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

Contents

1 Demographics

Table 1: Demographics

Characteristic	**Low Risk**, N = 53	**High Risk**, N = 40
Sex	0 (0%)	0 (0%)
Age, yr	0 (0%)	0 (0%)
Ethnicity	0 (0%)	0 (0%)
Race	0 (0%)	0 (0%)
Income	0 (0%)	0 (0%)
Unknown	1	2
BMI %tile	0 (0%)	0 (0%)
Mother's Education	0 (0%)	0 (0%)
Unknown	1	0
Father's Education	0 (0%)	0 (0%)
Unknown	0	5

[1] n (%)

2 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.

Table 2: Intake by Portion Size

Characteristic	**PS-1**, N = 93	**PS-2**, N = 93	**PS-3**, N = 93	**PS-4**, N = 93
chnug_grams	68.2 (43.0)	79.8 (64.4)	89.7 (73.5)	96.8 (66.0)
chnug_kcal	170.5 (107.6)	199.4 (161.1)	224.3 (183.7)	241.9 (165.0)
mac_grams	120.6 (96.6)	131.5 (105.1)	141.8 (123.3)	134.6 (114.6)
mac_kcal	205.0 (164.2)	223.6 (178.7)	241.0 (209.5)	228.9 (194.9)
grape_grams	91.0 (74.4)	99.5 (82.0)	98.5 (90.1)	110.8 (96.8)
grape_kcal	63.3 (51.7)	69.2 (57.0)	68.5 (62.6)	77.0 (67.3)
broc_grams	28.9 (45.5)	26.7 (45.3)	26.8 (47.6)	29.5 (54.8)
broc_kcal	29.0 (45.7)	26.7 (45.4)	26.8 (47.7)	29.6 (55.0)
mac_vas	3.9 (0.9)	3.8 (1.0)	3.8 (1.1)	3.8 (1.0)
chnug_vas	4.2 (0.9)	4.3 (0.8)	4.2 (0.9)	4.2 (0.9)
broc_vas	3.1 (1.4)	2.9 (1.3)	3.0 (1.3)	3.1 (1.4)
grape_vas	4.2 (0.9)	4.2 (1.0)	4.2 (1.0)	4.2 (0.9)

[1] Mean (SD)

Table 3: Intake by Portion Size and Risk Status

	High Risk				Low Risk			
Characteristic	**PS-1**, N = 40	**PS-2**, N = 40	**PS-3**, N = 40	**PS-4**, N = 40	**PS-1**, N = 53	**PS-2**, N = 53	**PS-3**, N = 53	**PS**
chnug_grams	66.3 (45.1)	74.9 (79.3)	77.5 (60.7)	87.0 (63.9)	69.6 (41.8)	83.2 (51.9)	98.5 (80.8)	10
chnug_kcal	165.8 (112.7)	187.3 (198.3)	193.7 (151.8)	217.4 (159.7)	174.0 (104.6)	208.0 (129.8)	246.2 (202.1)	26
mac_grams	126.1 (105.4)	132.7 (110.9)	139.4 (134.9)	134.1 (123.9)	116.5 (90.3)	130.7 (101.9)	143.4 (115.5)	13
mac_kcal	214.3 (179.2)	225.6 (188.5)	237.0 (229.4)	228.0 (210.7)	198.1 (153.4)	222.2 (173.3)	243.8 (196.3)	22
grape_grams	85.5 (65.5)	94.8 (75.6)	93.6 (87.4)	103.7 (88.7)	95.2 (80.9)	102.9 (86.9)	102.0 (92.7)	11
grape_kcal	59.4 (45.5)	65.9 (52.6)	65.1 (60.8)	72.1 (61.7)	66.1 (56.2)	71.5 (60.4)	70.9 (64.4)	8
broc_grams	31.3 (51.8)	23.1 (28.6)	23.6 (37.3)	21.8 (36.5)	27.0 (40.6)	29.2 (54.2)	29.0 (54.0)	3
broc_kcal	31.4 (52.0)	23.2 (28.7)	23.7 (37.4)	21.9 (36.6)	27.1 (40.7)	29.3 (54.4)	29.1 (54.2)	3
mac_vas	4.1 (0.8)	3.9 (1.0)	3.9 (1.1)	3.9 (1.0)	3.7 (1.0)	3.8 (1.0)	3.8 (1.1)	
chnug_vas	4.3 (1.0)	4.3 (1.0)	4.2 (1.2)	4.3 (0.9)	4.1 (0.9)	4.3 (0.7)	4.2 (0.7)	
broc_vas	2.9 (1.6)	2.8 (1.5)	2.7 (1.4)	2.9 (1.6)	3.2 (1.3)	3.0 (1.1)	3.2 (1.2)	
grape_vas	4.2 (0.8)	4.4 (0.9)	4.4 (0.9)	4.4 (0.8)	4.2 (0.9)	4.1 (1.0)	4.1 (1.1)	

[1] Mean (SD)

2.1 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.

2.1.1 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 4: 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 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)

2.1.2 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 5: 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.

2.2 Risk Status x Portion Size (linear effect)

2.2.1 Grams

Adding an interaction between Risk Status and Portion Size (linear effect) 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
```

Adding an interaction between Risk Status and the quadradic Portion Size effect did not significantly improve the model fit.

```
Data: intake_long
Models:
grams_psxrisk_psquad_mod: grams ~ preFF + bmi + sex + age_yr + avg_vas + meal_order + risk_status_mom *
grams_psxrisk_psquadxrisk_mod: grams ~ preFF + bmi + sex + age_yr + avg_vas + meal_order + ps_prop * ps_
                              npar    AIC    BIC  logLik deviance Chisq Df
grams_psxrisk_psquad_mod        13 4483.5 4534.0 -2228.7   4457.5
grams_psxrisk_psquadxrisk_mod   14 4486.8 4541.2 -2229.4   4458.8     0  1
                              Pr(>Chisq)
grams_psxrisk_psquad_mod
grams_psxrisk_psquadxrisk_mod          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 6: 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

Linear mixed model fit by REML. t-tests use Satterthwaite's method [lmerModLmerTest] Formula: grams ~ preFF + bmi + sex + age_yr + avg_vas + meal_order + risk_status_mom * ps_prop + ps_prop2 + (1 | sub) Data: intake_long

