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

Contents

lavaan 0.6-9 ended normally after 268 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 10.688 6.067 Degrees of freedom 4 4 P-value (Chi-square) 0.030 0.194 Scaling correction factor 1.762 Yuan-Bentler correction (Mplus variant)

Parameter Estimates:

Standard errors Robust.cluster Information Observed Observed information based on Hessian

Regressions: Estimate Std.Err z-value P(>|z|) grams ~
sub -0.519 0.368 -1.410 0.159 preFF -0.989 0.359 -2.755 0.006 bmi 24.568 13.062 1.881 0.060 sex -46.264 31.220 -1.482 0.138 age_yr -32.496 22.436 -1.448 0.148 avg_vas 54.473 25.530 2.134 0.033 meal_order -4.852 4.364 -1.112 0.266 rsk_stts_m -25.248 35.142 -0.718 0.472 ps_prop 200.816 49.851 4.028 0.000 psxrisk_nt (c) -57.886 23.682 -2.444 0.015 ps_prop2 -124.824 46.449 -2.687 0.007 broc_grams ~

preFF -0.078 0.072 -1.086 0.278 bmi -0.417 2.462 -0.169 0.866 sex 6.230 7.841 0.795 0.427 age_yr 12.671 7.993 1.585 0.113 broc_vas 12.256 2.870 4.271 0.000 meal_order -0.949 1.431 -0.663 0.507 rsk_stts_m 7.381 7.907 0.934 0.351 ps_prop 6.061 5.450 1.112 0.266 psxrisk_nt (a) -14.482 7.155 -2.024 0.043 grams ~ broc_grams (b) 1.199 0.207 5.786 0.000

Intercepts: Estimate Std.Err z-value P(>|z|) .grams 216.029 297.161 0.727 0.467 .broc_grams -115.550 66.490 -1.738 0.082

Variances: Estimate Std.Err z-value P(>|z|) .grams 23259.471 2446.615 9.507 0.000 .broc_grams 1967.220 683.868 2.877 0.004

Defined Parameters: Estimate Std.Err z-value P(>|z|) ab -17.360 8.969 -1.936 0.053 total -75.245 25.352 -2.968 0.003

lavaan 0.6-9 ended normally after 241 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 15.179 6.728 Degrees of freedom 3 3 P-value (Chi-square) 0.002 0.081 Scaling correction factor 2.256 Yuan-Bentler correction (Mplus variant)

Parameter Estimates:

Standard errors Robust.cluster Information Observed Observed information based on Hessian

Regressions: Estimate Std.Err z-value P(>|z|) kcal ~
sub -0.357 0.534 -0.668 0.504 preFF -1.529 0.454 -3.367 0.001 bmi 41.413 17.364 2.385 0.017 sex -55.320 43.797 -1.263 0.207 age_yr -55.000 31.362 -1.754 0.079 avg_vas 70.058 29.848 2.347 0.019 meal_order 7.533 6.795 1.109 0.268 rsk_stts_m -16.321 45.944 -0.355 0.722 ps_prop 142.185 22.396 6.349 0.000 psxrisk_nt (c) -69.167 37.010 -1.869 0.062 broc_kcal ~
preFF -0.078 0.072 -1.086 0.278 bmi -0.418 2.469 -0.169 0.866 sex 6.248 7.864 0.795 0.427 age_yr 12.709 8.017 1.585 0.113 broc_vas 12.293 2.878 4.271 0.000 meal_order -0.952 1.436 -0.663 0.507 rsk_stts_m 7.403 7.931 0.934 0.351 ps_prop 6.080 5.466 1.112 0.266 psxrisk_nt (a) -14.526 7.176 -2.024 0.043 kcal ~
broc_kcal (b) 1.232 0.332 3.713 0.000

Intercepts: Estimate Std.Err z-value P(>|z|) .kcal 128.447 416.610 0.308 0.758 .broc_kcal -115.897 66.690 -1.738 0.082

