

# Carbohydrates and Feeding: An Extension of the Glucostatic Theory of Appetite Regulation

**Robert-MacDonald, M.**, Roberts, L.E., Hopkins, M., Tannous, T. and Éric Doucet  
 School of Human Kinetics, University of Ottawa, Ottawa, Canada

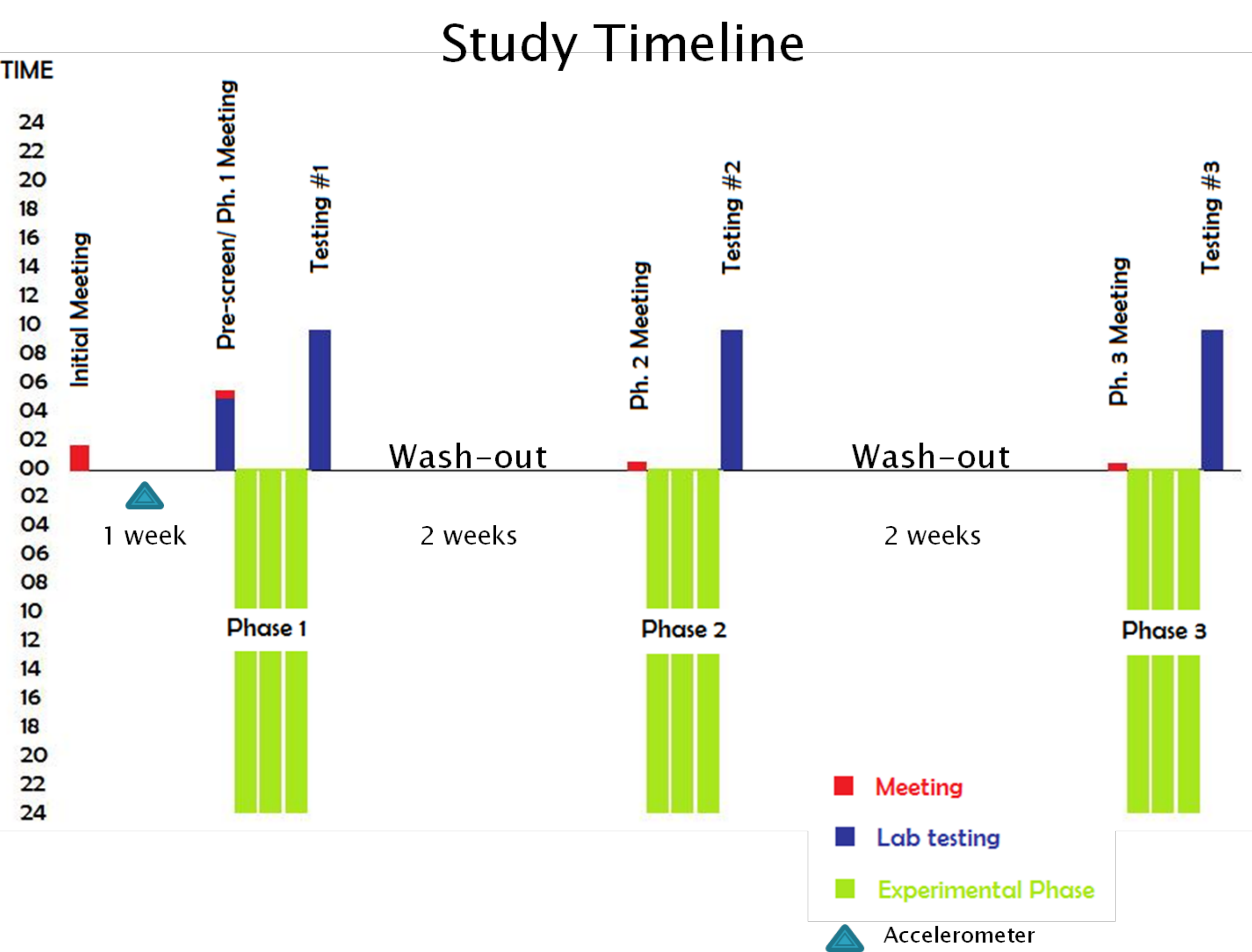
## INTRODUCTION

Mayer's 1953 Glucostatic Theory on appetite regulation considered how normal blood glucose fluctuations relate to feeding and appetite. No studies have tried to apply this model to extreme fluctuations of blood glucose. This study extends Mayer's theory to see how CHO stores (loaded and depleted) affect feeding and appetite.

