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# BMI of parents of 4th graders aligns with psychosocial and demographic factors but is stable over a year: Considerations for healthy weight intervention design and assessment

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## Background

Family and school environments are important in childhood obesity prevention, thus including parents and families in interventions is critical.

The *Fuel for Fun* (FFF) project is a theory-based multiple-component cluster-randomized controlled study conducted among 4th graders and their families to promote positive food and activity environments, policies and behaviors at the individual, family and school levels.<sup>1</sup> The impact of FFF on students' interest in cooking, fruit and vegetable preferences and activity levels<sup>2,3</sup> have been evaluated, however, its impact on parent weight outcomes is yet to be investigated.

Higher BMI is associated with higher risks of morbidity and mortality.<sup>4,5</sup> Weight fluctuations (cycling) is common among dieters or people with chronic diseases, and is suggested to pose more health risks, independent of obesity.<sup>6,7</sup> Similar to weight cycling, long-term weight change has been reported to increase risks for type 2 diabetes mellitus.<sup>8</sup> Thus, weight stability in adults is desirable to reduce health risks and consequences.

## Objective

Examine weight status over a 1-year period of northern Colorado parents, whose 4<sup>th</sup> graders participated in a randomized controlled trial of a school-based intervention focused on culinary and physical activity experiences.

## Methods

**Study design:** a cluster-randomized controlled trial  
**Intervention:** FFF is a year-long school-based, culinary-driven program for 4th graders that includes classroom cooking and tasting lessons, cafeteria, physical and family-based activities, as well as parent participation in online nutrition education. Student cohorts were designated as either control or FFF intervention.<sup>1</sup>  
**Trial registration:** Clinicaltrials.gov registration number NCT02491294. Registered 7th July, 2015 and study was approved by the Institutional Review Boards of RIT and CSU.

**Data collection:** Qualtrics online survey completed by intervention (n=205 parents) and control parents (n=205 parents) at baseline (beginning of child's 4th grade year) (BL, n=410), end of their child's 4th grade year (FU1, n=220) and beginning of 5th grade year (FU2, n=219).

**The survey included:**  
• Self-reported height and weight. Self-report height and weight has concordance with measured height and weight.<sup>9</sup>  
• Validated tools used to measure parent gender, age, education and ethnicity. Income status was defined as either worrying about money for food or using at least one nutrition assistance program.  
• Validated tools used to measure cooking and eating behaviors, attitudes, and psychosocial attributes:

• A 16-item eating competence (ecSI 2.0<sup>TM</sup>) tool with components on eating attitudes, internal regulation, food acceptance and contextual skills. Parents' satisfaction on current weight also assessed.<sup>10,11</sup>

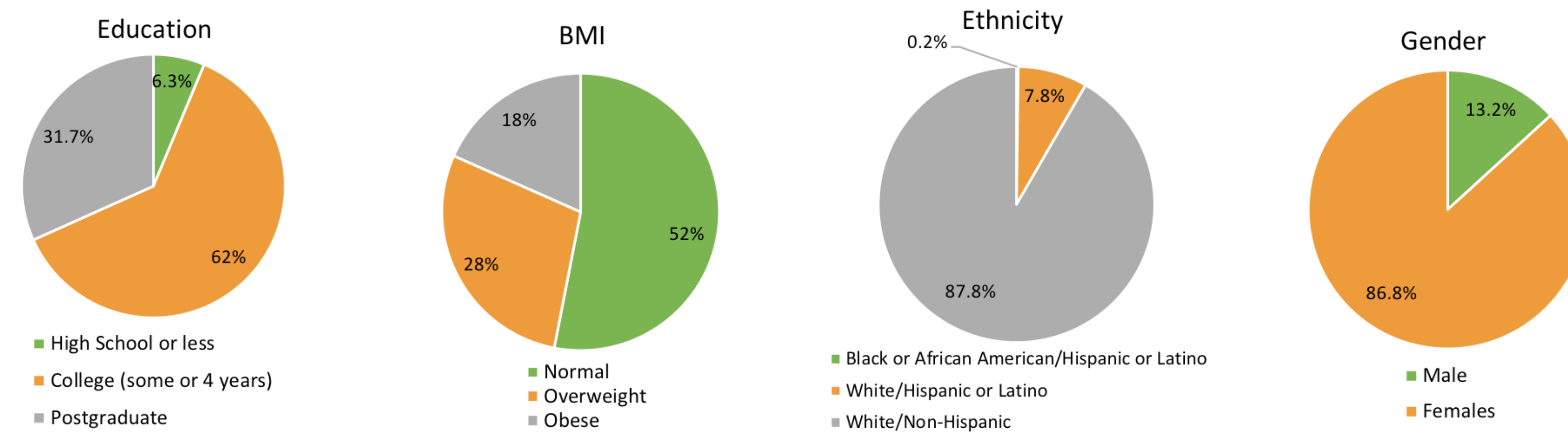
• In-home fruit and vegetable availability was assessed using a 20-items (fresh, frozen, canned fruits, vegetables and 100% juices) listed inventory. Availability was affirmed or denied.<sup>12</sup>  
• Parent perceived stress was measured using the visual analog scale from 0 (no stress) to 10 (extreme stress).<sup>13</sup>

