

Portion Size Effect for Children at High and Low Familial Risk for Obesity (Food and Brain Study)

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1 Demographics

Table 1: Demographics

Characteristic	Risk Groups		Overall
	Low Risk, N = 53	High Risk, N = 40	N = 93
Sex			
Male	30 (57%)	18 (45%)	48 (52%)
Female	23 (43%)	22 (55%)	45 (48%)
Age, yr	7.8 (0.7)	7.8 (0.6)	7.8 (0.6)
Ethnicity			
Not Hispanic/Latinx	53 (100%)	40 (100%)	93 (100%)
Race			
0	50 (94%)	40 (100%)	90 (97%)
2	3 (5.7%)	0 (0%)	3 (3.2%)
Income			
< \$51,000	4 (7.7%)	8 (21%)	12 (13%)
>\$100,000	26 (50%)	7 (18%)	33 (37%)
\$51,000 - \$100,000	22 (42%)	23 (61%)	45 (50%)
Unknown	1	2	3
BMI %tile	41.7 (23.9)	55.7 (23.6)	47.7 (24.7)
Mother's Education			
> Bachelor Degree	23 (44%)	6 (15%)	29 (32%)
AA/Technical Degree	3 (5.8%)	7 (18%)	10 (11%)
Bachelor Degree	23 (44%)	21 (52%)	44 (48%)
High School/GED	3 (5.8%)	6 (15%)	9 (9.8%)
Unknown	1	0	1
Father's Education			
> Bachelor Degree	29 (55%)	4 (11%)	33 (38%)
AA/Technical Degree	3 (5.7%)	11 (31%)	14 (16%)
Bachelor Degree	15 (28%)	14 (40%)	29 (33%)
High School/GED	6 (11%)	5 (14%)	11 (12%)
Other/NA	0 (0%)	1 (2.9%)	1 (1.1%)
Unknown	0	5	5

¹ n (%); Mean (SD)

Welch Two Sample t-test

data: age_yr by risk_status_mom

t = 0.44031, df = 89.66, p-value = 0.6608

alternative hypothesis: true difference in means between group Low Risk and group High Risk is not equal

95 percent confidence interval:

-0.1989028 0.3121669

sample estimates:

mean in group Low Risk mean in group High Risk

7.841132

7.784500

Welch Two Sample t-test

data: bmi_percentile by risk_status_mom

t = -2.8098, df = 84.587, p-value = 0.006157

alternative hypothesis: true difference in means between group Low Risk and group High Risk is not equal

95 percent confidence interval:

-23.873036 -4.086775

sample estimates:

mean in group Low Risk mean in group High Risk
41.73509 55.71500

Low Risk High Risk

23.89437 23.64924

Pearson's Chi-squared test with Yates' continuity correction

data: r01_intake\$sex and r01_intake\$risk_status_mom

X-squared = 0.80831, df = 1, p-value = 0.3686

Pearson's Chi-squared test

data: r01_intake\$income and r01_intake\$risk_status_mom

X-squared = 10.368, df = 2, p-value = 0.005605

Fisher's Exact Test for Count Data

data: r01_intake\$mom_ed and r01_intake\$risk_status_mom

p-value = 0.008449

alternative hypothesis: two.sided

2 Meal Liking

Table 2: Regression Table: Portion Size for Grams

	Estimate	Std. Error	df	t value	Pr(> t)
(Intercept)	3.393	0.773	90.323	4.392	0.000
preFF	-0.002	0.001	321.687	-2.381	0.018
bmi	0.025	0.049	89.043	0.500	0.618
sexFemale	0.099	0.121	88.885	0.820	0.415
meal_order	0.014	0.014	267.062	1.011	0.313
risk_status_momHigh Risk	0.029	0.127	89.401	0.227	0.821
ps_prop	0.027	0.042	266.468	0.654	0.514

3 Portion Size Effect

Note - Portion Size was coded in ps_prop as the proportion increase in amount served: Portion Size 1 = 0, Portion Size 2 = 0.33, Portion Size 3 = 0.66, and Portion Size 4 = 0.99. This means that a 1 unit increase is equal to a 100% increase in amount served – the difference between Portion Size 1 and Portion Size 4.

3.1 Total Intake

Table 3: Intake by Portion Size

Characteristic	Risk Groups		Overall
	Low Risk, N = 53	High Risk, N = 40	N = 93
ps1_total_g	407.1 (167.0)	402.2 (164.2)	405.0 (164.9)
ps1_total_kcal	475.6 (199.5)	485.2 (196.6)	479.7 (197.2)
ps1_avg_vas	3.8 (0.6)	3.9 (0.6)	3.8 (0.6)
ps2_total_g	465.0 (176.3)	403.8 (172.3)	439.6 (176.3)
ps2_total_kcal	542.6 (218.3)	513.3 (271.9)	530.4 (241.0)
ps2_avg_vas	3.8 (0.6)	3.9 (0.6)	3.8 (0.6)
ps3_total_g	488.9 (191.1)	433.1 (191.2)	465.6 (192.1)
ps3_total_kcal	602.7 (271.9)	534.3 (292.1)	574.1 (281.0)
ps3_avg_vas	3.8 (0.6)	3.8 (0.7)	3.8 (0.6)
ps4_total_g	496.4 (189.0)	415.6 (167.8)	461.8 (183.7)
ps4_total_kcal	620.1 (244.9)	555.6 (250.4)	592.4 (247.9)
ps4_avg_vas	3.8 (0.7)	3.9 (0.6)	3.8 (0.6)

¹ Mean (SD)

3.2 Intake by Food

Table 4: High Risk: Intake by Portion Size

Characteristic	PS-1, N = 40	PS-2, N = 40	PS-3, N = 40	PS-4, N = 40
chnug_grams	66.3 (45.1)	74.9 (79.3)	77.5 (60.7)	87.0 (63.9)
chnug_kcal	165.8 (112.7)	187.3 (198.3)	193.7 (151.8)	217.4 (159.7)
mac_grams	126.1 (105.4)	132.7 (110.9)	139.4 (134.9)	134.1 (123.9)
mac_kcal	214.3 (179.2)	225.6 (188.5)	237.0 (229.4)	228.0 (210.7)
grape_grams	85.5 (65.5)	94.8 (75.6)	93.6 (87.4)	103.7 (88.7)
grape_kcal	59.4 (45.5)	65.9 (52.6)	65.1 (60.8)	72.1 (61.7)
broc_grams	31.3 (51.8)	23.1 (28.6)	23.6 (37.3)	21.8 (36.5)
broc_kcal	31.4 (52.0)	23.2 (28.7)	23.7 (37.4)	21.9 (36.6)
mac_vas	4.1 (0.8)	3.9 (1.0)	3.9 (1.1)	3.9 (1.0)
chnug_vas	4.3 (1.0)	4.3 (1.0)	4.2 (1.2)	4.3 (0.9)
broc_vas	2.9 (1.6)	2.8 (1.5)	2.7 (1.4)	2.9 (1.6)
grape_vas	4.2 (0.8)	4.4 (0.9)	4.4 (0.9)	4.4 (0.8)

¹ Mean (SD)

