

**Supplementary Table 1:** Menu for a 2000 kcal energy prescription provided on test days. These standard meals were 55% carbohydrate, 15% protein, and 30% fat.

	Energy (kcal)	Meal % of total calories/d	Carbohydrates (g)	Protein (g)	Fat (g)
<b>BREAKFAST*</b>					
Hash browns; English muffins with margarine, and strawberry jelly Scrambled egg, cheddar cheese with salsa.	481.0	24%	68.7	18.3	15.0
<b>LUNCH*</b>					
Cheese quesadilla - green tortilla, cheddar cheese, black beans, picante salsa sauce.  Red sweet peppers and cabbage salad, with Mexican salad dressing.	800.0	41%	107.3	30.4	27.6
<b>Total</b>	1281.0	65%	176.0	48.7	42.6

\* Provided as the standard meals- energy content adjusted proportionately to achieve different energy prescriptions and maintain % of total calories/d as estimated by Mifflin St.Jeor equation, using 1.4 as the activity factor.

**Supplementary Table 2:** Clinical fasting and postprandial measures of insulin, glucose, lipid profile and steroid hormones in n = 17 women.

Parameter	Time	Follicular phase	Luteal phase
Insulin mU/mL	Fasting	5.26 ± 3.8	9.4 ± 15.2
	1hPP	9.9 ± 7.63	10.3 ± 14.1
	2hPP	11.68 ± 7.71	6.4 ± 2.8*
Glucose (mg/dL)	Fasting	88.0 ± 4.7	87.9 ± 5.5
	1hPP	93.6 ± 14.18	90.4 ± 14.3
	2hPP	89.5 ± 8.4	95.0 ± 16.9
Triglycerides (mg/dL)	Fasting	69.6 ± 27.0	68.5 ± 24.8
	1hPP	97.2 ± 27.8	87.0 ± 26.5
	2hPP	102.3 ± 42.7	92.1 ± 30.6
Glucose Insulin Ratio (mg/10 <sup>-4</sup> mU)	Fasting	34.6 ± 36.5	32.7 ± 29.9
	1hPP	24.0 ± 34.6	20.6 ± 14.3
	2hPP	12.0 ± 10.6	17.5 ± 8.3
Total Cholesterol (mg/dL)	Fasting	151.9 ± 26.9	154.1 ± 24.0
	1hPP	153 ± 28.4	149.8 ± 25.5
	2hPP	151.3 ± 27.9	150.0 ± 22.5
HDL-c (mg/dL)	Fasting	61.2 ± 9.4	61.6 ± 11.3
	1hPP	59.3 ± 9.4	58.4 ± 11.9
	2hPP	57.1 ± 8.9	58.0 ± 10.7
LDL-c (mg/dL)	Fasting	76.8 ± 23.9	78.8 ± 20.0
	1hPP	74.9 ± 24.2	74.0 ± 19.7
	2hPP	73.7 ± 23.9	73.6 ± 17.7
HOMA-IR		1.13 ± 0.07	2.0 ± 3.2
QUICKI		0.41 ± 0.07	0.4 ± 0.1

‘\*’ - indicates significant difference at  $p < 0.05$

**Supplementary Table 3:** Endocannabinoids in the follicular and luteal phase in n = 17 women. All data are presented as mean  $\pm$  SD.

<b>Endocannabinoids</b>	<b>Follicular Phase (pmol/mL)</b>	<b>Luteal Phase (pmol/mL)</b>
<b>1-OG</b>	281.27 $\pm$ 194.70	252.18 $\pm$ 110.01
<b>2-OG</b>	293.57 $\pm$ 122.09	266.59 $\pm$ 96.80
<b>1-LG</b>	253.58 $\pm$ 167.93	237.68 $\pm$ 170.80
<b>2-LG</b>	271.94 $\pm$ 124.22	251.73 $\pm$ 84.94
<b>1-AG</b>	10.95 $\pm$ 5.16	10.96 $\pm$ 4.09
<b>2-AG</b>	10.44 $\pm$ 5.18	8.84 $\pm$ 2.60
<b>OEA</b>	6.51 $\pm$ 2.22	6.11 $\pm$ 1.99
<b>LEA</b>	2.37 $\pm$ 0.59	2.30 $\pm$ 0.87
<b>aLEA</b>	0.09 $\pm$ 0.03	0.09 $\pm$ 0.04
<b>DGLEA</b>	0.16 $\pm$ 0.08	0.13 $\pm$ 0.05
<b>AEA</b>	1.23 $\pm$ 0.44	1.14 $\pm$ 0.41
<b>DEA</b>	0.39 $\pm$ 0.16	0.33 $\pm$ 0.11
<b>DHEA</b>	0.87 $\pm$ 0.43	0.78 $\pm$ 0.34