## HYPOTHESES

1. Decrease in Endogenous Glucose = Increased appetite
2. Decrease in Endogenous Glucose = Increased food intake
3. Decrease in Endogenous Glucose = Increased preference for CHO

## METHODS



**Sample :** Six normal weight, apparently healthy university aged men ( $23.8 \pm 1.3$  kg/m<sup>2</sup>).

**Initial :** Accelerometer worn for 7 days for activity energy expenditure (AEE).

**Pre-screen testing :** Resting energy expenditure (REE), body composition (DEXA)

**Three diet conditions :** CHO loading (75%), CHO normal (control, 45%), CHO depletion (75%). Randomized selection. Include:

- **Three day dietary manipulation** - Diet similar to the participant's normal diet. Caloric intake based on REE and AEE. Macronutrient composition predetermined.
- **Lab testing :** 10 hours, time-blinded, food given on request. Measurements taken include REE, hunger and appetite by VAS, blood glucose continuously, caloric intake.
- **Washout period :** 2 weeks

## RESULTS

**Table 1. Subjects characteristics**

Variables	Mean	SD	Range
Age (years)	23.8	1.3	22.0-26.0
Body weight (kg)	76.5	7.9	70.0-89.9
Height (m)	1.8	0.05	1.7-1.9
BMI (kg/m <sup>2</sup> )	22.8	1.8	20.4-25.6
REE (kcal/day)	1871.3	52.7	1805.0-1932.0

All values are presented as mean  $\pm$  SD.

**Table 2. Loading and depletion results.**

	N	HI	LO
Total EI (kcal/d)	2828.0 $\pm$ 311.3	2858.4 $\pm$ 337.1	2757.4 $\pm$ 320.4
CHO (%)	50.6 $\pm$ 5.7 <sup>a</sup>	73.6 $\pm$ 1.3 <sup>c</sup>	13.3 $\pm$ 4.0 <sup>b</sup>
Lipids (%)	30.4 $\pm$ 5.6 <sup>a</sup>	12.6 $\pm$ 2.1 <sup>c</sup>	61.04 $\pm$ 0.3 <sup>b</sup>
Proteins (%)	19.0 $\pm$ 0.6 <sup>a</sup>	13.8 $\pm$ 2.6 <sup>c</sup>	25.66 $\pm$ 0.9 <sup>b</sup>