Table 5: Low Risk: Intake by Portion Size

Characteristic	PS-1, N = 53	PS-2, N = 53	PS-3, N = 53	PS-4, N = 53
chnug_grams	69.6 (41.8)	83.2 (51.9)	98.5 (80.8)	104.0 (67.2)
chnug_kcal	174.0 (104.6)	208.0 (129.8)	246.2 (202.1)	260.0 (168.1)
mac_grams	116.5 (90.3)	130.7 (101.9)	143.4 (115.5)	135.0 (108.4)
mac_kcal	198.1 (153.4)	222.2 (173.3)	243.8 (196.3)	229.5 (184.3)
grape_grams	95.2 (80.9)	102.9 (86.9)	102.0 (92.7)	116.1 (102.9)
grape_kcal	66.1 (56.2)	71.5 (60.4)	70.9 (64.4)	80.7 (71.5)
broc_grams	27.0 (40.6)	29.2 (54.2)	29.0 (54.0)	35.2 (64.9)
broc_kcal	27.1 (40.7)	29.3 (54.4)	29.1 (54.2)	35.3 (65.1)
mac_vas	3.7 (1.0)	3.8 (1.0)	3.8 (1.1)	3.8 (1.0)
chnug_vas	4.1 (0.9)	4.3 (0.7)	4.2 (0.7)	4.2 (0.9)
broc_vas	3.2 (1.3)	3.0 (1.1)	3.2 (1.2)	3.2 (1.4)
grape_vas	4.2 (0.9)	4.1 (1.0)	4.1 (1.1)	4.1 (1.0)

¹ Mean (SD)

3.3 Base Model - Test Quadratic Effect

All intake models are currently controlling for: pre-meal Freddy Fullness, child BMI, average VAS liking rating for the meal foods conducted at each meal, and meal order.

3.3.1 Grams

The difference between models with and without quadratic effect was significant ($p=0.022$) indicating the added model parameters/complexity resulted in significant more variance explained. Should model gram intake with both linear and quadratic effects.

Data: intake_long

Models:

grams_ps_mod: grams ~ preFF + bmi + sex + avg_vas + meal_order + ps_prop + (1 | sub)

grams_psquad_mod: grams ~ preFF + bmi + sex + avg_vas + meal_order + ps_prop + ps_prop2 + (1 | sub)

	npar	AIC	BIC	logLik	deviance	Chisq	Df	Pr(>Chisq)
grams_ps_mod	9	4493.1	4528.1	-2237.5	4475.1			
grams_psquad_mod	10	4489.8	4528.7	-2234.9	4469.8	5.2665	1	0.02174 *

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Table 6: Regression Table: Portion Size for Grams

	Estimate	Std. Error	df	t value	Pr(> t)
(Intercept)	-68.001	208.998	97.895	-0.325	0.746
preFF	-0.316	0.218	331.732	-1.452	0.147
bmi	22.343	12.717	88.663	1.757	0.082
sexFemale	-25.834	32.258	88.748	-0.801	0.425
avg_vas	40.962	15.328	350.731	2.672	0.008
meal_order	-4.632	4.142	264.070	-1.118	0.264
ps_prop	149.605	43.528	263.722	3.437	0.001
ps_prop2	-96.803	42.406	264.036	-2.283	0.023

The quadratic of portion size was significant after controlling for all other variables. This indicates there is a

curvilinear effect of portion size on intake. The increase in amount consumed decreases by 63.9 grams for each increase in meal portions (i.e., 33% increase with each meal). The vertex of the curve is at 77% increase, which indicates that intake increased up to the third largest meal (66% increase) with little change between the third and forth meals (i.e., 99% increase).

*To calculate effect of portion size by 0.33 proportion increase need to first get total quadratic effect. The β coefficient for a quadratic effect is half the change in the linear slope for a unit increase, so total change in linear slope = 2 x ps_prop2. Since a 1 unit increase = 100% increase in portion, can then multiply the total effect by 0.33. Therefore, change in linear slope for each 33% increase in amount served = (ps_prop2 x 2) x 0.33. To calculate where the slope switches from positive to negative, need to find the vertex = -ps_prop/(ps_prop2 x 2)

3.3.2 kcal

The difference between models with and without quadratic effect was not significant (p=0.286) indicating the added model parameters/complexity was not needed Should model kcal intake with only the linear effect.

Data: intake_long

Models:

kcal_ps_mod: kcal ~ preFF + bmi + sex + avg_vas + meal_order + ps_prop + (1 | sub)

kcal_psquad_mod: kcal ~ preFF + bmi + sex + avg_vas + meal_order + ps_prop + ps_prop2 + (1 | sub)

	npar	AIC	BIC	logLik	deviance	Chisq	Df	Pr(>Chisq)
kcal_ps_mod	9	4765.8	4800.8	-2373.9	4747.8			
kcal_psquad_mod	10	4766.7	4805.6	-2373.3	4746.7	1.1374	1	0.2862

Table 7: Regression Table: Portion Size for kcal

	Estimate	Std. Error	df	t value	Pr(> t)
(Intercept)	-313.355	270.694	98.812	-1.158	0.250
preFF	-0.899	0.324	347.400	-2.772	0.006
bmi	38.704	16.321	88.411	2.371	0.020
sexFemale	-43.413	41.408	88.578	-1.048	0.297
avg_vas	58.697	22.177	330.988	2.647	0.009
meal_order	8.612	6.321	265.490	1.363	0.174
ps_prop	112.595	19.083	264.373	5.900	0.000

Control Variables - There was a significant effect of pre Freddy Fullness such that for each 10 mm more full, 9 fewer kcals were consumed. BMI was also associated with intake such each BMI point increase was associated with 39 greater kcal consumed. Similarly, each unit increase in average liking was associated with a 59 kcal increase.

The linear effect of portion size shows that 113 more kcals were consumed in the largest portion (100% increase) compared to the baseline meal.

3.4 Risk Status x Portion Size (linear effect)

3.4.1 Grams

Adding an interaction between Risk Status and Portion Size significantly improved model fit.

Data: intake_long

Models:

grams_psquad_mod: grams ~ preFF + bmi + sex + avg_vas + meal_order + ps_prop + ps_prop2 + (1 | sub)

grams_psxrisk_psquad_mod: grams ~ preFF + bmi + sex + age_yr + avg_vas + meal_order + risk_status_mom *

	npar	AIC	BIC	logLik	deviance	Chisq	Df
grams_psquad_mod	10	4489.8	4528.7	-2234.9	4469.8		
grams_psxrisk_psquad_mod	13	4483.5	4534.0	-2228.7	4457.5	12.363	3

Pr(>Chisq)

grams_psquad_mod

grams_psxrisk_psquad_mod 0.006237 **

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

For the control variables, we see that children consumed 30.6 grams more for each unit higher their BMI was at baseline. Also children consumed 49.9 grams more for each unit higher their average liking of meal foods was.

Table 8: Regression Table: Risk x Portion Size for Grams

	Estimate	Std. Error	df	t value	Pr(> t)
(Intercept)	-103.324	276.800	93.319	-0.373	0.710
preFF	-0.327	0.216	328.851	-1.514	0.131
bmi	30.568	13.189	86.990	2.318	0.023
sexFemale	-17.095	32.184	87.150	-0.531	0.597
age_yr	-10.125	25.934	87.608	-0.390	0.697
avg_vas	39.907	15.146	347.225	2.635	0.009
meal_order	-4.537	4.091	263.153	-1.109	0.268
risk_status_momHigh Risk	-35.956	36.109	111.700	-0.996	0.322
ps_prop	179.042	44.301	262.740	4.042	0.000
ps_prop2	-96.886	41.880	263.172	-2.313	0.021
risk_status_momHigh Risk:ps_prop	-69.028	24.753	262.312	-2.789	0.006

