

## SUPPLEMENTARY DATA

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**Supplementary Figure 7.** Study protocol: fMRI scanning days

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**Supplementary Table 1.** Cerebral blood flow (CBF) Main Effect of Group (ANOVA) (a), covaried (ANCOVA) for change in acyl-ghrelin (b) and insulin (c) after drink consumption. The Main Effect of Drink (d), covaried (ANCOVA) for change in acyl-ghrelin (e) and insulin (f) after drink consumption. Talairach coordinates are shown for each region; R, right; L, left; B, Bilateral.

**MAIN EFFECT OF GROUP**

(a) Main effect of group	Brain Region	Hemisphere	Coordinates			F-value	Effect Size
			x	y	z		
	Prefrontal cortex/Anterior cingulate cortex	L	-15	35	6	6.59	0.42
<b>(b) Covaried for change in acyl ghrelin</b>							
	Thalamus	B	0	-22	3	6.58	0.42
	Hypothalamus	L	-4	-5	0	4.55	0.35
	Prefrontal cortex/Anterior cingulate cortex	L	-16	36	7	6.42	0.41
<b>(c) Covaried for change in insulin</b>							
	Thalamus	B	4	-11	6	5.98	0.4
	Hypothalamus	L	-4	-5	0	5.1	0.36
	Prefrontal cortex/Anterior cingulate cortex	L	-17	36	5	6.62	0.42

**MAIN EFFECT OF DRINK**

(d) Main Effect of Drink	Brain Region	Hemisphere	Coordinates			F-value	Effect Size
			x	y	z		
	Caudate/Putamen	L	-10	6	-5	4.98	0.36
<b>(e) Covaried for acyl-ghrelin</b>							
	Hypothalamus	R	3	-9	-4	5.88	0.39
	Insula	L	-30	6	-10	4.72	0.35
	Putamen	R	25	0	-3	5.55	0.38
	Thalamus	L	-14	-22	7	5.63	0.38
<b>(f) Covaried for insulin</b>							
	Visual areas	B	0	-78	7	5.6	0.38

Talairach coordinates are shown for each brain region  
L- left, R- right, B- bilateral