REML criterion at convergence: 4382.4

Scaled residuals: Min 1Q Median 3Q Max -2.46072 -0.63028 -0.02866 0.51872 2.45116

Random effects: Groups Name Variance Std.Dev. sub (Intercept) 21515 146.68
Residual 7282 85.34
Number of obs: 361, groups: sub, 93

Fixed effects: Estimate Std. Error df t value Pr(>|t|) (Intercept) -103.324 276.800 93.319 -0.373 0.70979 preFF -0.327 0.216 328.851 -1.514 0.13098 bmi 30.568 13.189 86.990 2.318 0.02281 sexFemale -17.095 32.184 87.150 -0.531 0.59666 age_yr -10.125 25.934 87.608 -0.390 0.69718 avg_vas 39.907 15.146 347.225 2.635 0.00880 meal_order -4.537 4.091 263.153 -1.109 0.26847 risk_status_momHigh Risk -35.956 36.109 111.700 -0.996 0.32151 ps_prop 179.042 44.301 262.740 4.042 6.98e-05 ps_prop2 -96.886 41.880 263.171 -2.313 0.02147 risk_status_momHigh Risk:ps_prop -69.028 24.753 262.312 -2.789 0.00568

(Intercept)
preFF
bmi *
sexFemale
age_yr
avg_vas ** meal_order
risk_status_momHigh Risk
ps_prop ***ps_prop2***
risk_status_momHigh Risk:ps_prop — Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Correlation of Fixed Effects: (Intr) preFF bmi sexFml age_yr avg_vs ml_rdr rs*_HR ps_prp preFF -0.079 bmi -0.644 0.065*
sexFemale 0.004 0.023 0.031
age_yr -0.645 -0.025 -0.122 -0.093
avg_vas -0.201 0.116 -0.032 -0.049 0.026
meal_order -0.035 -0.028 0.003 0.000 0.013 -0.060
rsk_stts_HR 0.101 -0.085 -0.276 -0.119 0.087 -0.020 0.011
ps_prop -0.020 -0.051 -0.010 0.002 -0.003 0.041 -0.084 0.088
ps_prop2 0.013 0.048 0.012 -0.003 0.003 -0.062 0.117 -0.006 -0.931 rsk_st_HR: 0.009 0.068 0.002 0.002 0.000 0.031 -0.014 -0.344 -0.242 ps_pr2 preFF
bmi
sexFemale
age_yr
avg_vas
meal_order
rsk_stts_HR
ps_prop
ps_prop2
rsk_st_HR:_ 0.004

The quadratic effect of portion size was also significant after controlling for all other variables, including Risk Status and Portion Size. 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) such that intake increases up to the third largest meal (66% increase) with little change between the

third and forth meals (i.e., 99% increase).