Figure 1: Grams Consumed: Risk Status x Portion Size

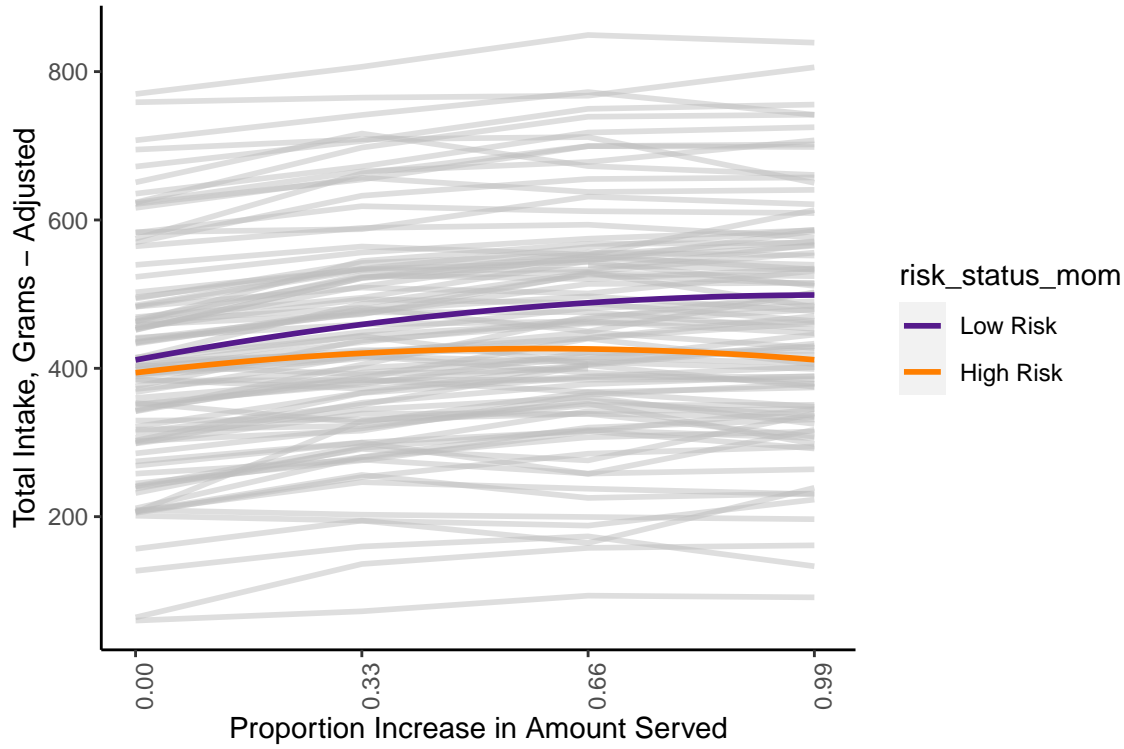


Table 9: Estimated Simple Slopes: Risk Status x Linear Portion Size for Grams

risk_status_mom	ps_prop.trend	SE	df	t.ratio	p.value
Low Risk	179.042	44.303	263.429	4.041	0.000
High Risk	110.014	45.229	263.607	2.432	0.016

Estimating the simple slopes (adjusted for all other variables) shows both groups have a significant linear portion size effect, however, the significant interaction in the model indicates that the slopes are significantly different from each other. The interaction between Risk Status and Portion Size can be interpreted in 2 ways depending on how we want to phrase it:

- 1) the difference in gram intake between Low and High Risk groups gets larger with each increase in Portion Size such that by Portion Size 4, the High Risk group consumes 105 fewer grams (i.e., condition effect of risk_status_mom + interaction), after accounting for all other control variables.
- 2) The association between proportion increase in amount served and amount consumed (i.e., ps_prop) is less positive for the High Risk than Low Risk group. The Low Risk group increases total gram intake by 110 grams when amount served is doubled (100% increase) while the High Risk Group only increased intake by 14 grams (i.e., condition effect of ps_prop + interaction).

Table 10: Estimated Marginal Means: Risk Status x Portion Size for Grams

	Low Risk	High Risk
0	411.365	393.028
0.33	458.793	423.504
0.66	488.577	422.997
0.99	498.710	412.579

Given the significant interaction between Risk Status and Portion Size, we cannot interpret the effect of Risk Status in the regression model as a main effect. We can, however, estimate the marginal means (group means after adjusting for all other variables) differ. Overall, the High Risk group consumed fewer grams than the Low Risk group with this difference becoming significant at the 3rd portion size.

Welch Two Sample t-test

```
data:  grams_pred_rxps by risk_status_mom
t = 0.58019, df = 84.853, p-value = 0.5633
alternative hypothesis: true difference in means between group Low Risk and group High Risk is not equal
95 percent confidence interval:
 -44.50383  81.17798
sample estimates:
mean in group Low Risk mean in group High Risk
      411.3649           393.0278
```

Welch Two Sample t-test

```
data:  grams_pred_rxps by risk_status_mom
t = 1.0944, df = 79.347, p-value = 0.2771
alternative hypothesis: true difference in means between group Low Risk and group High Risk is not equal
95 percent confidence interval:
 -28.88770  99.46721
sample estimates:
mean in group Low Risk mean in group High Risk
      458.7935           423.5037
```

Welch Two Sample t-test

```
data:  grams_pred_rxps by risk_status_mom
t = 1.9966, df = 78.626, p-value = 0.04932
alternative hypothesis: true difference in means between group Low Risk and group High Risk is not equal
95 percent confidence interval:
  0.1986526 130.9618261
sample estimates:
mean in group Low Risk mean in group High Risk
      488.5771           422.9968
```

Welch Two Sample t-test

```

data:  grams_pred_rxps by risk_status_mom
t = 2.7084, df = 82.994, p-value = 0.008208
alternative hypothesis: true difference in means between group Low Risk and group High Risk is not equal
95 percent confidence interval:
  22.87998 149.38225
sample estimates:
mean in group Low Risk mean in group High Risk
      498.7100          412.5789