Variances: Estimate Std.Err z-value P(>|z|) .kcal 45174.008 5486.634 8.233 0.000 .broc_kcal 1979.041 687.977 2.877 0.004

Defined Parameters: Estimate Std.Err z-value P(>|z|) ab -17.895 9.697 -1.845 0.065 total -87.063 38.089 -2.286 0.022

1 Demographics

Table 1: Demographics

	Risk Groups		Overall
Characteristic	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/Lantinx	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

	Risk Groups		Overall
Characteristic	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)	404.4 (171.7)	439.8 (176.0)
ps2_total_kcal	542.6 (218.3)	513.9 (271.5)	530.7 (240.8)
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)	416.4 (166.6)	462.1 (183.2)
ps4_total_kcal	620.1 (244.9)	556.4 (249.4)	592.8 (247.5)
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)	23.7 (29.2)	23.6 (37.3)	22.6 (36.4)
broc_kcal	31.4 (52.0)	23.8 (29.2)	23.7 (37.4)	22.7 (36.5)
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 4492.0 4527.0 -2237.0   4474.0
grams_psquad_mod   10 4488.8 4527.6 -2234.4   4468.8 5.2632  1    0.02178 *
---
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)	-65.142	208.783	97.894	-0.312	0.756
preFF	-0.320	0.217	331.675	-1.474	0.141
bmi	22.219	12.704	88.667	1.749	0.084
sexFemale	-25.529	32.226	88.751	-0.792	0.430
avg_vas	40.755	15.306	350.765	2.663	0.008
meal_order	-4.658	4.135	264.070	-1.126	0.261
ps_prop	149.645	43.456	263.723	3.444	0.001
ps_prop2	-96.613	42.336	264.037	-2.282	0.023