Figure 1: Grams Consumed: Risk Status x Portion Size

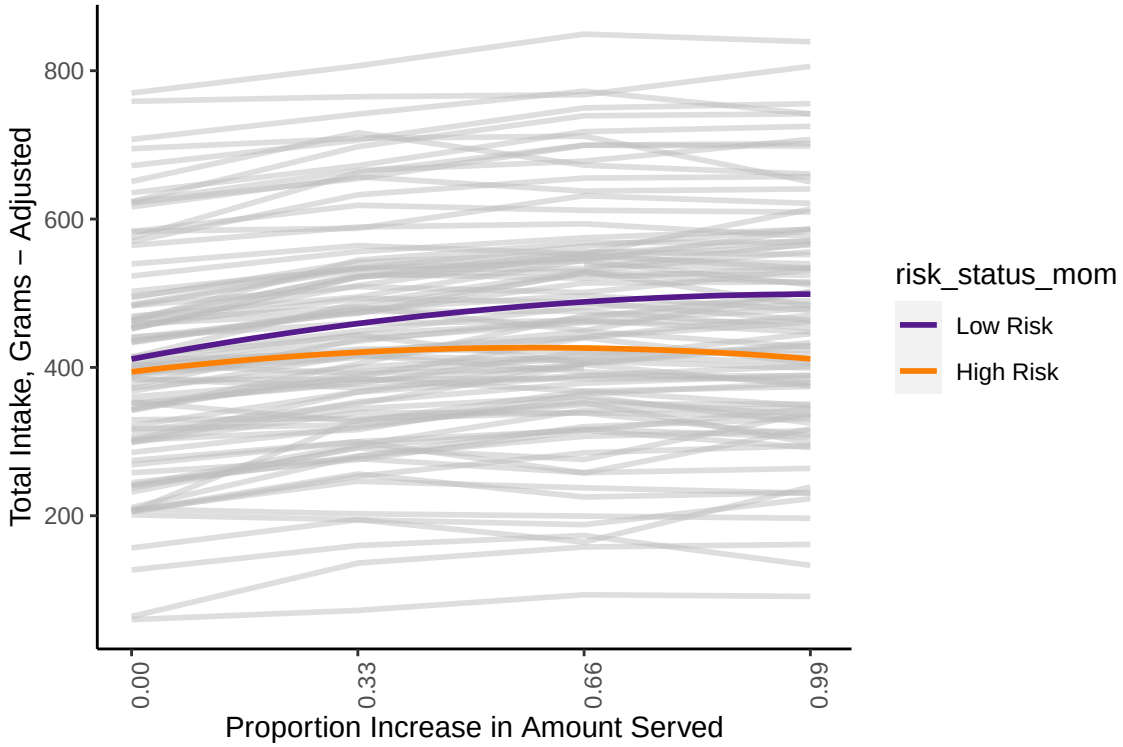

Table 7: Estimated Simple Slopes: Risk Status x Linear Portion Size for Grams

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 8: 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 protion 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
```

2.2.2 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 4765.8 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 9: 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

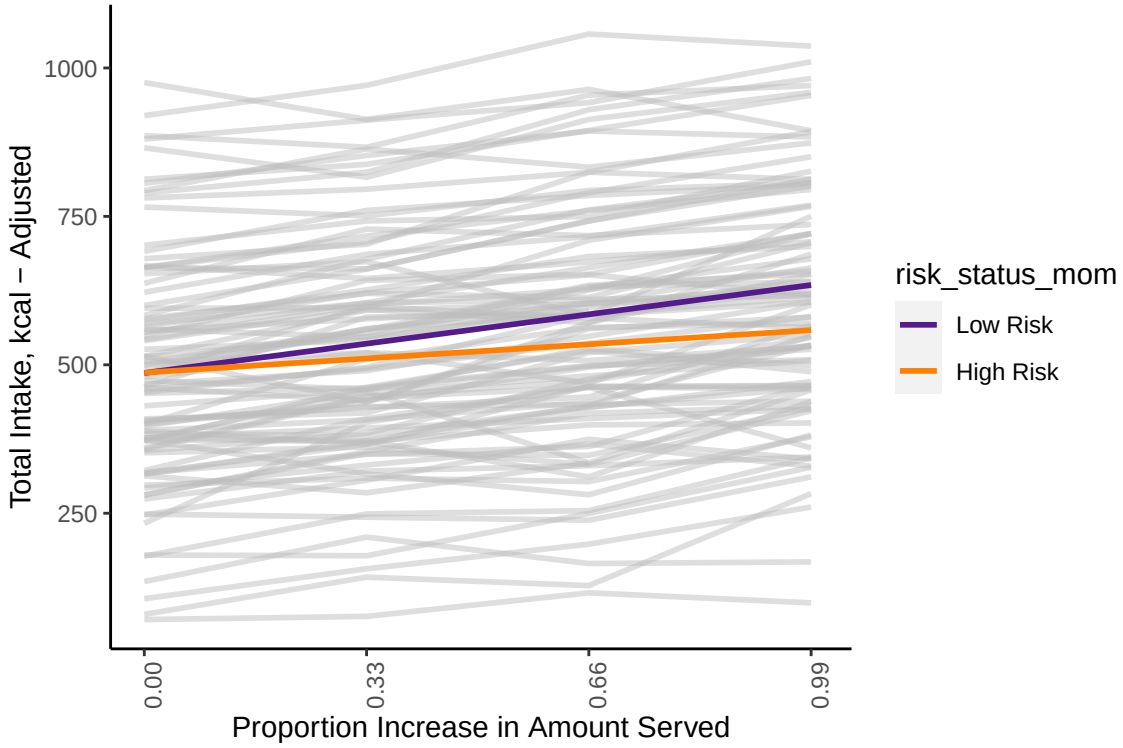

Table 10: Estimated Simple Slopes: Risk Status x Linear Portion Size for kcal

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 11: 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
```

2.3 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 12: 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.