```

3.4.2 kcal

Adding an interaction between Risk Status and Portion Size (linear effect) significantly improved model fit.

```

Data: intake_long
Models:
kcal_ps_mod: kcal ~ preFF + bmi + sex + avg_vas + meal_order + ps_prop + (1 | sub)
kcal_psxrisk_mod: kcal ~ preFF + bmi + sex + age_yr + avg_vas + meal_order + risk_status_mom * ps_prop + (1 | sub)
               npar    AIC    BIC  logLik deviance  Chisq Df Pr(>Chisq)
kcal_ps_mod      9 4765.8 4800.8 -2373.9   4747.8
kcal_psxrisk_mod 12 4763.8 4810.4 -2369.9   4739.8 8.0711  3    0.04456 *
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

Control Variables - We see that children consumed 47 kcal more for each unit higher their BMI was at baseline. Children consumed 57 kcal more for each unit higher their average liking of meal foods was. Unlike the grams model, pre-meal fullness was associated with total energy intake such that for each centimeter more 'full', the children ate 9 fewer kcal (Freddy is measured in mm so 10 x preFF gives change in cm).

Table 11: Regression Table: Risk x Portion Size for kcal

	Estimate	Std. Error	df	t value	Pr(> t)
(Intercept)	-203.130	360.837	93.852	-0.563	0.575
preFF	-0.904	0.324	343.956	-2.791	0.006
bmi	47.353	17.081	86.643	2.772	0.007
sexFemale	-33.131	41.694	86.876	-0.795	0.429
age_yr	-30.169	33.615	87.450	-0.897	0.372
avg_vas	57.012	22.053	327.258	2.585	0.010
meal_order	8.675	6.275	264.369	1.383	0.168
risk_status_momHigh Risk	-22.367	47.937	121.950	-0.467	0.642
ps_prop	149.322	24.960	263.579	5.983	0.000
risk_status_momHigh Risk:ps_prop	-86.290	38.235	263.454	-2.257	0.025

Figure 2: kCal Consumed: Risk Status x Portion Size

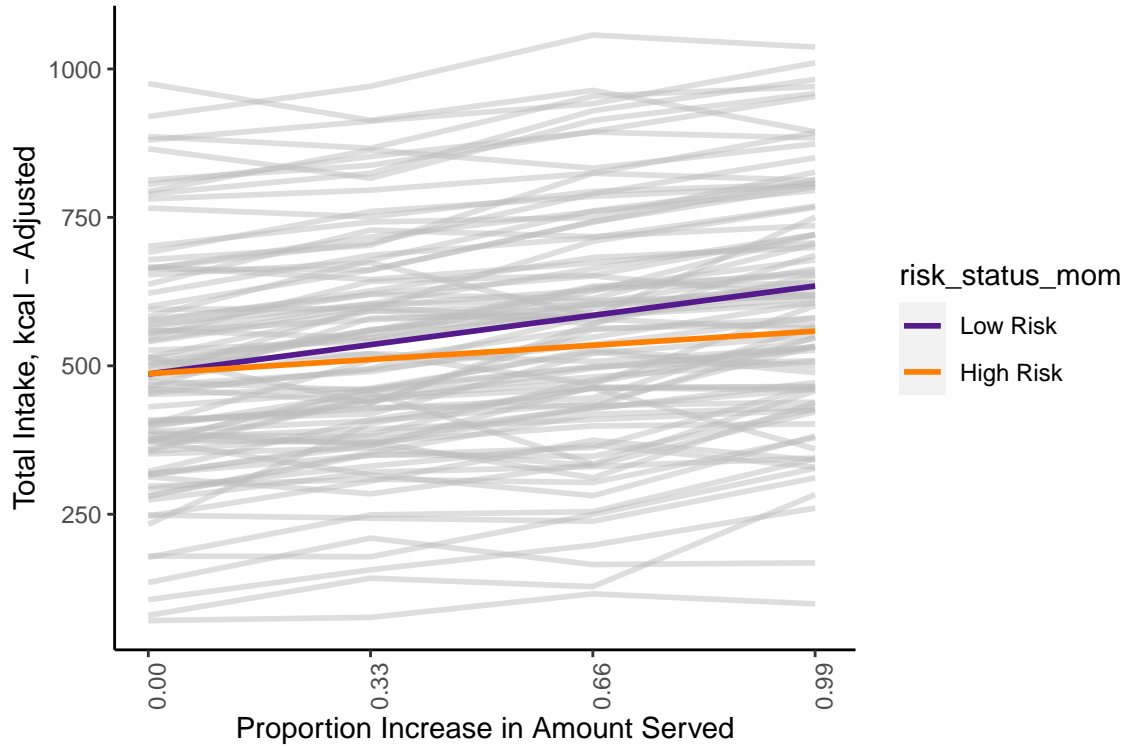


Table 12: Estimated Simple Slopes: Risk Status x Linear Portion Size for kcal

risk_status_mom	ps_prop.trend	SE	df	t.ratio	p.value
Low Risk	149.322	24.961	264.483	5.982	0.000
High Risk	63.032	29.014	264.130	2.172	0.031

Estimating the simple slopes (adjusted for all other variables) shows both groups have a significant portion size effect. The interaction indicates that the slopes are different from each other. The interaction between Risk Status and Portion Size can be interpreted in 2 ways depending on how we want to phrase it:

- 1) the difference in gram intake between Low and High Risk groups gets larger with each increase in Portion Size such that by Portion Size 4, the High Risk group consumes 109 fewer kcal (i.e., condition effect of risk_status_mom + interaction), after accounting for all other control variables.
- 2) The association between proportion increase served and kcal consumed (i.e., ps_prop) is less positive for the High Risk than Low Risk group. The Low Risk group increases total gram intake by 149 kcal when amount served is doubled (100% increase) while the High Risk Group only increased intake by 63 kcal (i.e., condition effect of ps_prop + interaction).

Table 13: Estimated Marginal Means: Risk Status x Portion Size for kcal

	Low Risk	High Risk
0	485.741	485.688
0.33	534.565	515.775
0.66	588.452	528.126
0.99	632.435	561.014

Given the significant interaction between Risk Status and Portion Size, we cannot interpret the effect of Risk Status in the regression model as a main effect. We can, however, estimate the marginal means (group means after adjusting for all other variables) differ.

Welch Two Sample t-test

```
data: kcal_pred_rxps by risk_status_mom
t = 0.0012687, df = 79.243, p-value = 0.999
alternative hypothesis: true difference in means between group Low Risk and group High Risk is not equal
95 percent confidence interval:
 -83.08177 83.18775
sample estimates:
mean in group Low Risk mean in group High Risk
      485.7413           485.6883
```

Welch Two Sample t-test

```
data: kcal_pred_rxps by risk_status_mom
t = 0.45558, df = 75.809, p-value = 0.65
alternative hypothesis: true difference in means between group Low Risk and group High Risk is not equal
95 percent confidence interval:
 -63.35792 100.93818
sample estimates:
mean in group Low Risk mean in group High Risk
      534.5648           515.7746
```

Welch Two Sample t-test

```
data: kcal_pred_rxps by risk_status_mom
t = 1.365, df = 72.709, p-value = 0.1765
alternative hypothesis: true difference in means between group Low Risk and group High Risk is not equal
95 percent confidence interval:
 -27.76119 148.41379
sample estimates:
mean in group Low Risk mean in group High Risk
      588.4525           528.1262
```

Welch Two Sample t-test