**Supplementary Table 4:** SEM model fit parameters for all tested models from n = 17 women

Independent variables	Dependent variable	RMSEA	Tucker Lewis Index	Comparative Fit Index	Chi square p-value for fit	Modification indices < 3.84	Model acceptability based on all validation parameters (Excellent, fair, poor)
<b>FOLLICULAR PHASE MODELS TESTED</b>							
<i>ECs Clinical Variables Dietary Restraint Ovarian and Satiety Hormones</i>	Craving Fats	0.207	0.084	0.293	0.000	No	Poor
	Craving Sweets	0.164	0.206	0.388	0.005	No	Poor
	Craving Carbs	0.196	0.107	0.311	0.000	No	Poor
<i>ECLs Clinical Variables Dietary Restraint Ovarian and Satiety Hormones</i>	Craving Fats	0.256	0.083	0.293	0.000	No	Poor
	Craving fats	0.284	0.111	0.296	0.000	No	Poor
<b>LUTEAL PHASE MODELS TESTED</b>							
<i>ECs Clinical Variables Dietary Restraint Ovarian and Satiety Hormones</i>	Craving Fats	0.108	0.701	0.799	0.189	No	Poor
	Craving Sweets	0.118	0.660	0.772	0.132	No	Poor
	Craving Carbs	0.158	0.488	0.655	0.045	No	Poor
<i>ECLs Clinical Variables Dietary Restraint Ovarian and Satiety Hormones</i>	Craving Fats	0.215	0.167	0.357	0.000	No	Poor