2.3.1 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_statu
                                 npar    AIC    BIC  logLik deviance Chisq Df
grams_psxrisk_psquad_mod           13 4483.5 4534.0 -2228.7   4457.5
grams_psxrisk_psxbmi_psquad_mod    14 4485.4 4539.8 -2228.7   4457.4  0.11  1
                                 Pr(>Chisq)
grams_psxrisk_psquad_mod
grams_psxrisk_psxbmi_psquad_mod     0.7401
```

2.3.2 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 Pr(>Chisq) kcal_psxrisk_mod 12 4763.8 4810.4 -2369.9 4739.8 kcal_psxrisk_psxbmi_mod 14 4765.0 4819.5 -2368.5 4737.0 2.727 2 0.2558

3 Exploratory Analyses: Individual Foods

3.1 Chicken Nuggets

3.1.1 Grams

3.1.1.1 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 13: 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

3.1.1.2 Risk x Portion Size For the control variables, we see that children consumed 2.5 fewer grams for each cm higher their fullness rating was. Also children consumed 21.4 grams more for each unit higher their liking of chicken nuggets was. Unlike the overall gram model, BMI was not associated with intake.

Table 14: Estimated Simple Slopes: Risk Status x Portion Size for Chicken Nuggets grams

risk_status_mom	ps_prop.trend	SE	df	t.ratio	p.value
Low Risk	36.482	7.551	265.760	4.831	0.000
High Risk	18.626	8.836	266.006	2.108	0.036

contrast	estimate	SE	df	t.ratio	p.value
Low Risk - High Risk	17.856	11.616	266.033	1.537	0.125

There was trend for the interaction between Risk Status and Portion Size such that children at low risk consumed 36 more grams of chicken nuggets at 100% increase in portion size compared to the standard size ($p < 0.001$) while children at high risk consumed only 16 grams more ($p = 0.071$). At portion size 1, the

children at high risk consumed 5 fewer grams with the gap increasing to 25 fewer grams at 100% increase in portion size.

3.1.2 kcal

3.1.2.1 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 15: 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

3.1.2.2 Risk x Portion Size Linear mixed model fit by REML. t-tests use Satterthwaite's method [lmerModLmerTest] Formula: grams ~ preFF + bmi + sex + age_yr + avg_vas + meal_order + risk_status_mom *

ps_prop + ps_prop2 + (1 | sub) Data: intake_long

REML criterion at convergence: 4382.4

Scaled residuals: Min 1Q Median 3Q Max -2.46072 -0.63028 -0.02866 0.51872 2.45116

Random effects: Groups Name Variance Std.Dev. sub (Intercept) 21515 146.68
Residual 7282 85.34
Number of obs: 361, groups: sub, 93

Fixed effects: Estimate Std. Error df t value Pr(>|t|) (Intercept) -103.324 276.800 93.319 -0.373 0.70979 preFF -0.327 0.216 328.851 -1.514 0.13098 bmi 30.568 13.189 86.990 2.318 0.02281 sexFemale -17.095 32.184 87.150 -0.531 0.59666 age_yr -10.125 25.934 87.608 -0.390 0.69718 avg_vas 39.907 15.146 347.225 2.635 0.00880 meal_order -4.537 4.091 263.153 -1.109 0.26847 risk_status_momHigh Risk -35.956 36.109 111.700 -0.996 0.32151 ps_prop 179.042 44.301 262.740 4.042 6.98e-05 ps_prop2 -96.886 41.880 263.171 -2.313 0.02147 risk_status_momHigh Risk:ps_prop -69.028 24.753 262.312 -2.789 0.00568

(Intercept)
preFF

bmi *
sexFemale
age_yr
avg_vas ** meal_order
risk_status_momHigh Risk
ps_prop ***ps_prop2***
risk_status_momHigh Risk:ps_prop — Signif. codes: 0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Correlation of Fixed Effects: (Intr) preFF bmi sexFml age_yr avg_vs ml_rdr rs_*HR ps_prp preFF -0.079 bmi -0.644 0.065*
sexFemale 0.004 0.023 0.031
age_yr -0.645 -0.025 -0.122 -0.093
avg_vas -0.201 0.116 -0.032 -0.049 0.026
meal_order -0.035 -0.028 0.003 0.000 0.013 -0.060
rsk_stts_HR 0.101 -0.085 -0.276 -0.119 0.087 -0.020 0.011
ps_prop -0.020 -0.051 -0.010 0.002 -0.003 0.041 -0.084 0.088
ps_prop2 0.013 0.048 0.012 -0.003 0.003 -0.062 0.117 -0.006 -0.931 rsk_st_HR: 0.009 0.068 0.002 0.002 0.000 0.031 -0.014 -0.344 -0.242 ps_pr2 preFF
bmi
sexFemale
age_yr
avg_vas
meal_order
rsk_stts_HR
ps_prop
ps_prop2
rsk_st_HR:_ 0.004

For the control variables, we see that children consumed 6.5 fewer kcal for each cm higher their fullness rating was. Also children consumed 53 kcal more for each unit higher their average liking of meal foods was. Unlike the overall gram model, BMI was not associated with intake.

Table 16: Estimated Simple Slopes: Risk Status x Portion Size for Chicken Nuggets kcal

risk_status_mom	ps_prop.trend	SE	df	t.ratio	p.value
Low Risk	91.206	18.878	265.760	4.831	0.000
High Risk	46.566	22.090	266.006	2.108	0.036

contrast	estimate	SE	df	t.ratio	p.value
Low Risk - High Risk	44.64	29.039	266.033	1.537	0.125

There was trend for the interaction between Risk Status and Portion Size such that children at low risk consumed 91 more kcal of chicken nuggets at 100% increase in portion size compared to the standard size ($p < 0.001$) while children at high risk consumed only 42 grams more ($p = 0.071$). At portion size 1, the children at high risk consumed 15 fewer kcal with the gap increasing to 50 fewer kcal at 100% increase in portion size.

3.2 Mac and Cheese

3.2.1 Grams

3.2.1.1 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 17: 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

3.2.1.2 Risk x Portion Size Linear mixed model fit by REML. t-tests use Satterthwaite's method [lmerModLmerTest] Formula: grams ~ preFF + bmi + sex + age_yr + avg_vas + meal_order + risk_status_mom *