```
data: kcal_pred_rxps by risk_status_mom
t = 1.7094, df = 80.286, p-value = 0.09124
alternative hypothesis: true difference in means between group Low Risk and group High Risk is not equal
95 percent confidence interval:
 -11.72311 154.56537
sample estimates:
mean in group Low Risk mean in group High Risk
      632.4346           561.0135
```

3.5 Exploratory Analyses: Effect of BMI

After controlling for age and sex, there was a difference in BMI by Risk Status such that the High Risk group had BMI that was 0.73 higher on average.

Table 14: Regression Table: BMI and Risk Status

	Estimate	Std. Error	t value	Pr(> t)
(Intercept)	13.615	1.622	8.395	0.000
age_yr	0.241	0.206	1.169	0.245
sexFemale	-0.073	0.258	-0.284	0.777
risk_status_momHigh Risk	0.749	0.260	2.877	0.005

Since BMI was associated with both total grams and kcal intake, I tested if adding a BMI x Portion Size interaction improved the model.

3.5.1 Grams

Adding a BMI x Portion Size interaction did not improve the model for grams

Data: intake_long

Models:

grams_psxrisk_psquad_mod: grams ~ preFF + bmi + sex + age_yr + avg_vas + meal_order + risk_status_mom *

grams_psxrisk_psbmi_psquad_mod: grams ~ preFF + bmi + sex + age_yr + avg_vas + meal_order + risk_status_mom *

	npar	AIC	BIC	logLik	deviance	Chisq	Df
grams_psxrisk_psquad_mod	13	4483.5	4534.0	-2228.7	4457.5		
grams_psxrisk_psbmi_psquad_mod	14	4485.4	4539.8	-2228.7	4457.4	0.11	1

Pr(>Chisq)

grams_psxrisk_psquad_mod

grams_psxrisk_psbmi_psquad_mod 0.7401

3.5.2 kcal

Adding a BMI x Portion Size interaction did not improve the model for kcal.

Data: intake_long Models: kcal_psxrisk_mod: kcal ~ preFF + bmi + sex + age_yr + avg_vas + meal_order

+ risk_status_mom * ps_prop + (1 | sub) kcal_psxrisk_psbmi_mod: kcal ~ preFF + bmi + sex + age_yr

+ avg_vas + meal_order + risk_status_mom * ps_prop + bmi * ps_prop + ps_prop2 + (1 | sub) npar

AIC BIC logLik deviance Chisq Df Pr(>Chisq) kcal_psxrisk_mod 12 4763.8 4810.4 -2369.9 4739.8

kcal_psxrisk_psbmi_mod 14 4765.0 4819.5 -2368.5 4737.0 2.727 2 0.2558

4 Exploratory Analyses: Individual Foods

4.1 Chicken Nuggets

4.1.1 Grams

4.1.1.1 Base Model The difference between models with and without quadratic effect was not significant indicating the added model parameters/complexity did not improve model fit. Should only model chicken nugget gram intake with linear effect.

Data: intake_long

Models:

grams_chnug_ps_mod: chnug_grams ~ preFF + bmi + sex + chnug_vas + meal_order + ps_prop + (1 | sub)

grams_chnug_ps_psquad_mod: chnug_grams ~ preFF + bmi + sex + chnug_vas + meal_order + ps_prop + ps_prop

	npar	AIC	BIC	logLik	deviance	Chisq	Df
grams_chnug_ps_mod	9	3850.0	3885.0	-1916.0	3832.0		
grams_chnug_ps_psquad_mod	10	3851.5	3890.4	-1915.8	3831.5	0.4363	1

Pr(>Chisq)

grams_chnug_ps_mod

grams_chnug_ps_psquad_mod 0.5089

Table 15: Chicken Nugget - Portion Size for Grams

	Estimate	Std. Error	df	t value	Pr(> t)
(Intercept)	-69.723	57.500	88.799	-1.213	0.229
preFF	-0.253	0.090	347.997	-2.810	0.005
bmi	3.812	3.495	80.424	1.091	0.279
sexFemale	-14.677	8.857	80.522	-1.657	0.101
chnug_vas	20.758	3.870	283.133	5.364	0.000
meal_order	2.890	1.908	260.333	1.514	0.131
ps_prop	28.974	5.760	257.778	5.030	0.000

Table 16: Chicken Nugget - Risk x Portion Size for Grams

	Estimate	Std. Error	df	t value	Pr(> t)
(Intercept)	-92.107	58.820	88.052	-1.566	0.121
preFF	-0.249	0.090	346.871	-2.754	0.006
bmi	5.308	3.629	79.382	1.463	0.147
sexFemale	-13.123	8.877	79.427	-1.478	0.143
chnug_vas	20.739	3.858	279.497	5.375	0.000
meal_order	2.884	1.903	258.873	1.515	0.131
ps_prop	36.482	7.551	256.361	4.832	0.000
risk_status_momHigh Risk	-4.738	11.038	150.039	-0.429	0.668
ps_prop:risk_status_momHigh Risk	-17.856	11.615	256.653	-1.537	0.125

4.1.1.2 Risk x Portion Size

4.1.2 kcal

4.1.2.1 Base Model The difference between models with and without quadratic effect was not significant indicating the added model parameters/complexity did not improve model fit. Should only model chicken nugget kcal intake with linear effect.

Data: intake_long

Models:

kcal_chnug_ps_mod: chnug_kcal ~ preFF + bmi + sex + chnug_vas + meal_order + ps_prop + (1 | sub)

kcal_chnug_ps_psquad_mod: chnug_kcal ~ preFF + bmi + sex + chnug_vas + meal_order + ps_prop + ps_prop2 +

	npars	AIC	BIC	logLik	deviance	Chisq	Df
kcal_chnug_ps_mod	9	4513.3	4548.4	-2247.7	4495.3		
kcal_chnug_ps_psquad_mod	10	4514.9	4553.8	-2247.4	4494.9	0.4363	1

Pr(>Chisq)

kcal_chnug_ps_mod

kcal_chnug_ps_psquad_mod 0.5089

Table 17: Chicken - Nugget Portion Size for kcal

	Estimate	Std. Error	df	t value	Pr(> t)
(Intercept)	-174.309	143.750	88.799	-1.213	0.229
preFF	-0.633	0.225	347.997	-2.810	0.005
bmi	9.531	8.739	80.424	1.091	0.279
sexFemale	-36.693	22.142	80.522	-1.657	0.101
chnug_vas	51.895	9.675	283.133	5.364	0.000
meal_order	7.224	4.771	260.333	1.514	0.131
ps_prop	72.436	14.399	257.778	5.030	0.000

Table 18: Chicken - Nugget Risk x Portion Size for kcal

	Estimate	Std. Error	df	t value	Pr(> t)
(Intercept)	-230.268	147.051	88.052	-1.566	0.121
preFF	-0.623	0.226	346.871	-2.754	0.006
bmi	13.271	9.071	79.382	1.463	0.147
sexFemale	-32.808	22.193	79.427	-1.478	0.143
chnug_vas	51.848	9.646	279.497	5.375	0.000
meal_order	7.209	4.758	258.873	1.515	0.131
ps_prop	91.206	18.877	256.361	4.832	0.000
risk_status_momHigh Risk	-11.844	27.594	150.039	-0.429	0.668
ps_prop:risk_status_momHigh Risk	-44.640	29.037	256.653	-1.537	0.125

4.1.2.2 Risk x Portion Size

4.2 Mac and Cheese

4.2.1 Grams

4.2.1.1 Base Model The difference between models with and without quadratic effect was not significant indicating the added model parameters/complexity did not improve model fit. Should only model chicken nugget gram intake with linear effect.

Data: intake_long

Models:

grams_mac_ps_mod: mac_grams ~ preFF + bmi + sex + mac_vas + meal_order + ps_prop + (1 | sub)

grams_mac_ps_psquad_mod: mac_grams ~ preFF + bmi + sex + mac_vas + meal_order + ps_prop + ps_prop2 + (1 | sub)

	npar	AIC	BIC	logLik	deviance	Chisq	Df
grams_mac_ps_mod	9	4051.2	4086.2	-2016.6	4033.2		
grams_mac_ps_psquad_mod	10	4051.4	4090.3	-2015.7	4031.4	1.7429	1

Pr(>Chisq)

grams_mac_ps_mod

grams_mac_ps_psquad_mod 0.1868

Table 19: Mac and Cheese - Portion Size for Grams

	Estimate	Std. Error	df	t value	Pr(> t)
(Intercept)	-216.789	121.852	86.156	-1.779	0.079
preFF	-0.118	0.116	316.475	-1.016	0.310
bmi	16.388	7.659	85.297	2.140	0.035
