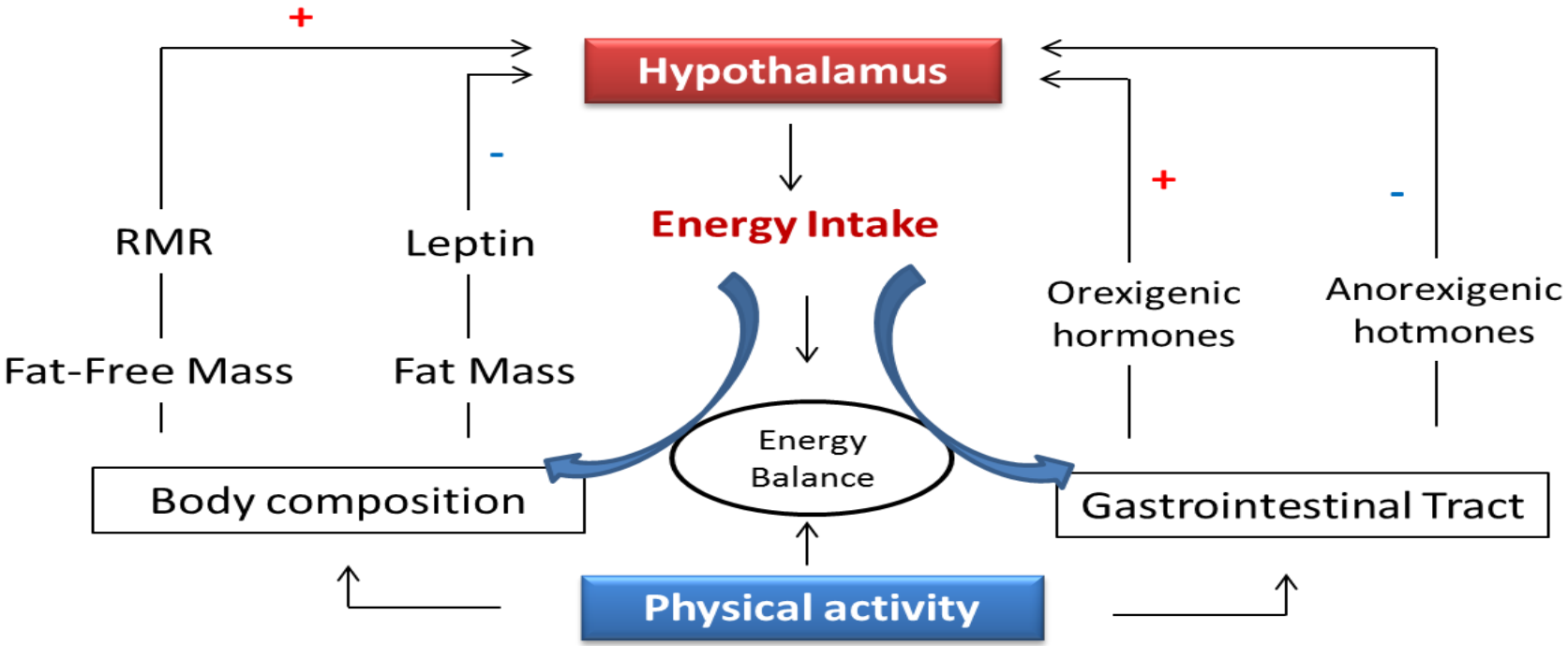
Table 2
Food intake values of aerobic training (AT) and aerobic training (AT) + resistance training (RT) groups at baseline and after 6 months and 1 year of therapy.

	Aerobic training (AT)			Aerobic training (AT) + resistance training (RT)		
	Baseline	6 months	1 year	Baseline	6 months	1 year
Energy (kcal)	1857.01 ± 357.61	1251.11 ± 89.11[a]	1318.14 ± 203.25[b]	1902.67 ± 508.68	1141.08 ± 402.74[a]	1310.79 ± 330.69[b]
Protein (g)	95.10 ± 21.39	72.54 ± 9.32	86.86 ± 23.68	66.80 ± 43.67	47.60 ± 14.28[a]	58.29 ± 20.02[b]
Carbohydrate (g)	248.57 ± 49.40	168.31 ± 18.75[a]	158.58 ± 30.88[b]	182.13 ± 105.28	162.22 ± 56.92	197.49 ± 48.02
Lipids (g)	49.41 ± 19.99	34.56 ± 4.20	37.22 ± 10.78	50.50 ± 28.33	33.91 ± 14.86[a]	33.48 ± 11.51[b]

Data are presented as mean ± SD. Significance set at $p < 0.05$.