ps_prop + ps_prop2 + (1 | sub) Data: intake_long

REML criterion at convergence: 4382.4

Scaled residuals: Min 1Q Median 3Q Max -2.46072 -0.63028 -0.02866 0.51872 2.45116

Random effects: Groups Name Variance Std.Dev. sub (Intercept) 21515 146.68
Residual 7282 85.34
Number of obs: 361, groups: sub, 93

Fixed effects: Estimate Std. Error df t value Pr(>|t|) (Intercept) -103.324 276.800 93.319 -0.373 0.70979 preFF -0.327 0.216 328.851 -1.514 0.13098 bmi 30.568 13.189 86.990 2.318 0.02281 sexFemale -17.095 32.184 87.150 -0.531 0.59666 age_yr -10.125 25.934 87.608 -0.390 0.69718 avg_vas 39.907 15.146 347.225 2.635 0.00880 meal_order -4.537 4.091 263.153 -1.109 0.26847 risk_status_momHigh Risk -35.956 36.109 111.700 -0.996 0.32151 ps_prop 179.042 44.301 262.740 4.042 6.98e-05 ps_prop2 -96.886 41.880 263.171 -2.313 0.02147 risk_status_momHigh Risk:ps_prop -69.028 24.753 262.312 -2.789 0.00568

(Intercept)
preFF
bmi *
sexFemale
age_yr
avg_vas ** meal_order
risk_status_momHigh Risk
ps_prop ***ps_prop2***
risk_status_momHigh Risk:ps_prop — Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Correlation of Fixed Effects: (Intr) preFF bmi sexFml age_yr avg_vs ml_rdr rs_*HR ps_prp preFF -0.079*
bmi -0.644 0.065
sexFemale 0.004 0.023 0.031
age_yr -0.645 -0.025 -0.122 -0.093
avg_vas -0.201 0.116 -0.032 -0.049 0.026
meal_order -0.035 -0.028 0.003 0.000 0.013 -0.060
rsk_stts_HR 0.101 -0.085 -0.276 -0.119 0.087 -0.020 0.011
ps_prop -0.020 -0.051 -0.010 0.002 -0.003 0.041 -0.084 0.088
ps_prop2 0.013 0.048 0.012 -0.003 0.003 -0.062 0.117 -0.006 -0.931 rsk_st_HR: 0.009 0.068 0.002 0.002
0.000 0.031 -0.014 -0.344 -0.242 ps_pr2 preFF
bmi
sexFemale
age_yr
avg_vas
meal_order
rsk_stts_HR
ps_prop
ps_prop2
rsk_st_HR:_ 0.004

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

Table 18: 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

Linear mixed model fit by REML. t-tests use Satterthwaite's method [lmerModLmerTest] Formula: grams ~
preFF + bmi + sex + age_yr + avg_vas + meal_order + risk_status_mom *
ps_prop + ps_prop2 + (1 | sub) Data: intake_long

REML criterion at convergence: 4382.4

Scaled residuals: Min 1Q Median 3Q Max -2.46072 -0.63028 -0.02866 0.51872 2.45116

Random effects: Groups Name Variance Std.Dev. sub (Intercept) 21515 146.68
Residual 7282 85.34
Number of obs: 361, groups: sub, 93

Fixed effects: Estimate Std. Error df t value Pr(>|t|) (Intercept) -103.324 276.800 93.319 -0.373 0.70979 preFF -0.327 0.216 328.851 -1.514 0.13098 bmi 30.568 13.189 86.990 2.318 0.02281 sexFemale -17.095 32.184 87.150 -0.531 0.59666 age_yr -10.125 25.934 87.608 -0.390 0.69718 avg_vas 39.907 15.146 347.225 2.635 0.00880 meal_order -4.537 4.091 263.153 -1.109 0.26847 risk_status_momHigh Risk -35.956 36.109 111.700 -0.996 0.32151 ps_prop 179.042 44.301 262.740 4.042 6.98e-05 ps_prop2 -96.886 41.880 263.171 -2.313 0.02147 risk_status_momHigh Risk:ps_prop -69.028 24.753 262.312 -2.789 0.00568

(Intercept)
preFF
bmi *
sexFemale
age_yr
avg_vas ** meal_order
risk_status_momHigh Risk
ps_prop ***ps_prop2***
risk_status_momHigh Risk:ps_prop — Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Correlation of Fixed Effects: (Intr) preFF bmi sexFml age_yr avg_vs ml_rdr rs*_HR ps_prp preFF -0.079 bmi -0.644 0.065 sexFemale 0.004 0.023 0.031 age_yr -0.645 -0.025 -0.122 -0.093 avg_vas -0.201 0.116 -0.032 -0.049 0.026 meal_order -0.035 -0.028 0.003 0.000 0.013 -0.060 rsk_stts_HR 0.101 -0.085 -0.276 -0.119 0.087 -0.020 0.011 ps_prop -0.020 -0.051 -0.010 0.002 -0.003 0.041 -0.084 0.088 ps_prop2 0.013 0.048 0.012 -0.003 0.003 -0.062 0.117 -0.006 -0.931 rsk_st_HR:* 0.009 0.068 0.002 0.002 0.000 0.031 -0.014 -0.344 -0.242 ps_pr2 preFF
bmi
sexFemale
age_yr
avg_vas
meal_order
rsk_stts_HR
ps_prop
ps_prop2
rsk_st_HR:_ 0.004

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.

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.

3.2.2 kcal

3.2.2.1 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 19: 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

3.2.2.2 Risk x Portion Size Linear mixed model fit by REML. t-tests use Satterthwaite's method [lmerModLmerTest] Formula: grams ~ preFF + bmi + sex + age_yr + avg_vas + meal_order + risk_status_mom *

ps_prop + ps_prop2 + (1 | sub) Data: intake_long

REML criterion at convergence: 4382.4

Scaled residuals: Min 1Q Median 3Q Max -2.46072 -0.63028 -0.02866 0.51872 2.45116

Random effects: Groups Name Variance Std.Dev. sub (Intercept) 21515 146.68
Residual 7282 85.34
Number of obs: 361, groups: sub, 93

Fixed effects: Estimate Std. Error df t value Pr(>|t|) (Intercept) -103.324 276.800 93.319 -0.373 0.70979 preFF -0.327 0.216 328.851 -1.514 0.13098 bmi 30.568 13.189 86.990 2.318 0.02281 sexFemale -17.095 32.184 87.150 -0.531 0.59666 age_yr -10.125 25.934 87.608 -0.390 0.69718 avg_vas 39.907 15.146 347.225 2.635 0.00880 meal_order -4.537 4.091 263.153 -1.109 0.26847 risk_status_momHigh Risk -35.956 36.109 111.700 -0.996 0.32151 ps_prop 179.042 44.301 262.740 4.042 6.98e-05 ps_prop2 -96.886 41.880 263.171 -2.313 0.02147 risk_status_momHigh Risk:ps_prop -69.028 24.753 262.312 -2.789 0.00568

(Intercept)
preFF
bmi *
sexFemale
age_yr

avg_vas ** meal_order
risk_status_momHigh Risk
ps_prop ***ps_prop2***
risk_status_momHigh Risk:ps_prop — Signif. codes: 0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Correlation of Fixed Effects: (Intr) preFF bmi sexFml age_yr avg_vs ml_rdr rs_*HR ps_prp preFF -0.079 bmi -0.644 0.065*