sexFemale	-1.088	19.381	84.697	-0.056	0.955
mac_vas	21.428	4.564	339.777	4.695	0.000
meal_order	2.640	2.167	259.812	1.218	0.224
ps_prop	14.781	6.546	259.245	2.258	0.025

Table 20: Mac and Cheese - Risk x Portion Size for Grams

	Estimate	Std. Error	df	t value	Pr(> t)
(Intercept)	-238.981	125.534	85.279	-1.904	0.060
preFF	-0.116	0.117	313.849	-0.995	0.320
bmi	18.109	8.008	84.039	2.261	0.026
sexFemale	0.643	19.569	83.563	0.033	0.974
mac_vas	21.342	4.593	338.344	4.646	0.000
meal_order	2.643	2.171	258.605	1.218	0.224
ps_prop	16.970	8.644	258.137	1.963	0.051
risk_status_momHigh Risk	-12.919	21.682	102.444	-0.596	0.553
ps_prop:risk_status_momHigh Risk	-5.160	13.291	258.831	-0.388	0.698

4.2.1.2 Risk x Portion Size The interaction between Risk Status and Portion Size was not significant so it was removed from the model.

For the control variables, we see that children consumed 18 grams more of mac and cheese for each unit higher their BMI was at baseline. Also children consumed 21.3 grams more for each unit higher their average liking of meal foods was. Unlike the overall gram model, BMI was not associated with intake.

Table 21: Mac and Cheese - Risk x Portion Size for Grams

	Estimate	Std. Error	df	t value	Pr(> t)
(Intercept)	-238.410	125.442	85.343	-1.901	0.061
preFF	-0.113	0.116	314.719	-0.971	0.332
bmi	18.100	8.002	84.132	2.262	0.026
sexFemale	0.640	19.556	83.656	0.033	0.974
mac_vas	21.495	4.568	339.011	4.705	0.000
meal_order	2.632	2.167	259.695	1.214	0.226
ps_prop	14.782	6.546	259.141	2.258	0.025
risk_status_momHigh Risk	-15.526	20.601	83.910	-0.754	0.453

There was a significant effect of portion size such that 16.1 more grams of mac and cheese were consumed in meal 4 (100% increase in portion) than in meal 1. however, there was no effect of risk status.

4.2.2 kcal

4.2.2.1 Base Model The difference between models with and without quadratic effect was not significant indicating the added model parameters/complexity did not improve model fit. Should only model chicken nugget kcal intake with linear effect.

Data: intake_long

Models:

kcal_mac_ps_mod: mac_kcal ~ preFF + bmi + sex + mac_vas + meal_order + ps_prop + (1 | sub)

kcal_mac_ps_psquad_mod: mac_kcal ~ preFF + bmi + sex + mac_vas + meal_order + ps_prop + ps_prop2 + (1 |

	npar	AIC	BIC	logLik	deviance	Chisq	Df	Pr(>Chisq)
kcal_mac_ps_mod	9	4434.3	4469.3	-2208.1	4416.3			
kcal_mac_ps_psquad_mod	10	4434.5	4473.4	-2207.3	4414.5	1.7429	1	0.1868

Table 22: Mac and Cheese - Portion Size for kcal

	Estimate	Std. Error	df	t value	Pr(> t)
(Intercept)	-368.541	207.149	86.156	-1.779	0.079
preFF	-0.201	0.197	316.475	-1.016	0.310
bmi	27.860	13.021	85.297	2.140	0.035
sexFemale	-1.850	32.948	84.697	-0.056	0.955
mac_vas	36.428	7.760	339.777	4.695	0.000
meal_order	4.488	3.684	259.812	1.218	0.224
ps_prop	25.128	11.128	259.245	2.258	0.025

Table 23: Mac and Cheese - Risk x Portion Size for kcal

	Estimate	Std. Error	df	t value	Pr(> t)
(Intercept)	-406.267	213.407	85.279	-1.904	0.060
preFF	-0.198	0.199	313.849	-0.995	0.320
bmi	30.785	13.613	84.039	2.261	0.026
sexFemale	1.094	33.268	83.563	0.033	0.974
mac_vas	36.281	7.809	338.344	4.646	0.000
meal_order	4.494	3.690	258.605	1.218	0.224
ps_prop	28.849	14.695	258.137	1.963	0.051
risk_status_momHigh Risk	-21.963	36.860	102.444	-0.596	0.553
ps_prop:risk_status_momHigh Risk	-8.771	22.594	258.831	-0.388	0.698

4.2.2.2 Risk x Portion Size The interaction between Risk Status and Portion Size was not significant so it was removed from the model.

For the control variables, we see that children consumed 30.6 more kcal of mac and cheese for unit higher their BMI was. Also children consumed 36.2 kcal more for each unit higher their average liking of meal foods was.

There was a significant effect of portion size such that 27.3 more kcal of mac and cheese were consumed in meal 4 (100% increase in portion) than in meal 1. There was no effect of risk status.

Table 24: Mac and Cheese - Risk x Portion Size for kcal

	Estimate	Std. Error	df	t value	Pr(> t)
(Intercept)	-405.297	213.251	85.343	-1.901	0.061
preFF	-0.192	0.198	314.719	-0.971	0.332
bmi	30.770	13.604	84.131	2.262	0.026
sexFemale	1.088	33.246	83.656	0.033	0.974
mac__vas	36.542	7.766	339.011	4.705	0.000
meal_order	4.474	3.685	259.695	1.214	0.226
ps_prop	25.130	11.129	259.141	2.258	0.025
risk_status_momHigh Risk	-26.395	35.022	83.910	-0.754	0.453

4.3 Grapes

4.3.1 Grams

4.3.1.1 Base Model The difference between models with and without quadratic effect was not significant indicating the added model parameters/complexity did not improve model fit. Should only model chicken nugget gram intake with linear effect.

Data: intake_long

Models:

grams_grape_ps_mod: grape_grams ~ preFF + bmi + sex + grape_vas + meal_order + ps_prop + (1 | sub)

grams_grape_ps_psquad_mod: grape_grams ~ preFF + bmi + sex + grape_vas + meal_order + ps_prop + ps_prop^2

	npar	AIC	BIC	logLik	deviance	Chisq	Df
grams_grape_ps_mod	9	3930.7	3965.7	-1956.3	3912.7		
grams_grape_ps_psquad_mod	10	3932.7	3971.6	-1956.3	3912.7	0.0313	1

Pr(>Chisq)

grams_grape_ps_mod

grams_grape_ps_psquad_mod 0.8596

Table 25: Grapes - Portion Size for Grams

	Estimate	Std. Error	df	t value	Pr(> t)
(Intercept)	196.269	99.993	89.166	1.963	0.053
preFF	-0.047	0.097	320.872	-0.480	0.631
bmi	-7.841	6.214	85.038	-1.262	0.210
sexFemale	-8.929	15.763	85.123	-0.566	0.573
grape_vas	8.881	3.976	341.406	2.234	0.026
meal_order	-4.988	1.817	261.402	-2.746	0.006
ps_prop	16.184	5.488	260.794	2.949	0.003

Table 26: Grapes - Risk x Portion Size for Grams

	Estimate	Std. Error	df	t value	Pr(> t)
(Intercept)	186.380	103.244	88.740	1.805	0.074
preFF	-0.047	0.098	317.893	-0.479	0.633
bmi	-7.187	6.507	84.063	-1.104	0.273
sexFemale	-8.296	15.931	84.096	-0.521	0.604
grape_vas	9.085	4.006	339.439	2.267	0.024
meal_order	-4.988	1.820	260.289	-2.741	0.007
ps_prop	18.157	7.229	259.699	2.511	0.013
risk_status_momHigh Risk	-3.701	17.694	104.068	-0.209	0.835
ps_prop:risk_status_momHigh Risk	-4.698	11.158	260.352	-0.421	0.674

4.3.1.2 Risk x Portion Size The interaction between Risk Status and Portion Size was not significant so it was removed from the model.

For the control variables, we see that children consumed 9.1 grams more for each unit higher their average liking of grapes was. There was also an effect of meal order such that 4.7 fewer grams of grapes were consumed at each subsequent meal, regardless of portion size. Unlike the overall gram model, BMI was not associated with intake.