[a] Baseline ≠ 6 months.
[b] Baseline ≠ 1 year.
[c] 6 months ≠ 1 year.
[*] Difference between AT and AT + RT groups at the same time.

Carbier et al., 2012, Appetite



Adapted from Blundell et al., 2012, DMM

Restrictive feeding practices and adiposity are differentially related to P3b cortical responses to food stimuli in children ☆

Appetite 63 (2013) 7–17

Claire Hill [a], Jia Wu [b], Michael J. Crowley [b], Pasco Fearon [c,*]

Fig. 1. Stimuli used in visual food oddball task (Study 1).

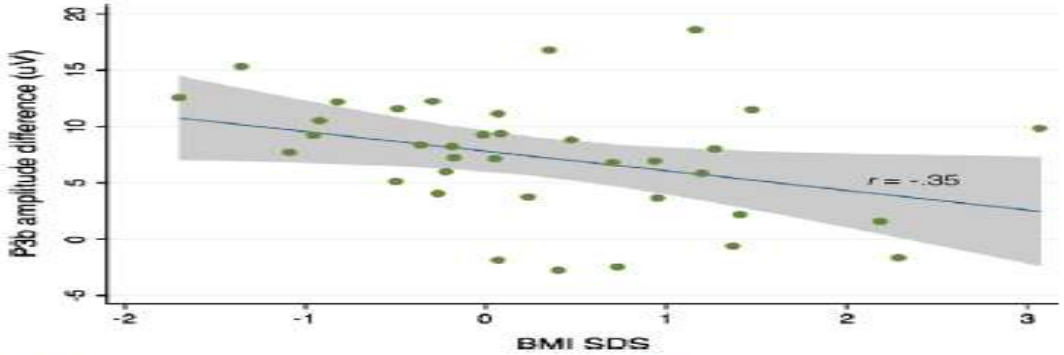
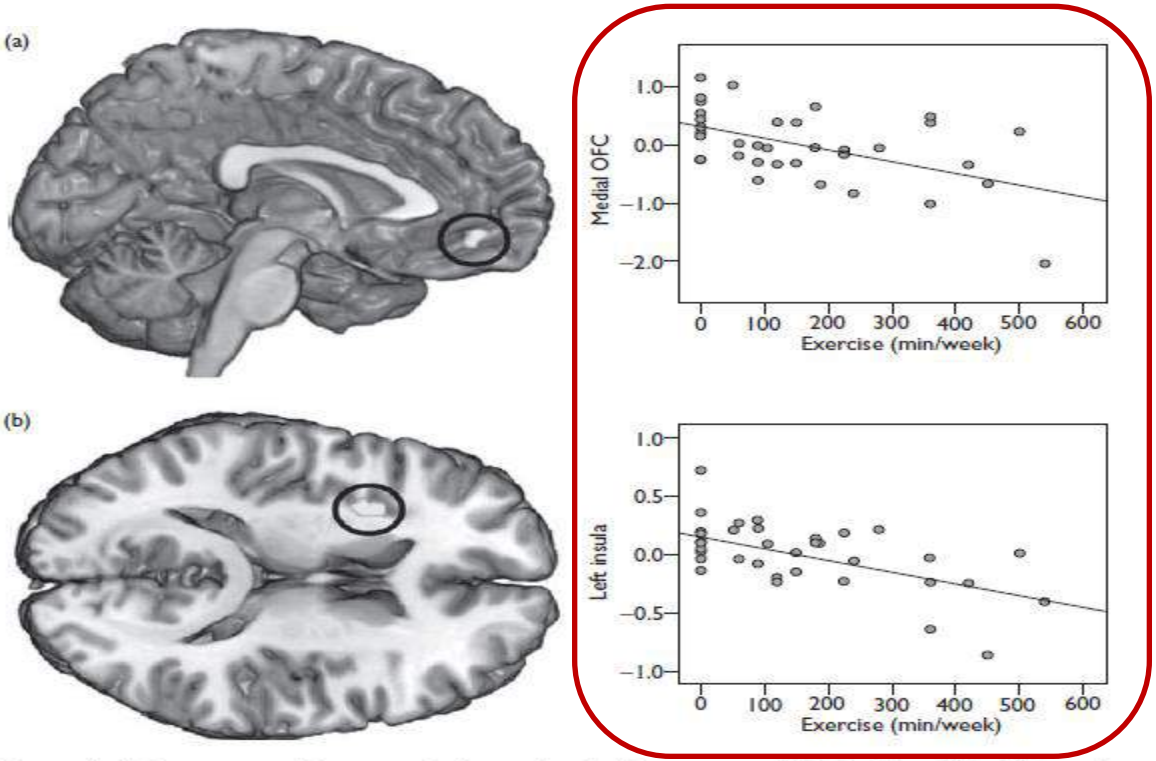


Fig. 4. Scatterplot showing association between BMI SD score and P3b amplitude difference between food and non-food trials (Study 1).