The quadratic of portion size was significant after controlling for all other variables. This indicates there is a curvelinear 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 4765.2 4800.2 -2373.6   4747.2
kcal_psquad_mod   10 4766.1 4805.0 -2373.1   4746.1 1.1333  1     0.2871
```

Table 7: Regression Table: Portion Size for kcal

	Estimate	Std. Error	df	t value	Pr(>|t|)
(Intercept)	-310.580	270.563	98.814	-1.148	0.254
preFF	-0.903	0.324	347.368	-2.786	0.006
bmi	38.580	16.314	88.415	2.365	0.020
sexFemale	-43.106	41.389	88.582	-1.041	0.300
avg_vas	58.506	22.160	331.075	2.640	0.009
meal_order	8.584	6.315	265.491	1.359	0.175
ps_prop	112.823	19.065	264.375	5.918	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 4488.8 4527.6 -2234.4   4468.8
grams_psxrisk_psquad_mod   13 4482.5 4533.1 -2228.3   4456.5 12.219  3
                         Pr(>Chisq)
grams_psquad_mod
grams_psxrisk_psquad_mod   0.006669 **
---
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)	-99.187	276.591	93.315	-0.359	0.721
preFF	-0.331	0.216	328.787	-1.535	0.126
bmi	30.399	13.179	86.991	2.307	0.023
sexFemale	-16.831	32.161	87.151	-0.523	0.602
age_yr	-10.206	25.915	87.609	-0.394	0.695
avg_vas	39.704	15.127	347.269	2.625	0.009
meal_order	-4.564	4.085	263.151	-1.117	0.265
risk_status_momHigh Risk	-35.761	36.079	111.663	-0.991	0.324
ps_prop	178.857	44.235	262.738	4.043	0.000
ps_prop2	-96.695	41.818	263.170	-2.312	0.022
risk_status_momHigh Risk:ps_prop	-68.500	24.716	262.311	-2.771	0.006

Figure 1: Grams Consumed: Risk Status x Portion Size

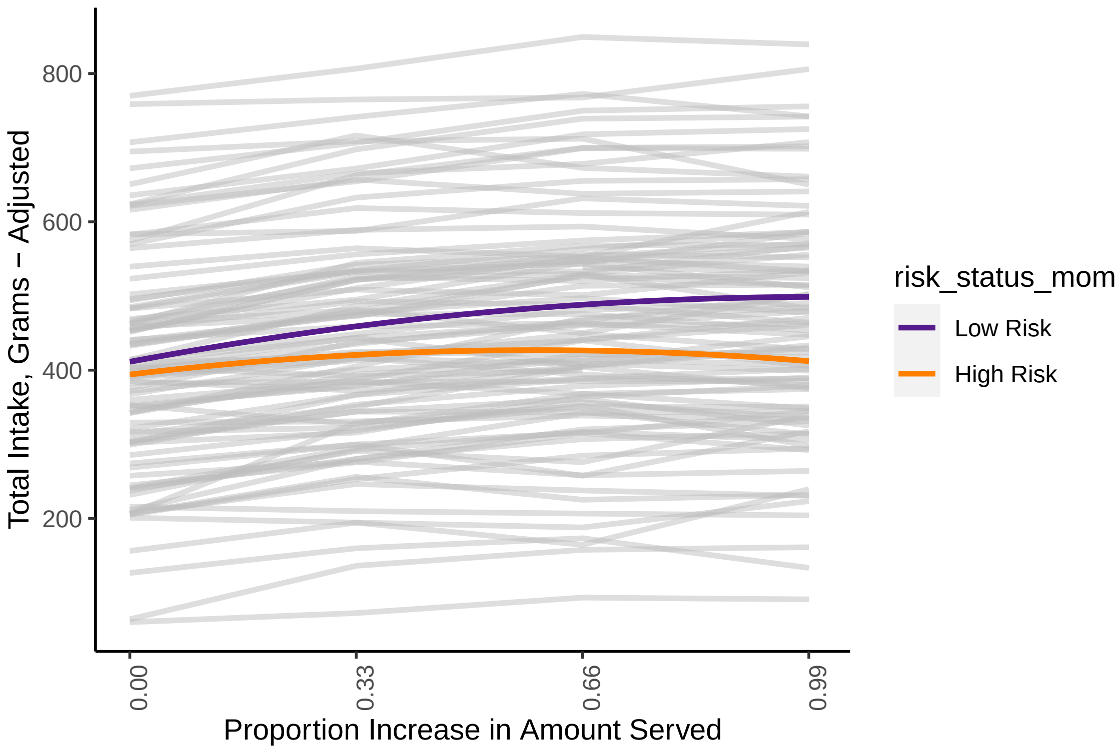

Table 9: Estimated Simple Slopes: Risk Status x Linear Portion Size for Grams

risk_status_mom	ps_prop.trend	SE	df	t.ratio	p.value
Low Risk	178.857	44.238	263.427	4.043	0.000
High Risk	110.358	45.162	263.605	2.444	0.015

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	411.393	393.109
0.33	458.768	423.761
0.66	488.546	423.405
0.99	498.740	413.233

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 protion size.

```
    Welch Two Sample t-test

data:  grams_pred_rxps by risk_status_mom
t = 0.57914, df = 84.923, p-value = 0.564
alternative hypothesis: true difference in means between group Low Risk and group High Risk is not equal
95 percent confidence interval:
 -44.48714  81.05440
sample estimates:
 mean in group Low Risk mean in group High Risk
              411.3927                393.1090


    Welch Two Sample t-test

data:  grams_pred_rxps by risk_status_mom
t = 1.0871, df = 79.465, p-value = 0.2803
alternative hypothesis: true difference in means between group Low Risk and group High Risk is not equal
95 percent confidence interval:
 -29.08150  99.09491
sample estimates:
 mean in group Low Risk mean in group High Risk
              458.7678                423.7611


    Welch Two Sample t-test

data:  grams_pred_rxps by risk_status_mom
t = 1.9856, df = 78.731, p-value = 0.05056
alternative hypothesis: true difference in means between group Low Risk and group High Risk is not equal
95 percent confidence interval:
  -0.1640152 130.4464035
sample estimates:
 mean in group Low Risk mean in group High Risk
              488.5457                423.4045