Table 27: Grapes - Risk x Portion Size for Grams

	Estimate	Std. Error	df	t value	Pr(> t)
(Intercept)	187.869	103.301	88.644	1.819	0.072
preFF	-0.044	0.097	318.814	-0.455	0.650
bmi	-7.174	6.514	84.134	-1.101	0.274
sexFemale	-8.251	15.949	84.165	-0.517	0.606
grape_vas	8.891	3.984	339.975	2.232	0.026
meal_order	-4.992	1.817	261.360	-2.748	0.006
ps_prop	16.183	5.488	260.776	2.949	0.003
risk_status_momHigh Risk	-6.024	16.825	84.803	-0.358	0.721

There was a significant effect of portion size such that 17.5 more grams of grapes were consumed in meal 4 (100% increase in portion) than in meal 1. However, there was no effect of risk status.

4.3.2 kcal

4.3.2.1 Base Model The difference between models with and without quadratic effect was not significant indicating the added model parameters/complexity did not improve model fit. Should only model chicken nugget kcal intake with linear effect.

Data: intake_long

Models:

kcal_grape_ps_mod: grape_kcal ~ preFF + bmi + sex + grape_vas + meal_order + ps_prop + (1 | sub)

kcal_grape_ps_psquad_mod: grape_kcal ~ preFF + bmi + sex + grape_vas + meal_order + ps_prop + ps_prop2 +

	npar	AIC	BIC	logLik	deviance	Chisq	Df
kcal_grape_ps_mod	9	3667.3	3702.3	-1824.6	3649.3		
kcal_grape_ps_psquad_mod	10	3669.2	3708.2	-1824.6	3649.2	0.0313	1

Pr(>Chisq)

kcal_grape_ps_mod

kcal_grape_ps_psquad_mod 0.8596

Table 28: Grapes - Portion Size for kcal

	Estimate	Std. Error	df	t value	Pr(> t)
(Intercept)	136.407	69.495	89.166	1.963	0.053
preFF	-0.032	0.068	320.872	-0.480	0.631
bmi	-5.449	4.319	85.038	-1.262	0.210
sexFemale	-6.205	10.955	85.123	-0.566	0.573
grape_vas	6.172	2.763	341.406	2.234	0.026
meal_order	-3.466	1.262	261.402	-2.746	0.006
ps_prop	11.248	3.814	260.794	2.949	0.003

Table 29: Grapes - Risk x Portion Size for kcal

	Estimate	Std. Error	df	t value	Pr(> t)
(Intercept)	129.534	71.754	88.740	1.805	0.074
preFF	-0.032	0.068	317.893	-0.479	0.633
bmi	-4.995	4.522	84.063	-1.104	0.273
sexFemale	-5.766	11.072	84.096	-0.521	0.604
grape_vas	6.314	2.785	339.439	2.267	0.024
meal_order	-3.467	1.265	260.289	-2.741	0.007
ps_prop	12.619	5.024	259.699	2.511	0.013
risk_status_momHigh Risk	-2.572	12.297	104.068	-0.209	0.835
ps_prop:risk_status_momHigh Risk	-3.265	7.755	260.352	-0.421	0.674

4.3.2.2 Risk x Portion Size The interaction between Risk Status and Portion Size was not significant so it was removed from the model.

For the control variables, we see that children consumed 6.3 kcal more for each unit higher their average liking of meal foods was. The also consumed 3.3 fewer kcal of grapes in each subsequent meal regardless of portion size.

There was a significant effect of portion size such that 12.1 more kcal of grapes consumed in meal 4 (100% increase in portion) than in meal 1. There was no effect of risk status.

Table 30: Grapes - Risk x Portion Size for kcal

	Estimate	Std. Error	df	t value	Pr(> t)
(Intercept)	130.569	71.795	88.644	1.819	0.072
preFF	-0.031	0.068	318.814	-0.455	0.650
bmi	-4.986	4.528	84.134	-1.101	0.274
sexFemale	-5.734	11.085	84.165	-0.517	0.606
grape__vas	6.179	2.769	339.975	2.232	0.026
meal_order	-3.470	1.263	261.360	-2.748	0.006
ps_prop	11.247	3.814	260.776	2.949	0.003
risk_status_momHigh Risk	-4.187	11.693	84.803	-0.358	0.721

4.4 Broccoli

4.4.1 Grams

4.4.1.1 Base Model The difference between models with and without quadratic effect was not significant indicating the added model parameters/complexity did not improve model fit. Should only model chicken nugget gram intake with linear effect.

Data: intake_long

Models:

grams_broc_ps_mod: broc_grams ~ preFF + bmi + sex + broc_vas + meal_order + ps_prop + (1 | sub)

grams_broc_ps_psquad_mod: broc_grams ~ preFF + bmi + sex + broc_vas + meal_order + ps_prop + ps_prop2 +

	npar	AIC	BIC	logLik	deviance	Chisq	Df
grams_broc_ps_mod	9	3608.5	3643.5	-1795.2	3590.5		
grams_broc_ps_psquad_mod	10	3609.8	3648.7	-1794.9	3589.8	0.6595	1

Pr(>Chisq)

grams_broc_ps_mod

grams_broc_ps_psquad_mod 0.4167

Table 31: Broccoli - Portion Size for Grams

	Estimate	Std. Error	df	t value	Pr(> t)
(Intercept)	25.934	55.825	83.875	0.465	0.643
preFF	0.012	0.064	339.264	0.190	0.849
bmi	-0.528	3.448	79.750	-0.153	0.879
sexFemale	9.180	8.725	79.452	1.052	0.296
broc_vas	2.428	2.202	299.680	1.102	0.271
meal_order	-0.994	1.224	256.181	-0.812	0.418
ps_prop	0.587	3.702	256.036	0.159	0.874

Table 32: brocs - Risk x Portion Size for Grams

	Estimate	Std. Error	df	t value	Pr(> t)
(Intercept)	16.390	57.575	82.512	0.285	0.777
preFF	0.006	0.064	334.958	0.100	0.921
bmi	0.089	3.621	78.761	0.024	0.981
sexFemale	9.901	8.859	78.708	1.118	0.267
broc_vas	2.047	2.204	302.533	0.929	0.354
meal_order	-0.978	1.214	255.116	-0.806	0.421
ps_prop	7.397	4.825	255.131	1.533	0.126
risk_status_momHigh Risk	1.820	10.063	106.864	0.181	0.857
ps_prop:risk_status_momHigh Risk	-16.079	7.414	254.625	-2.169	0.031

4.4.1.2 Risk x Portion Size Unlike other models, none of the control variables were associated with broccoli intake.

There was a significant interaction between Risk Status and Portion Size.

There was trend for the interaction between Risk Status and Portion Size such that children at low risk consumed 7.4 more grams of chicken nuggets at 100% increase in portion size compared to the standard size

Table 33: Estimated Simple Slopes: Risk Status x Portion Size for Broccoli grams

risk_status_mom	ps_prop.trend	SE	df	t.ratio	p.value
Low Risk	7.397	4.825	265.648	1.533	0.126
High Risk	-8.681	5.642	265.057	-1.539	0.125
contrast	estimate	SE	df	t.ratio	p.value
Low Risk - High Risk	16.079	7.414	265.178	2.169	0.031

($p = 0.128$) while children at high risk consumed 9.3 grams fewer ($p = 0.107$) - though neither individual slope was different. Regardless of portion size, children with low risk consumed 16.7 grams more broccoli on average, regardless of portion size ($p = 0.027$) At portion size 1, the children at high risk consumed 2 grams more broccoli but consumed 14.64 fewer grams by the 4th portion (100% increase in portion size).

4.4.2 kcal

4.4.2.1 Base Model The difference between models with and without quadratic effect was not significant indicating the added model parameters/complexity did not improve model fit. Should only model chicken nugget kcal intake with linear effect.

Data: intake_long

Models:

kcal_broc_ps_mod: broc_kcal ~ preFF + bmi + sex + broc_vas + meal_order + ps_prop + (1 | sub)