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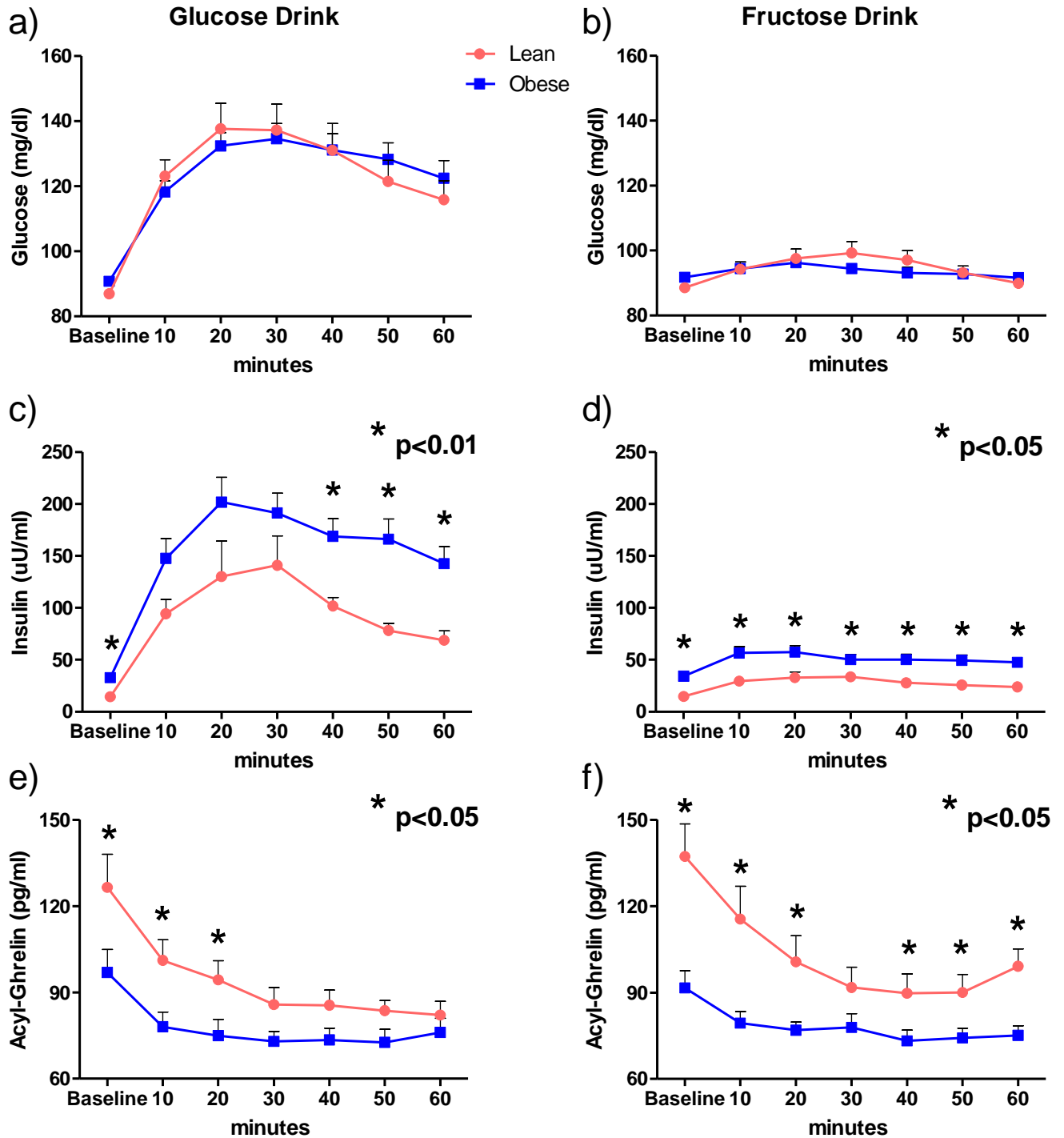
**Supplementary Table 2.** Cerebral blood flow response to glucose ingestion vs. baseline and fructose ingestion vs. baseline in lean and obese adolescents. Talairach coordinates are shown for each region; R, right; L, left; B, bilateral.

<b>GLUCOSE INGESTION</b>							
<b>Lean Group</b>	<u>Brain Region</u>	<u>Hemisphere</u>	<u>Coordinates</u>			<u>t-value</u>	<u>Effect Size</u>
			x	y	z		d
	Prefrontal cortex (BA10)	L	-12	62	-2	2.42	0.65
	Caudate	R	18	22	1	2.55	0.68
<b>Obese Group</b>							
	Hypothalamus	R	4	-8	-2	2.65	0.54
	Hypothalamus	L	-4	-8	-2	2.29	0.47
	Caudate	L	-13	17	-1	2.61	0.53
	Prefrontal cortex (BA10)	L	-31	49	0	-2.74	0.56
	ACC	L	-6	37	0	-2.65	0.54
	Thalamus	R	5	-8	2	2.89	0.59
		L	-5	-8	2	2.94	0.6
<b>FRUCTOSE INGESTION</b>							
<b>Lean Group</b>	<u>Brain Region</u>	<u>Hemisphere</u>	<u>Coordinates</u>			<u>t-value</u>	<u>Effect Size</u>
			x	y	z		d
	Parahippocampus	R	17	-41	-1	-2.87	0.77
<b>Obese Group</b>							
	Nucleus Accumbens	L	-11	7	-8	2.7	0.55
	Prefrontal cortex (BA10)	R	7	57	-14	-2.72	0.55
	Prefrontal cortex (BA10)	L	-7	57	-14	-2.6	0.53
	Putamen	L	-28	1	2	2.27	0.46
	Thalamus	R	7	-8	2	2.97	0.6
		L	-7	-8	2	2.55	0.52