    Welch Two Sample t-test
```

```
data:  grams_pred_rxps by risk_status_mom
t = 2.6926, df = 83.109, p-value = 0.008573
alternative hypothesis: true difference in means between group Low Risk and group High Risk is not equal
95 percent confidence interval:
  22.34566 148.66905
sample estimates:
 mean in group Low Risk mean in group High Risk
               498.7399                413.2325
```

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 +
                 npar    AIC    BIC  logLik deviance  Chisq Df Pr(>Chisq)
kcal_ps_mod         9 4765.2 4800.2 -2373.6   4747.2
kcal_psxrisk_mod   12 4763.2 4809.9 -2369.6   4739.2 7.9923  3    0.04617 *
---
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)	-199.070	360.713	93.851	-0.552	0.582
preFF	-0.908	0.324	343.921	-2.805	0.005
bmi	47.183	17.076	86.645	2.763	0.007
sexFemale	-32.866	41.680	86.878	-0.789	0.433
age_yr	-30.249	33.604	87.452	-0.900	0.371
avg_vas	56.824	22.039	327.352	2.578	0.010
meal_order	8.646	6.269	264.368	1.379	0.169
risk_status_momHigh Risk	-22.171	47.917	121.915	-0.463	0.644
ps_prop	149.324	24.939	263.579	5.988	0.000
risk_status_momHigh Risk:ps_prop	-85.760	38.203	263.454	-2.245	0.026

Figure 2: kCal Consumed: Risk Status x Portion Size

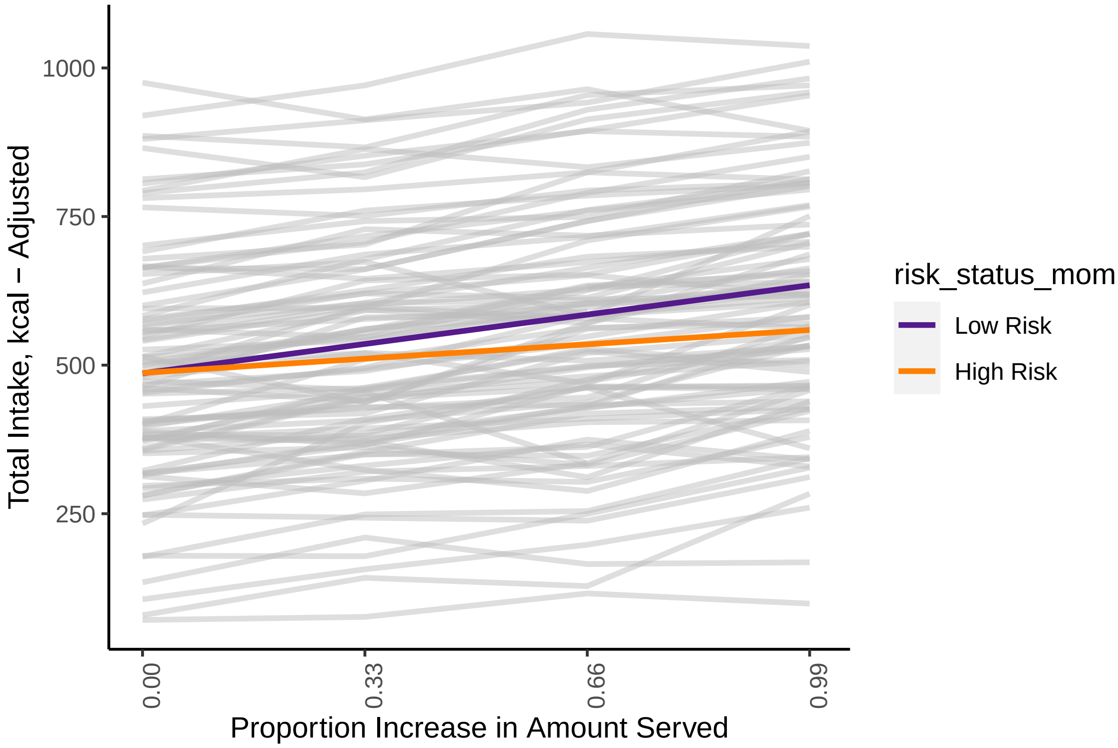

Table 12: Estimated Simple Slopes: Risk Status x Linear Portion Size for kcal

risk_status_mom	ps_prop.trend	SE	df	t.ratio	p.value
Low Risk	149.324	24.94	264.482	5.987	0.000
High Risk	63.564	28.99	264.129	2.193	0.029

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	485.748	485.751
0.33	534.560	516.052
0.66	588.442	528.555
0.99	632.444	561.650

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 = -6.7215e-05, df = 79.276, p-value = 0.9999
alternative hypothesis: true difference in means between group Low Risk and group High Risk is not equal
95 percent confidence interval:
 -83.10103  83.09542
sample estimates:
 mean in group Low Risk mean in group High Risk
              485.7485                485.7513


    Welch Two Sample t-test

data:  kcal_pred_rxps by risk_status_mom
t = 0.44911, df = 75.884, p-value = 0.6546
alternative hypothesis: true difference in means between group Low Risk and group High Risk is not equal
95 percent confidence interval:
 -63.57096 100.58643
sample estimates:
 mean in group Low Risk mean in group High Risk
              534.5596                516.0519


    Welch Two Sample t-test

data:  kcal_pred_rxps by risk_status_mom
t = 1.356, df = 72.77, p-value = 0.1793
alternative hypothesis: true difference in means between group Low Risk and group High Risk is not equal
95 percent confidence interval:
 -28.13734 147.91064
sample estimates:
 mean in group Low Risk mean in group High Risk
              588.4416                528.5550


    Welch Two Sample t-test
```

```
data:  kcal_pred_rxps by risk_status_mom
t = 1.6957, df = 80.359, p-value = 0.09382
alternative hypothesis: true difference in means between group Low Risk and group High Risk is not equal
95 percent confidence interval:
 -12.28412 153.87232
sample estimates:
 mean in group Low Risk mean in group High Risk
               632.4437                561.6496
```