Craving Sweets	0.206	0.193	0.108	0.000	No	Poor
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Craving Carbs	0.241	0.037	0.257	0.000	No	Poor
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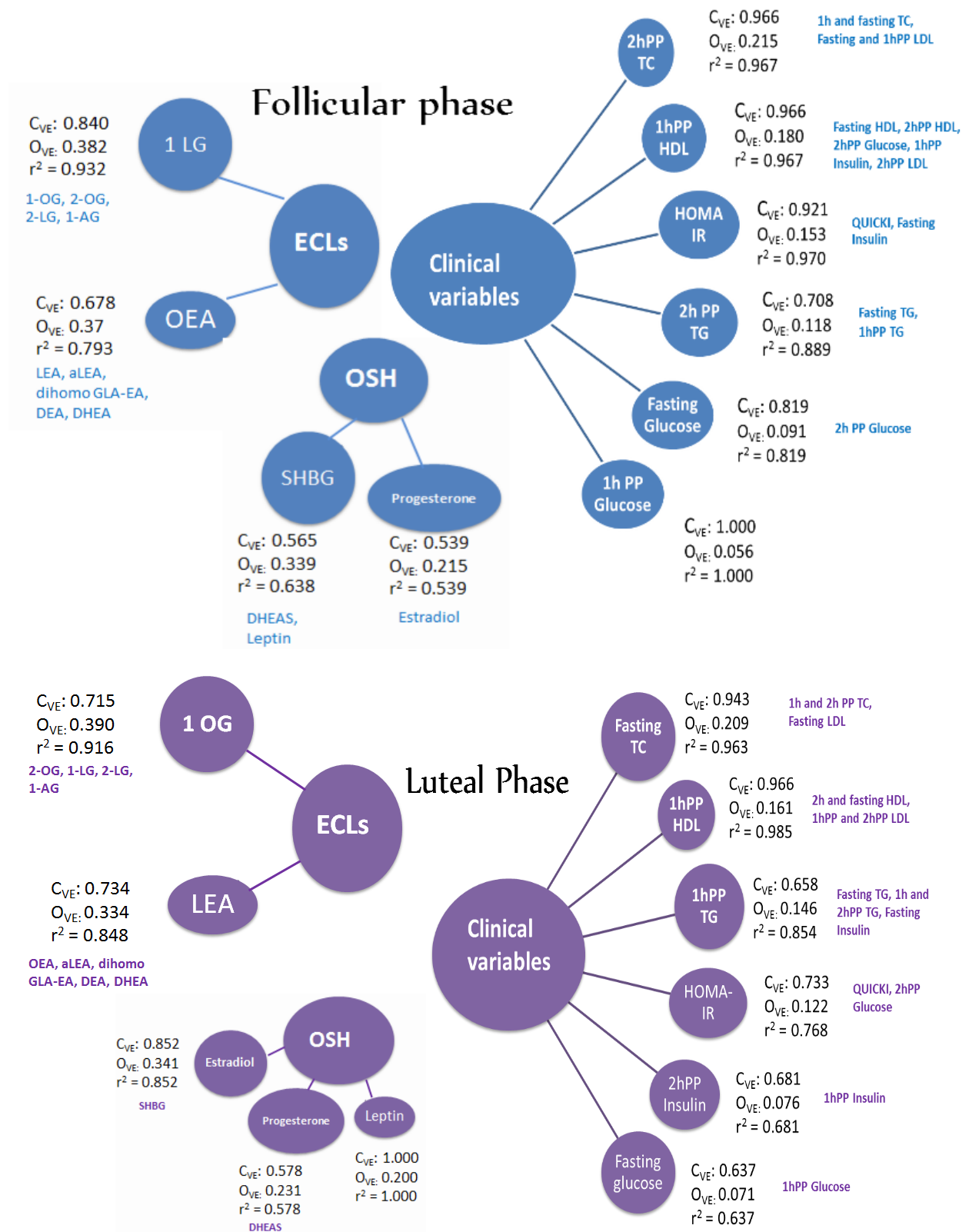
Craving Fats	0.245	0.289	0.437	0.000	No	Poor
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*ECs and ECLs  
Clinical Variables  
Dietary Restraint  
Ovarian and  
Satiety Hormones*

Craving Carbs	0.278	0.029	0.185	0.000	No	Poor
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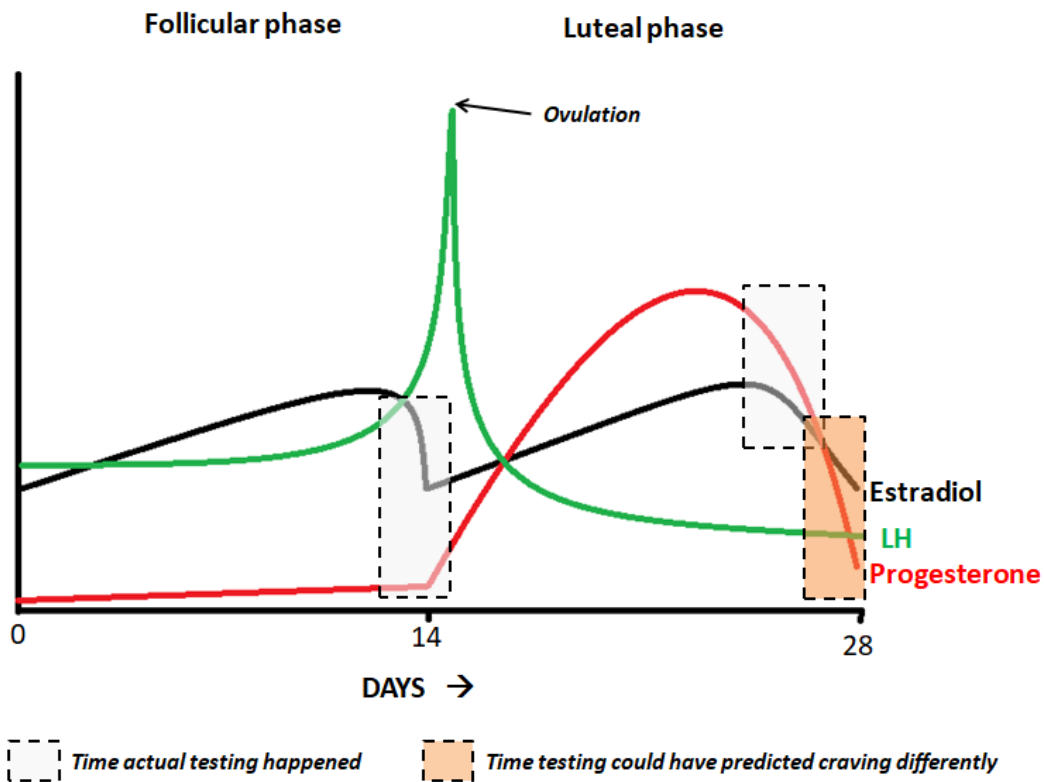
Craving Sweets	0.118	0.660	0.772	0.132	No	Poor
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**Supplemental figure 1:** Variables selected using cluster analysis based on correlation for clinical and endocannabinoid-like compounds in  $n = 17$  women. Cluster analysis revealed clusters for clinical and ECLs. Each small circle lists the variable representative for that cluster.  $C_{VE}$  is used to denote the cluster proportion of variance explained,  $O_{VE}$  represents the overall variance explained and  $r^2$  indicates the coefficient of multiple correlation of that variable with the