Talairach coordinates are shown for each brain region  
L- left, R- right, B- bilateral

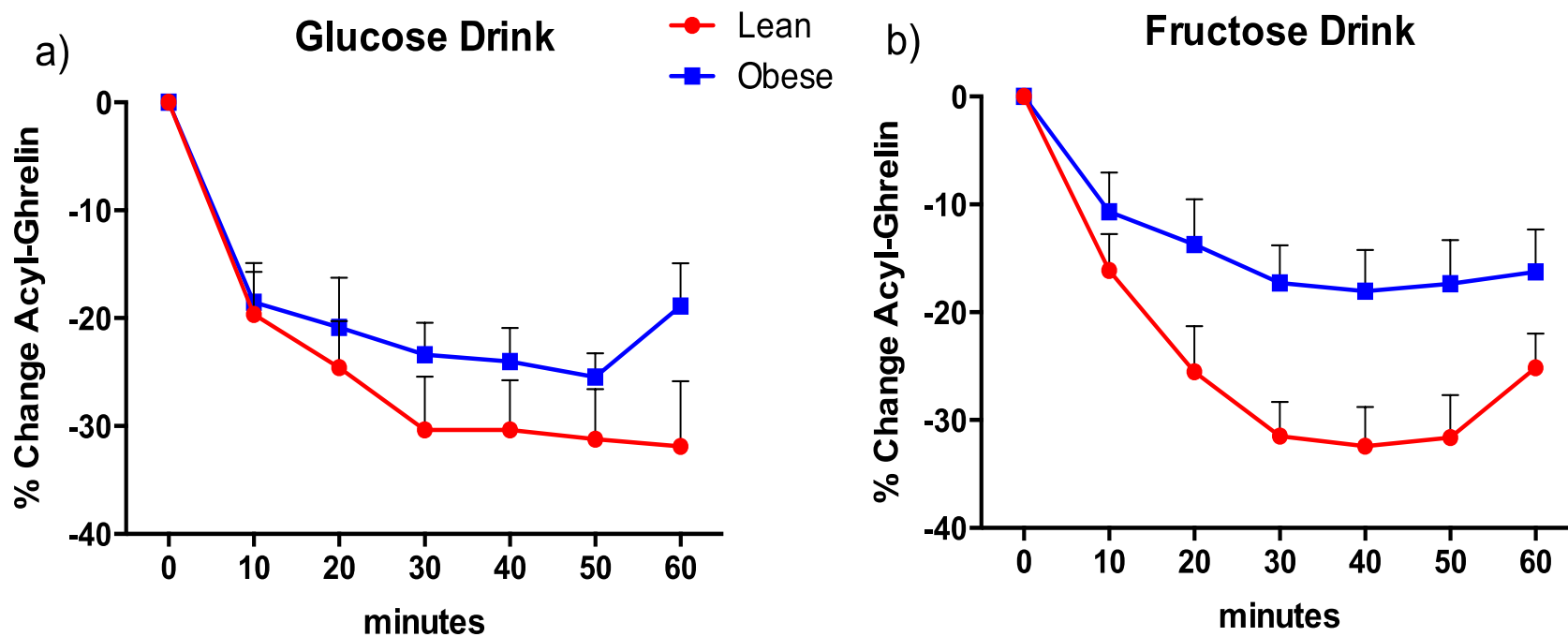
SUPPLEMENTARY DATA

**Supplementary Figure 1. Metabolic response to glucose and fructose drinks.** Glucose levels in obese and lean adolescents were not different in response to (a) glucose drink or (b) fructose drink. Insulin levels in obese adolescents were higher in obese adolescents in response to (c) glucose drink at 40, 50, and 60 minutes after ingestion and after (d) fructose drink at each time point.