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 Poriton 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_psxbmi_psquad_mod: grams ~ preFF + bmi + sex + age_yr + avg_vas + meal_order + risk_status
                                npar    AIC    BIC  logLik deviance  Chisq Df
grams_psxrisk_psquad_mod          13 4482.5 4533.1 -2228.3   4456.5
grams_psxrisk_psxbmi_psquad_mod   14 4484.4 4538.9 -2228.2   4456.4 0.0904  1
                                Pr(>Chisq)
grams_psxrisk_psquad_mod
grams_psxrisk_psxbmi_psquad_mod     0.7637
```

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_psxbmi_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 kcal_psxrisk_mod 12 4763.2 4809.9 -2369.6 4739.2 kcal_psxrisk_psxbmi_mod 14 4764.6 4819.0 -2368.3 4736.6 2.6742 2 Pr(>Chisq) kcal_psxrisk_mod kcal_psxrisk_psxbmi_mod 0.2626

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_prop2
                          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 +
                          npar    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
                        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	84.040	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	84.132	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_prop2
                          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 significiant 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 3610.6 3645.7 -1796.3   3592.6
grams_broc_ps_psquad_mod   10 3611.9 3650.9 -1796.0   3591.9 0.6953  1
                         Pr(>Chisq)
grams_broc_ps_mod
grams_broc_ps_psquad_mod     0.4044
```

Table 31: Broccoli - Portion Size for Grams

	Estimate	Std. Error	df	t value	Pr(>|t|)
(Intercept)	29.355	55.932	83.468	0.525	0.601
preFF	0.008	0.064	339.306	0.120	0.904
bmi	-0.689	3.455	79.354	-0.199	0.842
sexFemale	9.513	8.741	79.057	1.088	0.280
broc_vas	2.163	2.208	298.991	0.980	0.328
meal_order	-1.022	1.228	255.729	-0.832	0.406
ps_prop	0.829	3.715	255.582	0.223	0.823