sexFemale 0.004 0.023 0.031
age_yr -0.645 -0.025 -0.122 -0.093
avg_vas -0.201 0.116 -0.032 -0.049 0.026
meal_order -0.035 -0.028 0.003 0.000 0.013 -0.060
rsk_stts_HR 0.101 -0.085 -0.276 -0.119 0.087 -0.020 0.011
ps_prop -0.020 -0.051 -0.010 0.002 -0.003 0.041 -0.084 0.088
ps_prop2 0.013 0.048 0.012 -0.003 0.003 -0.062 0.117 -0.006 -0.931 rsk_st_HR: 0.009 0.068 0.002 0.002 0.000 0.031 -0.014 -0.344 -0.242 ps_pr2 preFF
bmi
sexFemale
age_yr
avg_vas
meal_order
rsk_stts_HR
ps_prop
ps_prop2
rsk_st_HR:_ 0.004

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

Table 20: 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

Linear mixed model fit by REML. t-tests use Satterthwaite’s method [lmerModLmerTest] Formula: grams ~ preFF + bmi + sex + age_yr + avg_vas + meal_order + risk_status_mom *
ps_prop + ps_prop2 + (1 | sub) Data: intake_long

REML criterion at convergence: 4382.4

Scaled residuals: Min 1Q Median 3Q Max -2.46072 -0.63028 -0.02866 0.51872 2.45116

Random effects: Groups Name Variance Std.Dev. sub (Intercept) 21515 146.68
Residual 7282 85.34
Number of obs: 361, groups: sub, 93

Fixed effects: Estimate Std. Error df t value Pr(>|t|) (Intercept) -103.324 276.800 93.319 -0.373 0.70979

preFF -0.327 0.216 328.851 -1.514 0.13098 bmi 30.568 13.189 86.990 2.318 0.02281 sexFemale -17.095 32.184 87.150 -0.531 0.59666 age_yr -10.125 25.934 87.608 -0.390 0.69718 avg_vas 39.907 15.146 347.225 2.635 0.00880 meal_order -4.537 4.091 263.153 -1.109 0.26847 risk_status_momHigh Risk -35.956 36.109 111.700 -0.996 0.32151 ps_prop 179.042 44.301 262.740 4.042 6.98e-05 ps_prop2 -96.886 41.880 263.171 -2.313 0.02147 risk_status_momHigh Risk:ps_prop -69.028 24.753 262.312 -2.789 0.00568

(Intercept)
preFF
bmi *
sexFemale
age_yr
avg_vas ** meal_order
risk_status_momHigh Risk
ps_prop ***ps_prop2***
risk_status_momHigh Risk:ps_prop — Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Correlation of Fixed Effects: (Intr) preFF bmi sexFml age_yr avg_vs ml_rdr rs_*HR ps_prp preFF -0.079 bmi -0.644 0.065*
sexFemale 0.004 0.023 0.031
age_yr -0.645 -0.025 -0.122 -0.093
avg_vas -0.201 0.116 -0.032 -0.049 0.026
meal_order -0.035 -0.028 0.003 0.000 0.013 -0.060
rsk_stts_HR 0.101 -0.085 -0.276 -0.119 0.087 -0.020 0.011
ps_prop -0.020 -0.051 -0.010 0.002 -0.003 0.041 -0.084 0.088
ps_prop2 0.013 0.048 0.012 -0.003 0.003 -0.062 0.117 -0.006 -0.931 rsk_st_HR: 0.009 0.068 0.002 0.002 0.000 0.031 -0.014 -0.344 -0.242 ps_pr2 preFF
bmi
sexFemale
age_yr
avg_vas
meal_order
rsk_stts_HR
ps_prop
ps_prop2
rsk_st_HR:_ 0.004

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.

3.3 Grapes

3.3.1 Grams

3.3.1.1 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
                          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 21: 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

3.3.1.2 Risk x Portion Size Linear mixed model fit by REML. t-tests use Satterthwaite's method [lmerModLmerTest] Formula: grams ~ preFF + bmi + sex + age_yr + avg_vas + meal_order + risk_status_mom *

ps_prop + ps_prop2 + (1 | sub) Data: intake_long

REML criterion at convergence: 4382.4

Scaled residuals: Min 1Q Median 3Q Max -2.46072 -0.63028 -0.02866 0.51872 2.45116

Random effects: Groups Name Variance Std.Dev. sub (Intercept) 21515 146.68
Residual 7282 85.34
Number of obs: 361, groups: sub, 93

Fixed effects: Estimate Std. Error df t value Pr(>|t|) (Intercept) -103.324 276.800 93.319 -0.373 0.70979 preFF -0.327 0.216 328.851 -1.514 0.13098 bmi 30.568 13.189 86.990 2.318 0.02281 sexFemale -17.095 32.184 87.150 -0.531 0.59666 age_yr -10.125 25.934 87.608 -0.390 0.69718 avg_vas 39.907 15.146 347.225 2.635 0.00880 meal_order -4.537 4.091 263.153 -1.109 0.26847 risk_status_momHigh Risk -35.956 36.109 111.700 -0.996 0.32151 ps_prop 179.042 44.301 262.740 4.042 6.98e-05 ps_prop2 -96.886 41.880 263.171 -2.313 0.02147 risk_status_momHigh Risk:ps_prop -69.028 24.753 262.312 -2.789 0.00568

(Intercept)
preFF
bmi *
sexFemale
age_yr
avg_vas ** meal_order
risk_status_momHigh Risk
ps_prop ***ps_prop2***
risk_status_momHigh Risk:ps_prop — Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Correlation of Fixed Effects: (Intr) preFF bmi sexFml age_yr avg_vs ml_rdr rs_*HR ps_prp preFF -0.079*
bmi -0.644 0.065
sexFemale 0.004 0.023 0.031
age_yr -0.645 -0.025 -0.122 -0.093
avg_vas -0.201 0.116 -0.032 -0.049 0.026
meal_order -0.035 -0.028 0.003 0.000 0.013 -0.060
rsk_stts_HR 0.101 -0.085 -0.276 -0.119 0.087 -0.020 0.011
ps_prop -0.020 -0.051 -0.010 0.002 -0.003 0.041 -0.084 0.088
ps_prop2 0.013 0.048 0.012 -0.003 0.003 -0.062 0.117 -0.006 -0.931 rsk_st_HR: 0.009 0.068 0.002 0.002
0.000 0.031 -0.014 -0.344 -0.242 ps_pr2 preFF
bmi
sexFemale
age_yr
avg_vas
meal_order
rsk_stts_HR
ps_prop
ps_prop2
rsk_st_HR:_ 0.004

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

Table 22: 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

Linear mixed model fit by REML. t-tests use Satterthwaite's method [lmerModLmerTest] Formula: grams ~
preFF + bmi + sex + age_yr + avg_vas + meal_order + risk_status_mom *
ps_prop + ps_prop2 + (1 | sub) Data: intake_long

REML criterion at convergence: 4382.4

Scaled residuals: Min 1Q Median 3Q Max -2.46072 -0.63028 -0.02866 0.51872 2.45116

Random effects: Groups Name Variance Std.Dev. sub (Intercept) 21515 146.68
Residual 7282 85.34
Number of obs: 361, groups: sub, 93