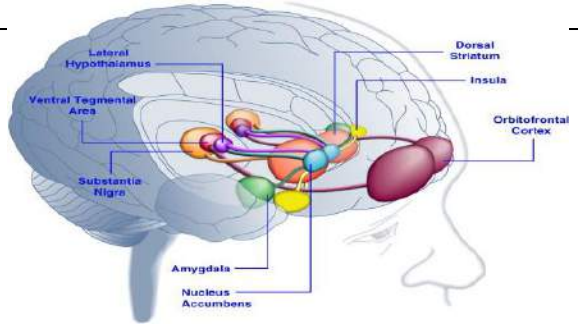
Physical exercise and brain responses to images of high-calorie food

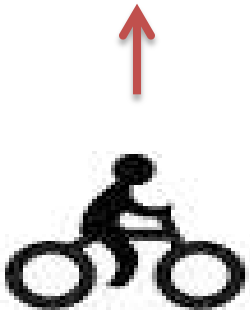
NeuroReport 2013,

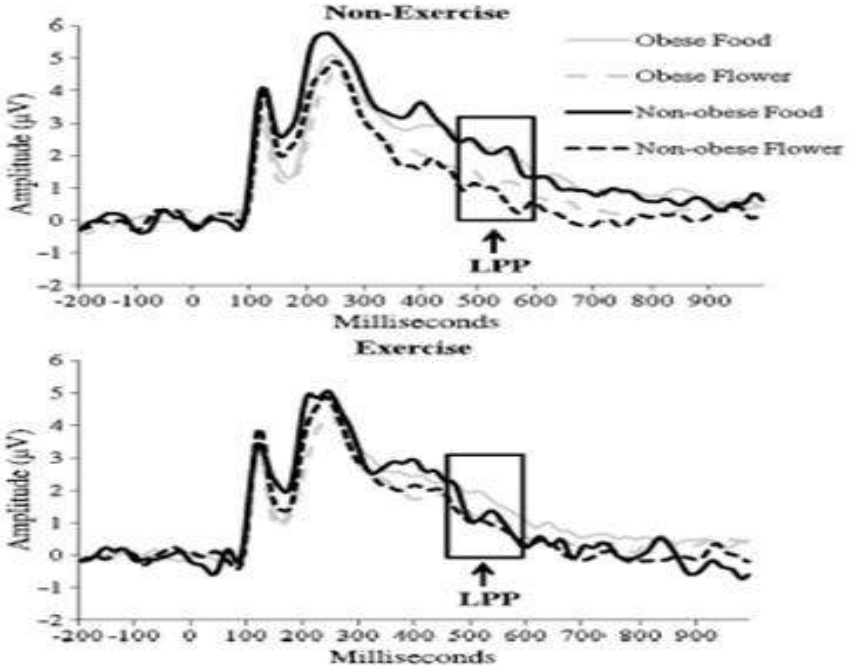


Self-reported physical exercise (minutes per week) was negatively correlated with responses within the (a) medial orbitofrontal cortex (OFC) (MNI: $x=0$, $y=48$, $z=-10$) and (b) left insula (MNI: $x=-30$, $y=128$, $z=160$) superimposed on the standard T1 template from SPM8. Scatterplots are displayed for descriptive purposes and show the pattern of association between exercise and the first extracted cluster eigenvariate. MNI, Montreal Neurological Institute.

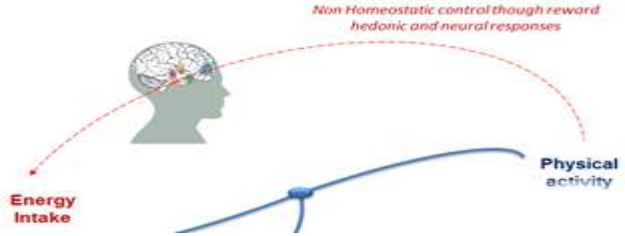
NOUVELLES PISTES EXPLORÉES







Hanlon et al., 2012, MSSE



Neural responses

ORIGINAL ARTICLE

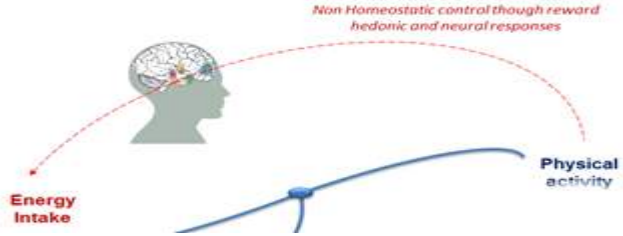
Reduced neural response to food cues following exercise is accompanied by decreased energy intake in obese adolescents