Table 32: brocs - Risk x Portion Size for Grams

	Estimate	Std. Error	df	t value	Pr(>|t|)
(Intercept)	20.397	57.700	82.100	0.354	0.725
preFF	0.002	0.064	335.020	0.031	0.975
bmi	-0.114	3.629	78.358	-0.031	0.975
sexFemale	10.188	8.878	78.306	1.148	0.255
broc_vas	1.793	2.211	301.774	0.811	0.418
meal_order	-1.006	1.219	254.656	-0.826	0.410
ps_prop	7.421	4.844	254.669	1.532	0.127
risk_status_momHigh Risk	1.956	10.087	106.482	0.194	0.847
ps_prop:risk_status_momHigh Risk	-15.564	7.444	254.162	-2.091	0.038

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	7.421	4.845	265.651	1.532	0.127
High Risk	-8.142	5.664	265.060	-1.437	0.152

contrast	estimate	SE	df	t.ratio	p.value
Low Risk - High Risk	15.564	7.444	265.181	2.091	0.037

($p = 0.128$) 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 + (
                        npar    AIC    BIC  logLik deviance  Chisq Df
kcal_broc_ps_mod           9 3612.8 3647.8 -1797.4   3594.8
kcal_broc_ps_psquad_mod   10 3614.1 3653.0 -1797.0   3594.1 0.6953  1
                        Pr(>Chisq)
kcal_broc_ps_mod
kcal_broc_ps_psquad_mod     0.4044
```

Table 34: Broccoli - Portion Size for kcal

	Estimate	Std. Error	df	t value	Pr(>|t|)
(Intercept)	29.443	56.100	83.468	0.525	0.601
preFF	0.008	0.064	339.306	0.120	0.904
bmi	-0.691	3.465	79.354	-0.199	0.842
sexFemale	9.542	8.767	79.057	1.088	0.280
broc_vas	2.169	2.215	298.991	0.980	0.328
meal_order	-1.025	1.232	255.729	-0.832	0.406
ps_prop	0.832	3.726	255.582	0.223	0.823

Table 35: brocs - Risk x Portion Size for kcal

	Estimate	Std. Error	df	t value	Pr(>|t|)
(Intercept)	20.458	57.873	82.100	0.354	0.725
preFF	0.002	0.064	335.020	0.031	0.975
bmi	-0.114	3.640	78.358	-0.031	0.975
sexFemale	10.219	8.905	78.306	1.148	0.255
broc_vas	1.799	2.218	301.774	0.811	0.418
meal_order	-1.009	1.222	254.656	-0.826	0.410
ps_prop	7.444	4.859	254.669	1.532	0.127
risk_status_momHigh Risk	1.961	10.118	106.482	0.194	0.847
ps_prop:risk_status_momHigh Risk	-15.610	7.466	254.162	-2.091	0.038

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	7.444	4.859	265.651	1.532	0.127
High Risk	-8.167	5.681	265.060	-1.437	0.152

contrast	estimate	SE	df	t.ratio	p.value
Low Risk - High Risk	15.61	7.466	265.181	2.091	0.037

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 Porion Size interaction using a mediated moderation model.

5.1 Grams

```
lavaan 0.6-9 ended normally after 268 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                                10.688       6.067
  Degrees of freedom                                 4           4
  P-value (Chi-square)                           0.030       0.194
  Scaling correction factor                                  1.762
       Yuan-Bentler correction (Mplus variant)

Parameter Estimates:

  Standard errors                           Robust.cluster
  Information                                     Observed
  Observed information based on                    Hessian