kcal_broc_ps_psquad_mod: broc_kcal ~ preFF + bmi + sex + broc_vas + meal_order + ps_prop + ps_prop2 + (1 | sub)

	npar	AIC	BIC	logLik	deviance	Chisq	Df
kcal_broc_ps_mod	9	3610.7	3645.7	-1796.3	3592.7		
kcal_broc_ps_psquad_mod	10	3612.0	3650.9	-1796.0	3592.0	0.6595	1

Pr(>Chisq)

kcal_broc_ps_mod

kcal_broc_ps_psquad_mod 0.4167

Table 34: Broccoli - Portion Size for kcal

	Estimate	Std. Error	df	t value	Pr(> t)
(Intercept)	26.012	55.993	83.875	0.465	0.643
preFF	0.012	0.064	339.264	0.190	0.849
bmi	-0.530	3.458	79.750	-0.153	0.879
sexFemale	9.208	8.751	79.452	1.052	0.296
broc_vas	2.435	2.209	299.680	1.102	0.271
meal_order	-0.997	1.228	256.181	-0.812	0.418
ps_prop	0.589	3.714	256.036	0.159	0.874

Table 35: brocs - Risk x Portion Size for kcal

	Estimate	Std. Error	df	t value	Pr(> t)
(Intercept)	16.440	57.748	82.512	0.285	0.777
preFF	0.006	0.064	334.958	0.100	0.921
bmi	0.089	3.632	78.761	0.024	0.981
sexFemale	9.930	8.886	78.708	1.118	0.267
broc_vas	2.054	2.211	302.533	0.929	0.354
meal_order	-0.981	1.218	255.116	-0.806	0.421
ps_prop	7.420	4.839	255.131	1.533	0.126
risk_status_momHigh Risk	1.825	10.093	106.864	0.181	0.857
ps_prop:risk_status_momHigh Risk	-16.127	7.436	254.625	-2.169	0.031

4.4.2.2 Risk x Portion Size Unlike other models, none of the control variables were associated with broccoli intake.

There was a significant interaction between Risk Status and Portion Size.

There was trend for the interaction between Risk Status and Portion Size such that children at low risk consumed 7.4 more kcal of chicken nuggets at 100% increase in portion size compared to the standard size ($p = 0.128$) while children at high risk consumed 9.3 kcal fewer ($p = 0.107$) - though neither individual slope was different. Regardless of portion size, children with low risk consumed 16.8 kcal more broccoli on average,

Table 36: Estimated Simple Slopes: Risk Status x Portion Size for Broccoli kcal

risk_status_mom	ps_prop.trend	SE	df	t.ratio	p.value
Low Risk	7.420	4.840	265.648	1.533	0.126
High Risk	-8.707	5.659	265.057	-1.539	0.125
contrast	estimate	SE	df	t.ratio	p.value
Low Risk - High Risk	16.127	7.436	265.178	2.169	0.031

regardless of portion size ($p = 0.027$) At portion size 1, the children at high risk consumed 2 kcal more broccoli but consumed 14.69 fewer kcal by the 4th portion (100% increase in portion size).

5 Exploratory Analyses: Mediated Moderation

Since broccoli was the only food showing a Risk Status x Portion Size interaction, I tested whether broccoli intake mediates the overall Risk x Portion Size interaction using a mediated moderation model.

5.1 Grams

lavaan 0.6-12 ended normally after 140 iterations

Estimator	ML	
Optimization method	NLMINB	
Number of model parameters	25	
	Used	Total
Number of observations	361	372
Number of clusters [sub]	93	

Model Test User Model:

	Standard	Robust
Test Statistic	10.702	6.153
Degrees of freedom	4	4
P-value (Chi-square)	0.030	0.188
Scaling correction factor		1.739
Yuan-Bentler correction (Mplus variant)		
Information	Observed	

Parameter Estimates:

Standard errors	Robust.cluster
Information	Expected
Information saturated (h1) model	Structured

Regressions:

	Estimate	Std.Err	z-value	P(> z)
grams ~				
sub	-0.519	0.369	-1.406	0.160
preFF	-0.989	0.359	-2.757	0.006
bmi	24.550	13.063	1.879	0.060
sex	-46.254	31.102	-1.487	0.137
age_yr	-32.625	22.490	-1.451	0.147
avg_vas	54.344	26.610	2.042	0.041
meal_order	-4.851	4.361	-1.112	0.266
rsk_stts_m	-25.249	35.145	-0.718	0.473
ps_prop	200.813	49.732	4.038	0.000
psxrisk_nt (c)	-57.637	23.760	-2.426	0.015
ps_prop2	-124.885	46.286	-2.698	0.007
broc_grams ~				
preFF	-0.077	0.072	-1.062	0.288
bmi	-0.241	2.469	-0.098	0.922
sex	5.948	7.836	0.759	0.448
age_yr	12.749	7.991	1.595	0.111
broc_vas	12.349	2.863	4.313	0.000

meal_order	-0.922	1.423	-0.647	0.517
rsk_stts_m	7.234	7.925	0.913	0.361
ps_prop	6.063	5.450	1.113	0.266
psxrisk_nt (a)	-15.029	7.085	-2.121	0.034
grams ~				
broc_grams (b)	1.208	0.222	5.435	0.000

Intercepts:

	Estimate	Std.Err	z-value	P(> z)
.grams	217.469	299.980	0.725	0.468
.broc_grams	-118.747	66.514	-1.785	0.074

Variances:

	Estimate	Std.Err	z-value	P(> z)
.grams	23251.375	2446.117	9.505	0.000
.broc_grams	1961.597	683.793	2.869	0.004

Defined Parameters:

	Estimate	Std.Err	z-value	P(> z)
ab	-18.153	9.058	-2.004	0.045
total	-75.789	25.338	-2.991	0.003

There was a significant level indirect effect ($p = 0.036$) indicating that broccoli intake mediated the interaction between risk status and portion size for gram intake.

5.2 kcal

lavaan 0.6-12 ended normally after 138 iterations

Estimator	ML	
Optimization method	NLMINB	
Number of model parameters	24	
	Used	Total
Number of observations	361	372
Number of clusters [sub]	93	

Model Test User Model:

	Standard	Robust
Test Statistic	15.301	6.858
Degrees of freedom	3	3
P-value (Chi-square)	0.002	0.077
Scaling correction factor		2.231
Yuan-Bentler correction (Mplus variant)		
Information	Observed	

Parameter Estimates:

Standard errors	Robust.cluster
Information	Expected
Information saturated (h1) model	Structured

Regressions:

	Estimate	Std.Err	z-value	P(> z)
kcal ~				
sub	-0.356	0.535	-0.665	0.506
preFF	-1.530	0.454	-3.368	0.001
bmi	41.392	17.374	2.382	0.017
sex	-55.299	43.749	-1.264	0.206
age_yr	-55.184	31.544	-1.749	0.080
avg_vas	69.886	31.521	2.217	0.027
meal_order	7.534	6.801	1.108	0.268
rsk_stts_m	-16.304	45.945	-0.355	0.723
ps_prop	142.122	22.395	6.346	0.000
psxrisk_nt (c)	-68.886	37.093	-1.857	0.063
broc_kcal ~				
preFF	-0.077	0.072	-1.062	0.288
bmi	-0.242	2.476	-0.098	0.922
sex	5.965	7.860	0.759	0.448
age_yr	12.787	8.015	1.595	0.111
broc_vas	12.386	2.872	4.313	0.000
meal_order	-0.924	1.428	-0.647	0.517
rsk_stts_m	7.256	7.949	0.913	0.361
ps_prop	6.081	5.466	1.113	0.266
psxrisk_nt (a)	-15.074	7.106	-2.121	0.034
kcal ~				
broc_kcal (b)	1.241	0.356	3.490	0.000

Intercepts:

	Estimate	Std.Err	z-value	P(> z)
.kcal	130.500	419.869	0.311	0.756
.broc_kcal	-119.104	66.713	-1.785	0.074

Variances:

	Estimate	Std.Err	z-value	P(> z)
.kcal	45164.381	5485.808	8.233	0.000
.broc_kcal	1973.385	687.902	2.869	0.004

Defined Parameters:

	Estimate	Std.Err	z-value	P(> z)
ab	-18.714	9.886	-1.893	0.058
total	-87.600	38.094	-2.300	0.021

There was a significant level indirect effect ($p = 0.048$) indicating that broccoli intake mediated the interaction between risk status and portion size for kcal intake.