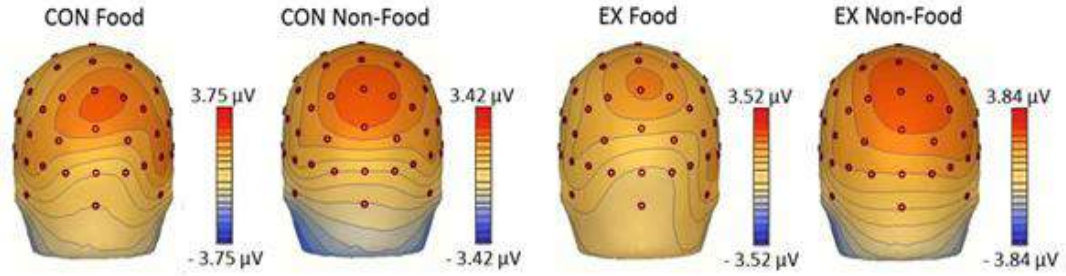
SN Fearnbach[1], L Silvert[2,3], KL Keller[1,4], PM Genin[5], B Morio[6], B Pereira[7], M Duclos[8,9,10], Y Boirie[9,10,11,12] and D Thivel[5,10]

International Journal of Obesity (2015), 1–7

www.nature.com/ijo

Activité de Recherche





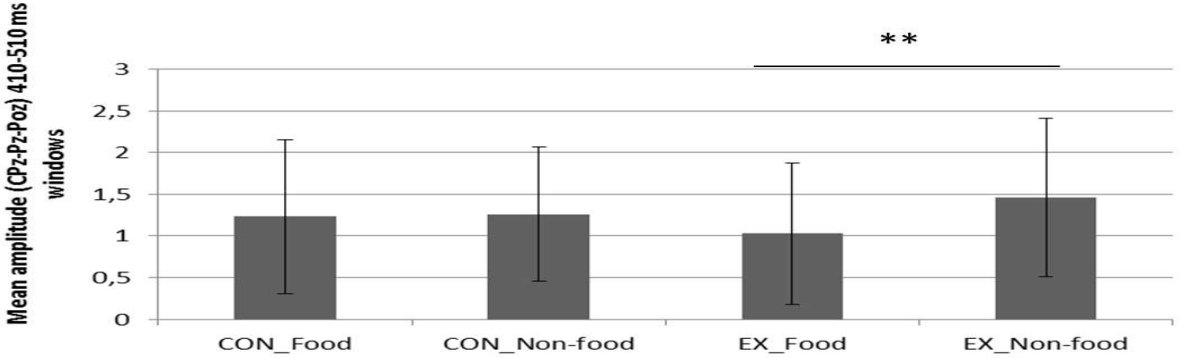


Table 2. Results from the *ad libiutm* lunch meal

	CON		EX	
	mean	***sd***	***mean***	***Sd***
Energy intake (kcal)	1116	243	1037*	260
Relative EI (kcal)	1011	239	639***	256
Protein (%)	29.4	7.2	30.5	6.7
Fat (%)	16.5	4.2	16.6	4.2
CHO (%)	53.4	11.0	52.3	10.5

Sd: Standard Deviations; CON: condition control; EX: condition exercise; EI: Energy Intake; CHO: Carbohydrate

CONCLUSION

Physical Activity in Children and Youth May Have Greater Impact on Energy Intake Than Energy Expenditure

Thivel D., Saunders T.J. & Chaput J.P.

Journal of Nutrition Education and Behavior • Volume 45, Number 1, 2013

AP modérée à intense régulière

Stratégies de réduction des Comportements sédentaires

↑ Dépense énergétique

Contrôle physiologique central; périphérique; non-homeostasique??

↓ prise alimentaire
↔ sensations d'appétit

Réduction de la BE

Merci de votre attention

“It looks as though man should be regarded now, if not in the past, as a predominantly sedentary rather than an upright animal”

Edholm, Fletcher, Widdowson & McCance, *BJN*, 1955