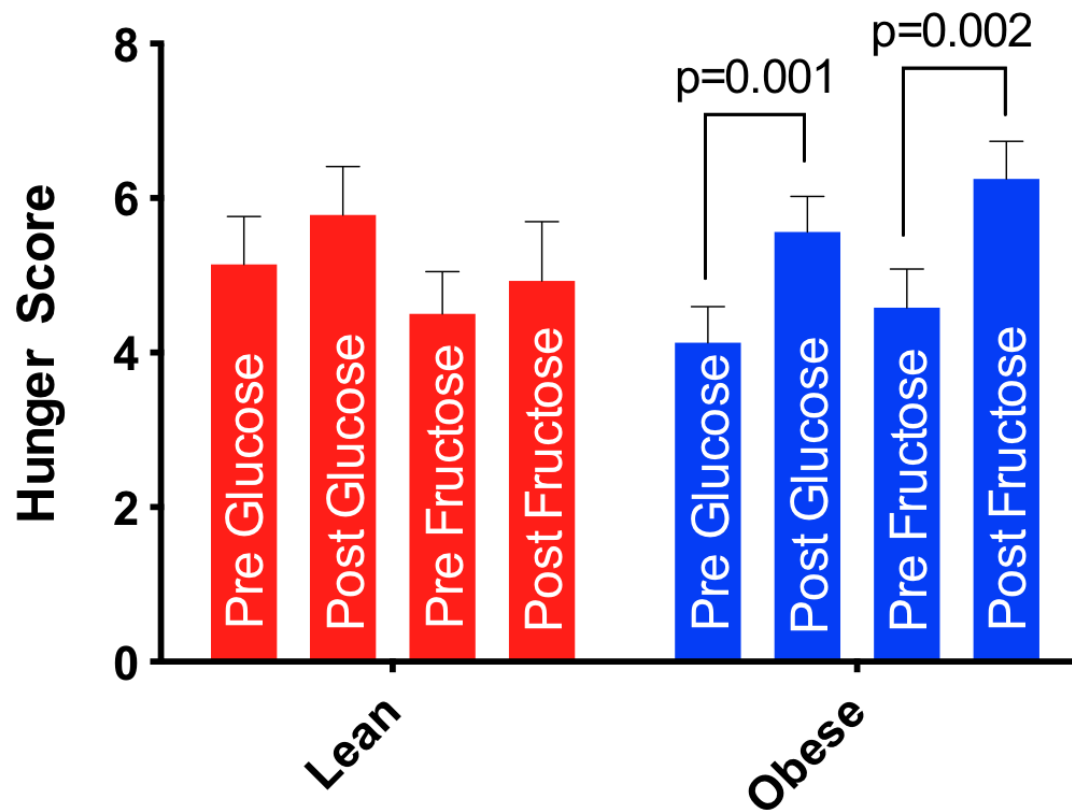
SUPPLEMENTARY DATA

**Supplementary Figure 2. Metabolic response to glucose and fructose drinks: Percent change in acyl-ghrelin:** Percent change in acyl-ghrelin in response to (a) glucose drink (b) and fructose drink.