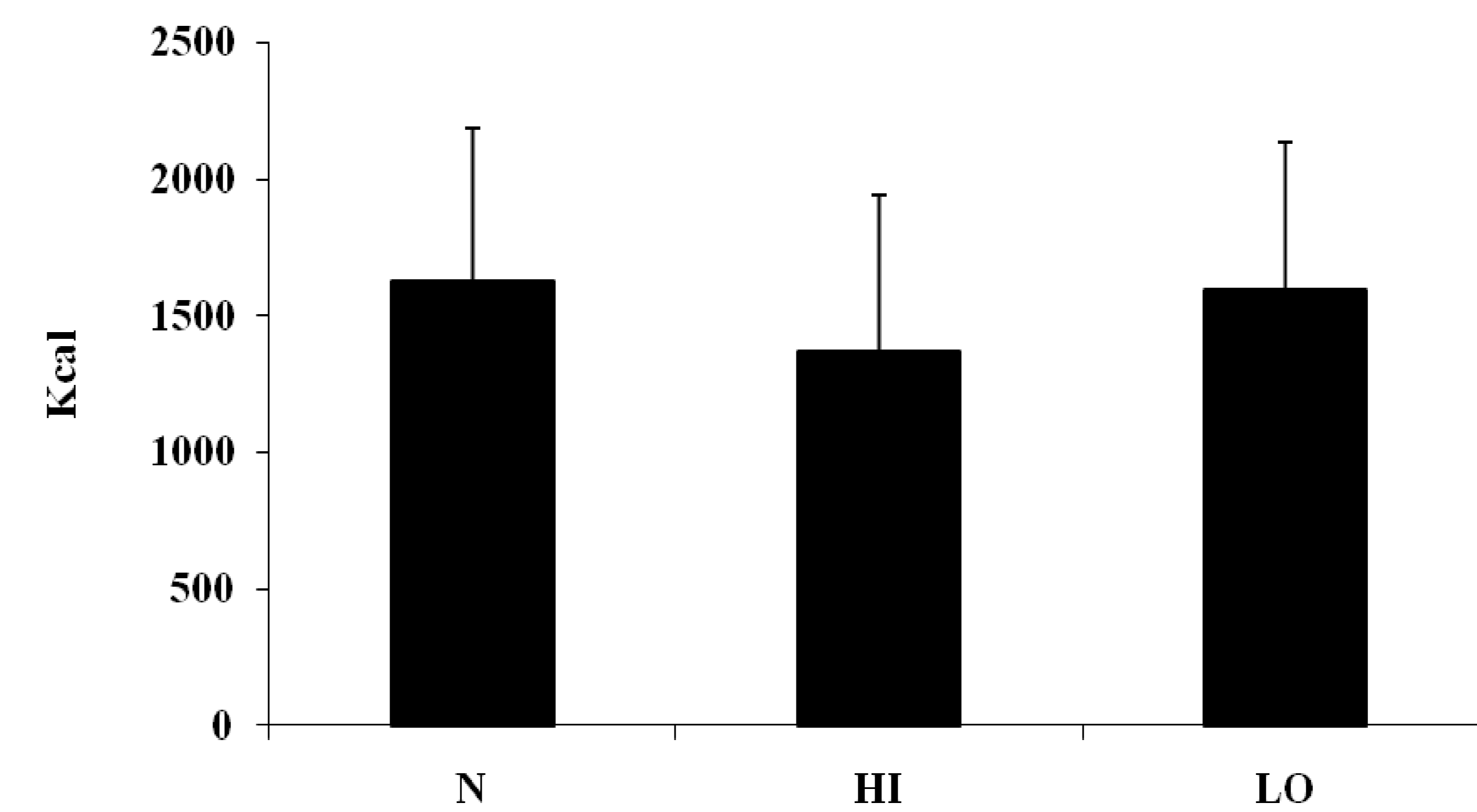
All values are presented as mean  $\pm$  SD.

**Figure 2. REE, RER and body weight for each diet phase**

	N	HI	LO
REE (kcal/day)	1865.7 $\pm$ 195.3	1914.9 $\pm$ 217.1	1915.5 $\pm$ 186.7
RER	0.84 $\pm$ 0.04 <sup>a</sup>	0.81 $\pm$ 0.04 <sup>a</sup>	0.79 $\pm$ 0.04 <sup>a</sup>
CHO ox(g/min)	0.17 $\pm$ 0.03 <sup>a</sup>	0.14 $\pm$ 0.05 <sup>a</sup>	0.11 $\pm$ 0.04 <sup>a</sup>
BW (kg)	77.5 $\pm$ 8.4	78.2 $\pm$ 8.5	78.0 $\pm$ 8.8

