DAT and DRD2 Polymorphisms and Depressive Symptoms Predict Intake of Salty & Sweet Foods in a Nationally Representative Sample of Young Adults

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Introduction

- The brain mesolimbic dopaminergic system may play an important role in the sensory pleasure of food, drugs and other rewards.
- This system also has a role in the central nervous control of energy balance and is involved in the symptomatology related to both obesity and depression.
- Evidence suggests that gene expression alterations in this system may mediate some of the rewarding effects of sucrose. Depression and emotional eating are associated with increased intake of sweet high energy-dense foods and salty high energy-dense foods.
- We assessed the association between genotypes linked to dopaminergic pathways and depressive symptoms on predicting consumption of salty and sweet snack foods in US adolescents and young adults.

Table 1. Demographics of Sample

	N	%
Gender		
Male	748	48.23
Female	803	51.77
Ethnicity		
White	1021	65.83
Hispanic	280	18.05
Black	250	16.12
Parental Education		
Less than High School	162	11.71
High School/Equivalent	384	27.77
Some College	410	29.65
College or Higher	427	30.87
BMI for Age and Gender		
Under (<5th percentile)	63	4.45
Normal (5-85th percentile)	992	70.06
Over (85-95th percentile)	186	13.14
At Risk for Overweight (>95th percentile)	175	12.36
	Mean	SD
Age (range 13-21 years)	16.55	1.69

Materials and Methods

Data Source and Study Sample

- The study population was 20,745 adolescents from the National Longitudinal study of Adolescent Health (Add Health), a longitudinal nationally representative study of adolescents.
- A subsample of 1454 participants in Wave III of the Add Health who provided DNA, an in-home 24-recall in Wave II, and completed a measure of depressive symptoms were included in the analysis.
- Demographics are shown in Table 1.

Measures

- Salty and sweet indices were developed based on selected foods from the 24-hour recall.
- Depressive symptoms were measured using the Center of Epidemiologic Studies-Depression Scale (CES-D).
- Buccal samples were collected and DNA extracted . Polymorphisms analyzed were dopamine transporter (DAT) and dopamine D2 receptor (DRD2).
- Body mass index (BMI) was calculated based on height and weight (BMI=weight in kilograms/height in meters^2)

Statistical Analyses

- Multivariate linear regression analyses for genotype and depressive symptoms were used to predict consumption of sweet and salty snack foods.
- All analyses were stratified by gender. Models were adjusted for age, parental education, race, and body mass index (zBMI).
- Interactions between genotype*depressive symptoms were explored.

Table 2. Food Items for all Children by Gender

Think about everything you had to eat and drink yesterday. This includes snacks as well as regular meals. Did you eat/drink…	% All n=1454	% Boys n=698	% Girls n=756	p-value chi-square
Donuts, sweet rolls, muffins, or pastries? (regular and/or low-fat)				
Yes	26.8	54.2	45.8	0.004
Chocolate bars or candy?				
Yes	29.2	52.4	47.6	0.033
Soft drinks or mixers, such as tonic water or club soda? (regular and/or diet)				
Yes	29.2	51.3	48.7	<.0001
Sweet Tasking Food Index	M (SD) 2.01 (1.3)	M (SD) 2.14 (1.3)	M (SD) 1.89 (1.2)	p-value <.0001
Potato chips, corn chips, tortilla chips, pretzels, or popcorn?				
Yes	53.6	51.4	48.7	0.006
French fries?				
Yes	31.2	54.9	45.2	<.0001
Pizza? (plain, meat, and/or vegetarian)				
Yes	24.1	55.5	44.5	0.001
Salty Tasking Food Index	M (SD) 1.1 (.9)	M (SD) 1.23 (.9)	M (SD) .99 (.8)	p-value <.0001
Sweet and Salty Tasking Food Index	3.11 (1.7)	3.37 (1.8)	2.88 (1.6)	<.0001

Results

- Study population consisted of majority white male and females, slightly more females, and normal weight. (Table 1)
- No main effects were observed for DRD2. (Table 3)
- Significant DRD2 gene*depressive symptoms interaction for males and females consuming salty snack foods (p=0.01) and (p=0.04) respectively. (Table 3)
- A main effect of the SLC6A3 gene on sweet and salty foods combined was observed among females such that having 10/10 allele was associated with a greater mean score for this index. When stratified by sweet and salty separately, the main effect was observed for salty foods only. (Table 4)
- A marginally significant main effect was observed between depressive symptoms and sweet foods among females (p =.057). (Table 4)
- Significant SLC6A3 gene*depressive symptoms interaction was observed for females predicting consumption of sweet snacks foods (p<.001) and for sweet & salty snack foods (p =0.01). (Table 4)
- Among girls, having the 10/10 allele was a risk factor for sweet food intake only if they were depressed (Figure 1)
- Having Any A1 among Boys was a risk factor for Salty food intake only if they were depressed. (Figure 2)
- Having Any A1 among Girls was a risk factor for Salty food intake only if they were not depressed. (Figure 2)