Fixed effects: Estimate Std. Error df t value Pr(>|t|) (Intercept) -103.324 276.800 93.319 -0.373 0.70979 preFF -0.327 0.216 328.851 -1.514 0.13098 bmi 30.568 13.189 86.990 2.318 0.02281 sexFemale -17.095 32.184 87.150 -0.531 0.59666 age_yr -10.125 25.934 87.608 -0.390 0.69718 avg_vas 39.907 15.146 347.225 2.635 0.00880 meal_order -4.537 4.091 263.153 -1.109 0.26847 risk_status_momHigh Risk -35.956 36.109 111.700 -0.996 0.32151 ps_prop 179.042 44.301 262.740 4.042 6.98e-05 ps_prop2 -96.886 41.880 263.171 -2.313 0.02147 risk_status_momHigh Risk:ps_prop -69.028 24.753 262.312 -2.789 0.00568

(Intercept)
preFF
bmi *
sexFemale
age_yr
avg_vas ** meal_order
risk_status_momHigh Risk
ps_prop ***ps_prop2***
risk_status_momHigh Risk:ps_prop — Signif. codes: 0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Correlation of Fixed Effects: (Intr) preFF bmi sexFml age_yr avg_vs ml_rdr rs_*HR ps_prp preFF -0.079 bmi -0.644 0.065 sexFemale 0.004 0.023 0.031 age_yr -0.645 -0.025 -0.122 -0.093 avg_vas -0.201 0.116 -0.032 -0.049 0.026 meal_order -0.035 -0.028 0.003 0.000 0.013 -0.060 rsk_stts_HR 0.101 -0.085 -0.276 -0.119 0.087 -0.020 0.011 ps_prop -0.020 -0.051 -0.010 0.002 -0.003 0.041 -0.084 0.088 ps_prop2 0.013 0.048 0.012 -0.003 0.003 -0.062 0.117 -0.006 -0.931 rsk_st_HR:* 0.009 0.068 0.002 0.002 0.000 0.031 -0.014 -0.344 -0.242 ps_pr2 preFF
bmi
sexFemale
age_yr
avg_vas
meal_order
rsk_stts_HR
ps_prop
ps_prop2
rsk_st_HR:_ 0.004

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.

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.

3.3.2 kcal

3.3.2.1 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 23: 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

3.3.2.2 Risk x Portion Size Linear mixed model fit by REML. t-tests use Satterthwaite's method [lmerModLmerTest] Formula: grams ~ preFF + bmi + sex + age_yr + avg_vas + meal_order + risk_status_mom *

ps_prop + ps_prop2 + (1 | sub) Data: intake_long

REML criterion at convergence: 4382.4

Scaled residuals: Min 1Q Median 3Q Max -2.46072 -0.63028 -0.02866 0.51872 2.45116

Random effects: Groups Name Variance Std.Dev. sub (Intercept) 21515 146.68
Residual 7282 85.34
Number of obs: 361, groups: sub, 93

Fixed effects: Estimate Std. Error df t value Pr(>|t|) (Intercept) -103.324 276.800 93.319 -0.373 0.70979 preFF -0.327 0.216 328.851 -1.514 0.13098 bmi 30.568 13.189 86.990 2.318 0.02281 sexFemale -17.095 32.184 87.150 -0.531 0.59666 age_yr -10.125 25.934 87.608 -0.390 0.69718 avg_vas 39.907 15.146 347.225 2.635 0.00880 meal_order -4.537 4.091 263.153 -1.109 0.26847 risk_status_momHigh Risk -35.956 36.109 111.700 -0.996 0.32151 ps_prop 179.042 44.301 262.740 4.042 6.98e-05 ps_prop2 -96.886 41.880 263.171 -2.313 0.02147 risk_status_momHigh Risk:ps_prop -69.028 24.753 262.312 -2.789 0.00568

(Intercept)
preFF

bmi *
sexFemale
age_yr
avg_vas ** meal_order
risk_status_momHigh Risk
ps_prop ***ps_prop2***
risk_status_momHigh Risk:ps_prop — Signif. codes: 0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Correlation of Fixed Effects: (Intr) preFF bmi sexFml age_yr avg_vs ml_rdr rs_*HR ps_prp preFF -0.079 bmi -0.644 0.065*
sexFemale 0.004 0.023 0.031
age_yr -0.645 -0.025 -0.122 -0.093
avg_vas -0.201 0.116 -0.032 -0.049 0.026
meal_order -0.035 -0.028 0.003 0.000 0.013 -0.060
rsk_stts_HR 0.101 -0.085 -0.276 -0.119 0.087 -0.020 0.011
ps_prop -0.020 -0.051 -0.010 0.002 -0.003 0.041 -0.084 0.088
ps_prop2 0.013 0.048 0.012 -0.003 0.003 -0.062 0.117 -0.006 -0.931 rsk_st_HR: 0.009 0.068 0.002 0.002 0.000 0.031 -0.014 -0.344 -0.242 ps_pr2 preFF
bmi
sexFemale
age_yr
avg_vas
meal_order
rsk_stts_HR
ps_prop
ps_prop2
rsk_st_HR:_ 0.004

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

Table 24: 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

Linear mixed model fit by REML. t-tests use Satterthwaite’s method [lmerModLmerTest] Formula: grams ~ preFF + bmi + sex + age_yr + avg_vas + meal_order + risk_status_mom *
ps_prop + ps_prop2 + (1 | sub) Data: intake_long

REML criterion at convergence: 4382.4

Scaled residuals: Min 1Q Median 3Q Max -2.46072 -0.63028 -0.02866 0.51872 2.45116

Random effects: Groups Name Variance Std.Dev. sub (Intercept) 21515 146.68

Residual 7282 85.34
Number of obs: 361, groups: sub, 93

Fixed effects: Estimate Std. Error df t value Pr(>|t|) (Intercept) -103.324 276.800 93.319 -0.373 0.70979 preFF -0.327 0.216 328.851 -1.514 0.13098 bmi 30.568 13.189 86.990 2.318 0.02281 sexFemale -17.095 32.184 87.150 -0.531 0.59666 age_yr -10.125 25.934 87.608 -0.390 0.69718 avg_vas 39.907 15.146 347.225 2.635 0.00880 meal_order -4.537 4.091 263.153 -1.109 0.26847 risk_status_momHigh Risk -35.956 36.109 111.700 -0.996 0.32151 ps_prop 179.042 44.301 262.740 4.042 6.98e-05 ps_prop2 -96.886 41.880 263.171 -2.313 0.02147 risk_status_momHigh Risk:ps_prop -69.028 24.753 262.312 -2.789 0.00568

(Intercept)
preFF
bmi *
sexFemale
age_yr
avg_vas ** meal_order
risk_status_momHigh Risk
ps_prop ***ps_prop2***
risk_status_momHigh Risk:ps_prop — Signif. codes: 0 ‘***’ 0.001 ’**’ 0.01 ’*’ 0.05 ‘.’ 0.1 ’ ’ 1

Correlation of Fixed Effects: (Intr) preFF bmi sexFml age_yr avg_vs ml_rdr rs_*HR ps_prp preFF -0.079 bmi -0.644 0.065 sexFemale 0.004 0.023 0.031 age_yr -0.645 -0.025 -0.122 -0.093 avg_vas -0.201 0.116 -0.032 -0.049 0.026 meal_order -0.035 -0.028 0.003 0.000 0.013 -0.060 rsk_stts_HR 0.101 -0.085 -0.276 -0.119 0.087 -0.020 0.011 ps_prop -0.020 -0.051 -0.010 0.002 -0.003 0.041 -0.084 0.088 ps_prop2 0.013 0.048 0.012 -0.003 0.003 -0.062 0.117 -0.006 -0.931 rsk_st_HR:* 0.009 0.068 0.002 0.002 0.000 0.031 -0.014 -0.344 -0.242 ps_pr2 preFF