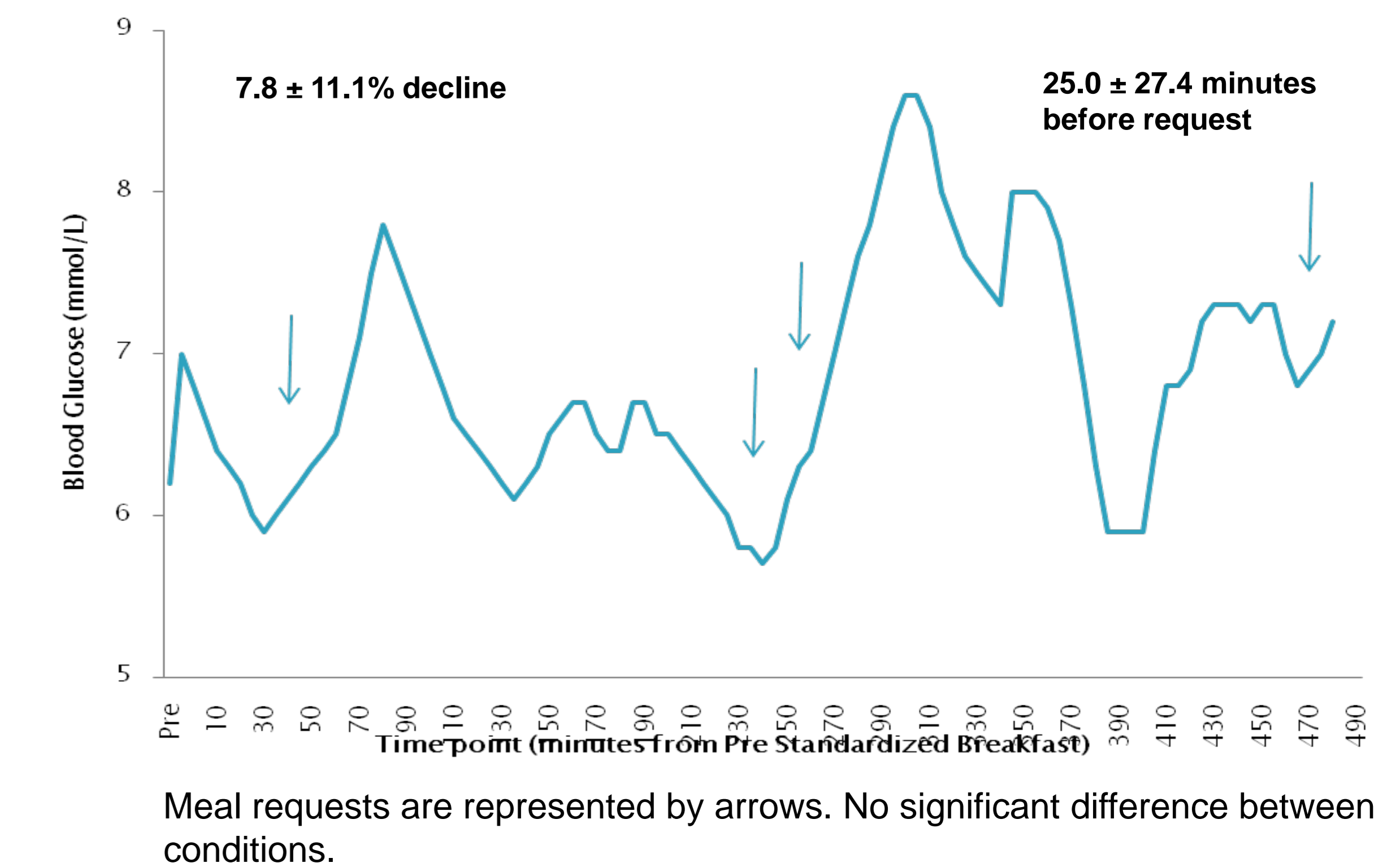
All values are presented as mean  $\pm$  SD.