remaining variables within the cluster it represents. The variables listed outside (in blue in follicular and purple in luteal phases) are the other variables that form that cluster, represented by the primary variable listed in the larger circle.



**Supplemental figure 2:** Representation of estradiol (black), progesterone (red) and LH (green) across a typical 28-day menstrual cycle, showing the follicular and luteal phases, as well as ovulation mid-cycle. The grey boxes with dashed lines indicate the time during which we captured the follicular and luteal phases in these women in our study. The cycle length of women in the current study was  $30.4 \pm 2.6$  days, not very different from the 28-day cycle depicted here.



## Supplemental material: R code to run structural equation models

This code was used to generate the structural equation models that were presented in the manuscript titled "*Structural equation modeling of food craving across the menstrual cycle using behavioral, neuroendocrine, and metabolic factors*". The following code uses functions from two individual packages (lavaan and semPaths) as well as basic R built in functions. This code was generated and run in R Studio version 1.0.153.

```
# Starting with data in R as 'dataframe' with independent variables labeled Var y1 – Var yn, dependent variables labeled Var x1 – Var xn. Independent variables in our models were ovarian and satiety hormones such as leptin, estradiol, progesterone, SHBG and DHEAS; eating behaviors such as cognitive restraint, disinhibition and hunger scores; endocannabinoids and metabolic parameters such as lipid profile and glucose. Latent factors (Factor1-Factorn) were represented by these independent variables, and craving scores for high fat, high sweet and high carbohydrate foods were our dependent variables/predicted latent variables (Var x1 –Var xn).
```

```
install.packages("lavaan", dependencies=TRUE) #For more information about this package please check out http://lavaan.ugent.be/start.html)
require(lavaan)
```

### #latent variable definitions

```
modelname <-
'Factor1 =~ Var y1 + Var y2 + Var y3 #Factor = latent factor, Var = Measured variables
Factor2 =~ Var y4 + Var y5 + Var y6 # Factor = latent factor, Var = Measured variables
Factor3 =~ Var y7 + Var y8 + Var y9 # Factor = latent factor, Var = Measured variables
```

### #Regressions

```
Var x1 ~ Factor1 + Factor2 + Factor3 #Predicted latent variable, there can be multiple variables predicted at once.
```

### #Variances and covariances

```
Factor1~~Factor2
Factor2~~Factor3
Factor1~~Factor2 #It is possible to evaluate covariance between dependent and independent variables as well.
```

### #Fitting structural equation model

```
fit <- sem(modelname, data=dataframe)
summary(fit, fit.measures = TRUE, modificationindices=T)
```

### #Drawing model path diagram using fit model

```
semPaths(fit, "std", edge.label.cex = 0.5, curvePivot = TRUE)
```

#check out this link for more visualization options

<http://sachaepskamp.com/documentation/semPlot/semPaths.html>