## Analysis

- SPSS version 24 was used for all analyses.
- BMI was calculated using weight/height<sup>2</sup> ( kg/m<sup>2</sup>), and categorized as underweight, normal, overweight or obese.<sup>14</sup>
- Frequencies of gender, age, educational status, and BMI categories were computed.
- For weight satisfaction, five possible responses: 5\_very satisfied 4\_dissatisfied, 3\_neutral, 2\_satisfied and 1\_very dissatisfied, were indicated and frequencies calculated.
- In the 16-item ecSI 2.0<sup>TM</sup>, five responses scored from 3 to 0. Possible score 0-48; scores  $\geq 32$  indicate eating competence.<sup>11</sup>
- Fruit and vegetable availability was scored 0-20. Higher scores indicated more fruit and vegetable availability.<sup>12</sup>
- The number indicated in the visual scale represented parent's perceived stress level.<sup>13</sup>
- Sociodemographic and psychosocial factors differences in baseline BMI were examined using one way ANOVA, and partial correlations when controlling for gender.
- BMI stability was examined using General Linear Model with repeated measures and controlling for student cohorts, treatment groups, parents, gender and psychosocial factors.

## Results

### Background characteristics and baseline BMI



- Mean age was 39.2  $\pm$  5.9 years. Mean baseline BMI was 25.9  $\pm$  5.6 kgm<sup>-2</sup>
- Baseline BMI was similar among parent intervention groups (mean BMI for FFF group: 26  $\pm$  5.9 kgm<sup>-2</sup>; Control group: 25.6  $\pm$  5.2 kgm<sup>-2</sup>) (F=0.735; p=0.392).

**Table 1: Association of demographic factors and baseline BMI (n=405)**

	Number Parents (Percentage)	Mean Body Mass Index (BMI)
<b>Gender (n=403)</b>		
Male	53 (13.2)	26 $\pm$ 4.5
Female	350 (86.8)	25.8 $\pm$ 5.8
<b>Education Level**</b>		
High school or less	26 (6.4)	29.88 $\pm$ 9.05
College (some or 4 years)	249 (61.5)	26.29 $\pm$ 5.61
Postgraduate	130 (32.1)	24.24 $\pm$ 4.03
<b>Income level**</b>		
Not low income	266 (65.7)	25.04 $\pm$ 4.66
Low income	139 (34.3)	27.42 $\pm$ 6.85
<b>Physical activity (n=399)**</b>		
Yes	227 (56.0)	24.77 $\pm$ 4.95
No	70 (17.3)	24.81 $\pm$ 5.13
No response	42 (10.4)	29.32 $\pm$ 6.51
<b>Weight satisfaction (n=404)</b>		
Very dissatisfied	56 (13.8)	32.43 $\pm$ 7.67
Dissatisfied	137 (33.8)	27.12 $\pm$ 4.83
Neutral	92 (22.7)	24.49 $\pm$ 3.48
Satisfied	83 (20.5)	23.02 $\pm$ 3.11
Very satisfied	36 (8.9)	22.37 $\pm$ 6.31

\*\*p<0.001, SD is standard deviation  
From Table 1: Baseline BMI was higher in parents with lower educational level, lower-income and parents who did not indicate whether they were active or not (all P<0.05).