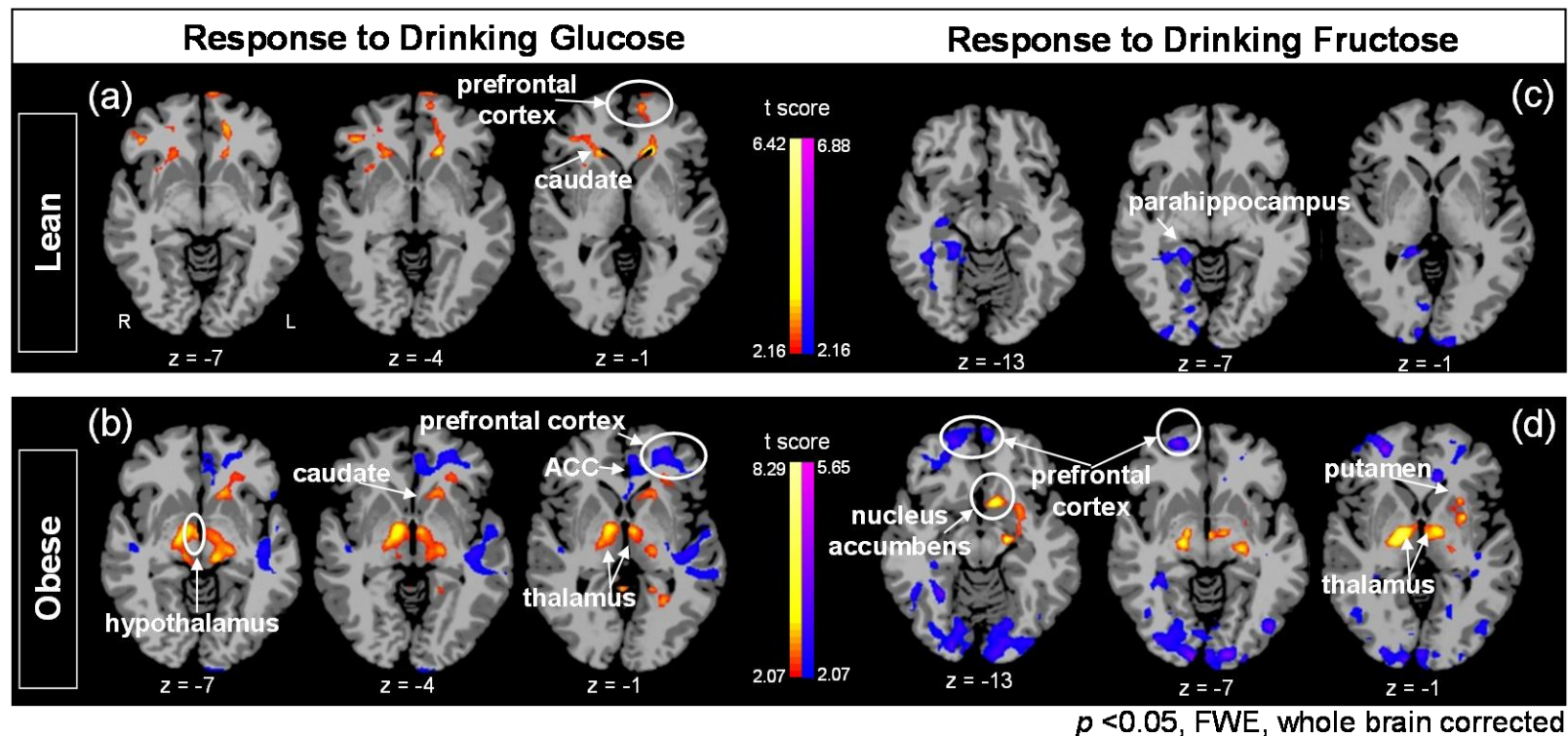
SUPPLEMENTARY DATA

**Supplementary Figure 3. Hunger ratings before and after glucose and fructose ingestion in lean and obese adolescents.** In obese but not lean adolescents hunger levels increased after glucose and fructose ingestion.