**Figure 4. Effect of CHO load on total EI**



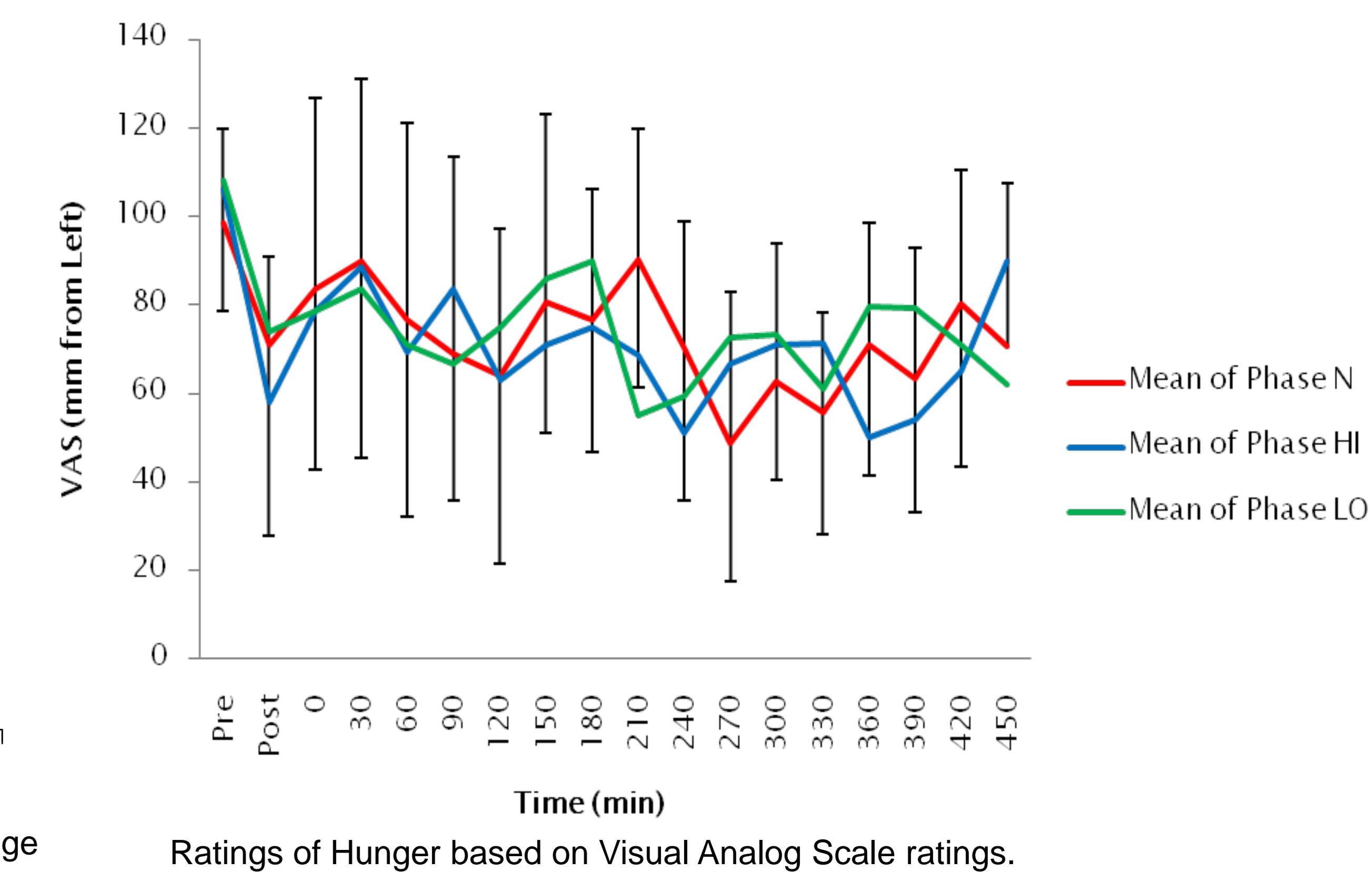
No change in EI which is contrary to expected shift due to change in CHO storage

**Figure 3. Blood Glucose and Meal requests**



Meal requests are represented by arrows. No significant difference between conditions.

**Figure 5. Effect of CHO load on Appetite**



## CONCLUSIONS

In summary, results from this study suggest that low or high glucose stores, after CHO depletion or loading, did not influence energy intake, CHO preference, appetite or number of meal requests. However, in concordance with Mayer's postulations, a decline of 7.8% in blood glucose was observed over 25.0 minutes prior each meal request, demonstrating appetite regulation by blood glucose fluctuations. In addition, the protocol standardization was supported by the significant difference seen in RER values across conditions paralleled with no changes in body weight in all conditions. While some results held true to Mayer's Glucostatic Theory, a larger sample is needed for further investigation.

Miesha Roberts-MacDonald  
 Faculty of Health Science  
 2nd year Honours Bachelor in Health Sciences  
 University of Ottawa  
 Ottawa, Ontario, Canada  
 Email: mrobe006@uottawa.ca

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