•Table 3

Results from linear model predicting salty or sweet foods from DRD2 by gender

	Salty			Sweet			Sweet and Salty		
Boys	*Estimate*	*SE*	*p-value*	*Estimate*	*SE*	*p-value*	*Estimate*	*SE*	*p-value*
Model 1 (main effects)									
Intercept	2.378	0.41	<.001	3.199	0.57	<.001	5.577	*0.850*	<.001
DRD2									
Any A1									
A2/A2	-0.085	0.08	0.30	0.034	0.09	0.72	-0.052	0.145	0.72
CESD									
Low (< 10)									
High (> = 10)	0.159	0.12	0.20	0.046	0.20	0.82	0.204	0.294	0.49
Model 2 (interaction)									
Intercept	2.304	0.41	<.001	3.195	0.57	<.001	5.498	0.848	<.001
DRD2 x CESD	**-0.567**	**0.22**	**0.01**	-0.030	0.29	0.92	-0.597	0.454	0.19
Girls	*Estimate*	*SE*	*p-value*	*Estimate*	*SE*	*p-value*	*Estimate*	*SE*	*p-value*
Model 1 (main effects)									
Intercept	1.828	0.41	<.001	3.555	0.44	<.001	5.388	0.729	<.001
DRD2									
Any A1									
A2/A2	-0.059	0.07	0.38	0.008	0.09	0.93	-0.051	0.121	0.67
CESD									
Low (< 10)									
High (> = 10)	0.030	0.13	0.82	0.186	0.11	0.08	0.216	0.200	0.28
Model 2 (interaction)									
Intercept	1.826	0.41	<.001	3.562	0.44	<.001	5.387	0.729	<.001
DRD2 x CESD	**0.307**	**0.15**	**0.04**	-0.123	0.26	0.64	0.185	0.324	0.57

Models 1 and 2 control for age, race, education level of parents, zBMI; Model 2 also contains main effects from Model 1

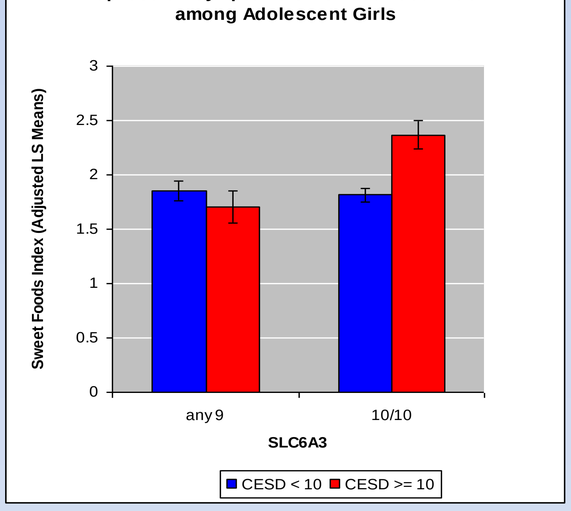
•Table 4

Results from linear model predicting salty or sweet foods from SLC6A3 by gender

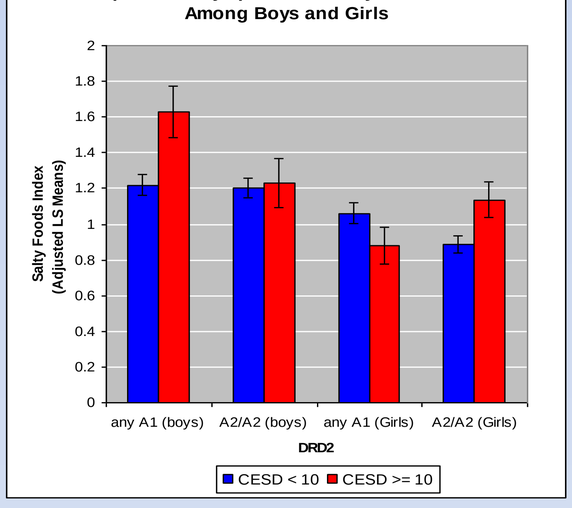
	Salty			Sweet			Sweet and Salty		
Boys	*Estimate*	*SE*	*p-value*	*Estimate*	*SE*	*p-value*	*Estimate*	*SE*	*p-value*
Model 1 (main effects)									
Intercept	2.224	0.46	<.001	3.284	0.61	<.001	5.557	0.908	<.001
SLC6A3									
any 9									
10/10	-0.012	0.06	0.95	-0.013	0.10	0.90	-0.025	0.139	0.86
CESD									
Low (< 10)									
High (> = 10)	0.137	0.12	0.27	-0.013	0.21	0.95	0.124	0.301	0.68
Model 2 (interaction)									
Intercept	2.232	0.45	<.001	3.373	0.60	0.00	5.605	0.889	<.001
SLC6A3 x CESD	0.074	0.23	0.74	0.357	0.31	0.25	0.431	0.479	0.37
Girls	*Estimate*	*SE*	*p-value*	*Estimate*	*SE*	*p-value*	*Estimate*	*SE*	*p-value*
Model 1 (main effects)									
Intercept	1.818	0.40	<.001	3.594	0.41	<.001	5.410	0.694	<.001
SLC6A3									
any 9									
10/10	**0.108**	**0.05**	**0.02**	0.124	0.08	0.14	**0.232**	**0.102**	**0.02**
CESD									
Low (< 10)									
High (> = 10)	0.027	0.12	0.83	**0.201**	**0.11**	**0.06**	0.227	0.195	0.24
Model 2 (interaction)									
Intercept	1.826	0.41	<.001	3.755	0.40	<.001	5.581	0.682	<.001
SLC6A3 x CESD	0.024	0.20	0.91	**0.724**	**0.23**	**<.001**	**0.748**	**0.296**	**0.01**

Models 1 and 2 control for age, race, education level of parents, zBMI; Model 2 also contains main effects from Model 1

•Figure 1



•Figure 2



Conclusion

These findings suggest that genes associated with dopaminergic system and depressive symptoms may play an important role in consumption of snack foods with possible gender differences. Additional research is needed to understand these relationships.

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