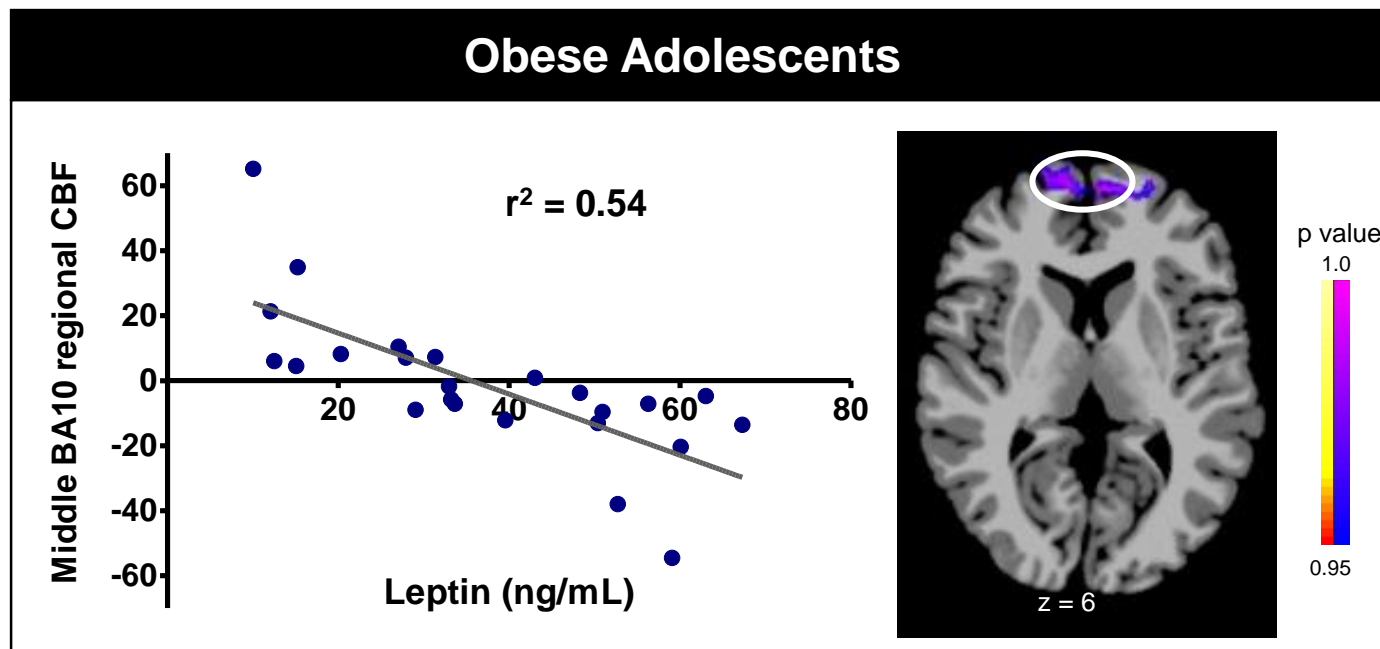
SUPPLEMENTARY DATA

**Supplementary Figure 4. Cerebral blood flow (CBF) in response to glucose and fructose ingestion in lean and in obese adolescents.** In response to glucose ingestion (vs. baseline) lean adolescents (a) demonstrated increase CBF in the prefrontal cortex (PFC) (Brodmann Area 10; BA10), ACC, insula and caudate, but not the hypothalamus. In contrast, the obese adolescents (b) demonstrated decreased CBF in the PFC and ACC and increase CBF in the hypothalamus, caudate, putamen, insula and thalamus. In response to fructose ingestion (vs. baseline), lean adolescents (c) demonstrated decreased CBF in the parahippocampus, where as obese adolescents (d) again demonstrated decreased CBF in the PFC and increased CBF in the ventral striatum (NAcc, putamen) and thalamus.



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Supplementary Figure 5. Whole-brain correlation of fasting leptin with CBF response to glucose ingestions (after vs. before glucose drink) in obese adolescents.