Regressions:
                   Estimate   Std.Err  z-value  P(>|z|)
  grams ~
    sub              -0.519    0.368   -1.410    0.159
    preFF            -0.989    0.359   -2.755    0.006
    bmi              24.568   13.062    1.881    0.060
    sex             -46.264   31.220   -1.482    0.138
    age_yr          -32.496   22.436   -1.448    0.148
    avg_vas          54.473   25.530    2.134    0.033
    meal_order       -4.852    4.364   -1.112    0.266
    rsk_stts_m      -25.248   35.142   -0.718    0.472
    ps_prop         200.816   49.851    4.028    0.000
    psxrisk_nt (c)  -57.886   23.682   -2.444    0.015
    ps_prop2       -124.824   46.449   -2.687    0.007
  broc_grams ~
    preFF            -0.078    0.072   -1.086    0.278
    bmi              -0.417    2.462   -0.169    0.866
    sex               6.230    7.841    0.795    0.427
    age_yr           12.671    7.993    1.585    0.113
    broc_vas         12.256    2.870    4.271    0.000
    meal_order       -0.949    1.431   -0.663    0.507
```

```
    rsk_stts_m         7.381    7.907    0.934    0.351
    ps_prop            6.061    5.450    1.112    0.266
    psxrisk_nt (a)   -14.482    7.155   -2.024    0.043
  grams ~
    broc_grams (b)     1.199    0.207    5.786    0.000

Intercepts:
                   Estimate   Std.Err  z-value  P(>|z|)
   .grams           216.029  297.161    0.727    0.467
   .broc_grams     -115.550   66.490   -1.738    0.082

Variances:
                   Estimate   Std.Err  z-value  P(>|z|)
   .grams         23259.471 2446.615    9.507    0.000
   .broc_grams     1967.220  683.868    2.877    0.004

Defined Parameters:
                   Estimate   Std.Err  z-value  P(>|z|)
    ab              -17.360    8.969   -1.936    0.053
    total           -75.245   25.352   -2.968    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 0.6-9 ended normally after 241 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                                 15.179       6.728
  Degrees of freedom                                  3           3
  P-value (Chi-square)                            0.002       0.081
  Scaling correction factor                                   2.256
       Yuan-Bentler correction (Mplus variant)

Parameter Estimates:

  Standard errors                           Robust.cluster
  Information                                     Observed
  Observed information based on                    Hessian

Regressions:
                   Estimate   Std.Err  z-value  P(>|z|)
```

```
  kcal ~
    sub               -0.357    0.534   -0.668    0.504
    preFF             -1.529    0.454   -3.367    0.001
    bmi               41.413   17.364    2.385    0.017
    sex              -55.320   43.797   -1.263    0.207
    age_yr           -55.000   31.362   -1.754    0.079
    avg_vas           70.058   29.848    2.347    0.019
    meal_order         7.533    6.795    1.109    0.268
    rsk_stts_m       -16.321   45.944   -0.355    0.722
    ps_prop          142.185   22.396    6.349    0.000
    psxrisk_nt (c)   -69.167   37.010   -1.869    0.062
  broc_kcal ~
    preFF             -0.078    0.072   -1.086    0.278
    bmi               -0.418    2.469   -0.169    0.866
    sex                6.248    7.864    0.795    0.427
    age_yr            12.709    8.017    1.585    0.113
    broc_vas          12.293    2.878    4.271    0.000
    meal_order        -0.952    1.436   -0.663    0.507
    rsk_stts_m         7.403    7.931    0.934    0.351
    ps_prop            6.080    5.466    1.112    0.266
    psxrisk_nt (a)   -14.526    7.176   -2.024    0.043
  kcal ~
    broc_kcal  (b)     1.232    0.332    3.713    0.000

Intercepts:
                   Estimate   Std.Err  z-value  P(>|z|)
   .kcal            128.447  416.610    0.308    0.758
   .broc_kcal      -115.897   66.690   -1.738    0.082

Variances:
                   Estimate   Std.Err  z-value  P(>|z|)
   .kcal          45174.008 5486.634    8.233    0.000
   .broc_kcal      1979.041  687.977    2.877    0.004

Defined Parameters:
                   Estimate   Std.Err  z-value  P(>|z|)
    ab              -17.895    9.697   -1.845    0.065
    total           -87.063   38.089   -2.286    0.022
```

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.