bmi
sexFemale
age_yr
avg_vas
meal_order
rsk_stts_HR
ps_prop
ps_prop2
rsk_st_HR:_ 0.004

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.

3.4 Broccoli

3.4.1 Grams

3.4.1.1 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 25: 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

3.4.1.2 Risk x Portion Size Linear mixed model fit by REML. t-tests use Satterthwaite's method [lmerModLmerTest] Formula: grams ~ preFF + bmi + sex + age_yr + avg_vas + meal_order + risk_status_mom *

ps_prop + ps_prop2 + (1 | sub) Data: intake_long

REML criterion at convergence: 4382.4

Scaled residuals: Min 1Q Median 3Q Max -2.46072 -0.63028 -0.02866 0.51872 2.45116

Random effects: Groups Name Variance Std.Dev. sub (Intercept) 21515 146.68
Residual 7282 85.34
Number of obs: 361, groups: sub, 93

Fixed effects: Estimate Std. Error df t value Pr(>|t|) (Intercept) -103.324 276.800 93.319 -0.373 0.70979 preFF -0.327 0.216 328.851 -1.514 0.13098 bmi 30.568 13.189 86.990 2.318 0.02281 sexFemale -17.095 32.184 87.150 -0.531 0.59666 age_yr -10.125 25.934 87.608 -0.390 0.69718 avg_vas 39.907 15.146 347.225 2.635 0.00880 meal_order -4.537 4.091 263.153 -1.109 0.26847 risk_status_momHigh Risk -35.956 36.109 111.700 -0.996 0.32151 ps_prop 179.042 44.301 262.740 4.042 6.98e-05 ps_prop2 -96.886 41.880 263.171 -2.313 0.02147 risk_status_momHigh Risk:ps_prop -69.028 24.753 262.312 -2.789 0.00568

(Intercept)
preFF
bmi *
sexFemale
age_yr
avg_vas ** meal_order
risk_status_momHigh Risk
ps_prop ***ps_prop2***
risk_status_momHigh Risk:ps_prop — Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Correlation of Fixed Effects: (Intr) preFF bmi sexFml age_yr avg_vs ml_rdr rs_*HR ps_prp preFF -0.079*
bmi -0.644 0.065
sexFemale 0.004 0.023 0.031
age_yr -0.645 -0.025 -0.122 -0.093
avg_vas -0.201 0.116 -0.032 -0.049 0.026
meal_order -0.035 -0.028 0.003 0.000 0.013 -0.060
rsk_stts_HR 0.101 -0.085 -0.276 -0.119 0.087 -0.020 0.011
ps_prop -0.020 -0.051 -0.010 0.002 -0.003 0.041 -0.084 0.088
ps_prop2 0.013 0.048 0.012 -0.003 0.003 -0.062 0.117 -0.006 -0.931 rsk_st_HR: 0.009 0.068 0.002 0.002 0.000 0.031 -0.014 -0.344 -0.242 ps_pr2 preFF
bmi
sexFemale
age_yr
avg_vas
meal_order
rsk_stts_HR
ps_prop
ps_prop2
rsk_st_HR:_ 0.004

Unlike other models, none of the control variables were associated with broccoli intake.

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

Table 26: 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

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 ($p = 0.128$) 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).

3.4.2 kcal

3.4.2.1 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 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 27: 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

3.4.2.2 Risk x Portion Size Linear mixed model fit by REML. t-tests use Satterthwaite's method [lmerModLmerTest] Formula: grams ~ preFF + bmi + sex + age_yr + avg_vas + meal_order + risk_status_mom *

ps_prop + ps_prop2 + (1 | sub) Data: intake_long

REML criterion at convergence: 4382.4

Scaled residuals: Min 1Q Median 3Q Max -2.46072 -0.63028 -0.02866 0.51872 2.45116

Random effects: Groups Name Variance Std.Dev. sub (Intercept) 21515 146.68
Residual 7282 85.34
Number of obs: 361, groups: sub, 93

Fixed effects: Estimate Std. Error df t value Pr(>|t|) (Intercept) -103.324 276.800 93.319 -0.373 0.70979 preFF -0.327 0.216 328.851 -1.514 0.13098 bmi 30.568 13.189 86.990 2.318 0.02281 sexFemale -17.095 32.184 87.150 -0.531 0.59666 age_yr -10.125 25.934 87.608 -0.390 0.69718 avg_vas 39.907 15.146 347.225 2.635 0.00880 meal_order -4.537 4.091 263.153 -1.109 0.26847 risk_status_momHigh Risk -35.956 36.109 111.700 -0.996 0.32151 ps_prop 179.042 44.301 262.740 4.042 6.98e-05 ps_prop2 -96.886 41.880 263.171 -2.313 0.02147 risk_status_momHigh Risk:ps_prop -69.028 24.753 262.312 -2.789 0.00568

(Intercept)
preFF

bmi *
sexFemale
age_yr
avg_vas ** meal_order
risk_status_momHigh Risk
ps_prop ***ps_prop2***
risk_status_momHigh Risk:ps_prop — Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Correlation of Fixed Effects: (Intr) preFF bmi sexFml age_yr avg_vs ml_rdr rs_*HR ps_prp preFF -0.079 bmi -0.644 0.065*
sexFemale 0.004 0.023 0.031
age_yr -0.645 -0.025 -0.122 -0.093
avg_vas -0.201 0.116 -0.032 -0.049 0.026
meal_order -0.035 -0.028 0.003 0.000 0.013 -0.060
rsk_stts_HR 0.101 -0.085 -0.276 -0.119 0.087 -0.020 0.011
ps_prop -0.020 -0.051 -0.010 0.002 -0.003 0.041 -0.084 0.088
ps_prop2 0.013 0.048 0.012 -0.003 0.003 -0.062 0.117 -0.006 -0.931 rsk_st_HR: 0.009 0.068 0.002 0.002 0.000 0.031 -0.014 -0.344 -0.242 ps_pr2 preFF
bmi
sexFemale
age_yr
avg_vas
meal_order
rsk_stts_HR
ps_prop
ps_prop2
rsk_st_HR:_ 0.004

Unlike other models, none of the control variables were associated with broccoli intake.

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

Table 28: 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

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, 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).

4 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.

4.1 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.

4.2 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.