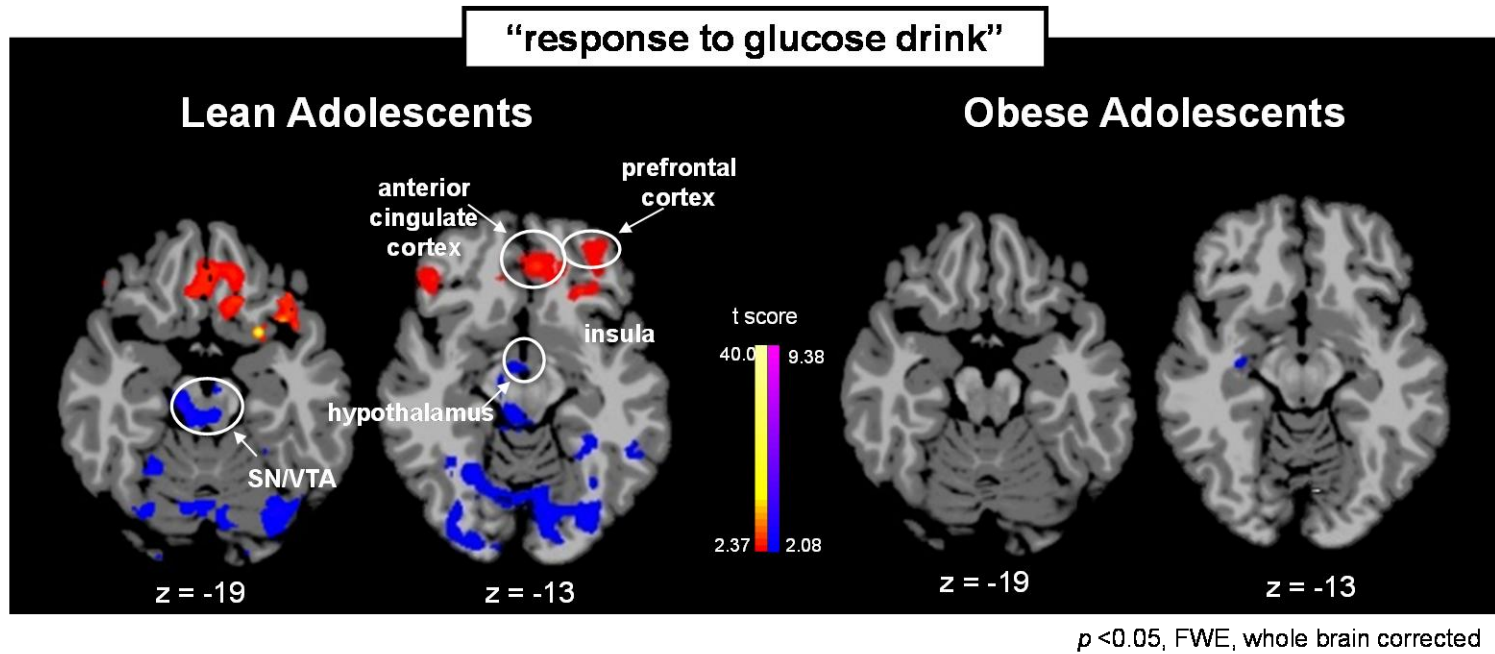


$p < 0.05$ , FWE, whole brain corrected



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**Supplementary Figure 6.** Within group connectivity (using the BA10 as a seed region): in obese and lean adolescents, glucose ingestion vs. baseline. SN/VTA, Substantia Nigra/ Ventral Tegmental Area;  $p < 0.05$ , FWE.



## SUPPLEMENTARY DATA

**Supplementary Figure 7. Study protocol: fMRI scanning days.** The scanning procedure was started at 8am. A baseline perfusion (CBF) scan was performed, in a blinded, cross-over design, each adolescent drank on two separate random-order days either a 75g glucose drink or a 75g fructose drink, dissolved in 300ml of cherry flavored water, within 5 minutes. After consuming glucose or fructose, each adolescent underwent a series of perfusion scans for 60minutes to measure the temporal brain response to the drink consumed. Throughout each perfusion scan, glucose and insulin were sampled at 10 minute intervals. Samples were also obtained for measurement of plasma fructose levels at baseline and at 20, 40, and 60 minutes following glucose and fructose ingestion. Hunger, satiety and fullness ratings were assessed using a visual analog scale (higher score indicated a stronger feeling) before each of the two drinks and after study completion.