**Table 3: Correlations between Baseline BMI with Psychosocial and Food-related Behaviors**

Variable (mean score $\pm$ SD)	r
Fruit and vegetable availability (12.1 $\pm$ 2.6)	0.018
Eating competence (32.2 $\pm$ 8.0) **	0.293
Parent perceived stress level (6.6 $\pm$ 2.1) **	0.228

\*\* p<0.001, Partial correlations controlled for gender; SD is standard deviation.

**Table 2: Association of cooking attitudes and practices with Weight Status at Baseline (n=405)**

	Number Parents (Percentage)	Mean Body Mass Index (BMI)
<b>Attitudes towards cooking</b>		
I don't like to cook	40 (9.8)	24.71 $\pm$ 5.49
I don't mind cooking	163 (40.2)	26.64 $\pm$ 6.10
I like to cook	199 (49.1)	25.50 $\pm$ 5.21
<b>Cooking practices</b>		
<b>Think about healthy choices (n=404)**</b>		
Do not do/Seldom	7 (1.7)	25.01 $\pm$ 3.53
Sometimes	78 (19.3)	25.60 $\pm$ 6.0
Most of the time	200 (49.4)	27.84 $\pm$ 6.0
Almost always	199 (29.4)	26.15 $\pm$ 5.6
<b>Low-fat or healthy cooking (n=318)</b>		
No	78 (19.3)	26.47 $\pm$ 6.29
Yes	240 (59.3)	25.70 $\pm$ 5.62
<b>Home-style made from scratch (n=348)</b>		
No	45 (11.1)	25.98 $\pm$ 6.54
Yes	303 (74.8)	25.85 $\pm$ 5.6
<b>Gourmet upscale cooking (n=211)</b>		
No	158 (39.0)	25.76 $\pm$ 5.8
Yes	53 (13.1)	24.75 $\pm$ 4.7

\*\*p<0.001, one way ANOVA was used to test mean difference. SD is standard deviation.  
From Table 2: Baseline BMI was higher among parents who sometimes or most times think of healthy choices when cooking (P<0.05).

From Table 3: Baseline BMI was positively correlated with parents eating competence, and stress levels, (all P<0.05) while controlling for gender. Thus, baseline BMI was higher among parents with lower eating competence, and higher stress levels.

## Results

**Table 4: Change in Parent BMI class over the intervention period (n=162)\***

Baseline BMI (Normal n=92)		Baseline BMI (Overweight n= 44)		Baseline BMI (Obese n=26 )	
Change in BMI from Follow-up 1 to Follow-up 2	Frequency (%)	Change in BMI from Follow-up 1 to Follow-up 2	Frequency (%)	Change in BMI from Follow-up 1 to Follow-up 2	Frequency (%)
Normal & Normal	84 (91.2)	Normal & Normal	2 (4.5)	Normal & Normal	1 (3.8)
Normal & Overweight	3 (3.3)	Normal & Overweight	2 (4.45)	Normal & Overweight	0 (0.0)
Normal & Obese	0 (0.0)	Normal & Obese	0 (0.0)	Normal & Obese	0 (0.0)
Overweight & Normal	2 (2.2)	Overweight & Normal	1 (2.4)	Overweight & Normal	0 (0.0)
Overweight & Overweight	3 (3.3)	Overweight & Overweight	31 (70.5)	Overweight & Overweight	2 (7.8)
Overweight & Obese	0 (0.0)	Overweight & Obese	3 (6.8)	Overweight & Obese	1 (3.8)
Obese & Normal	0 (0.0)	Obese & Normal	0 (0.0)	Obese & Normal	0 (0.0)
Obese & Overweight	0 (0.0)	Obese & Overweight	2 (4.5)	Obese & Overweight	1 (3.8)
Obese & Obese	0 (0.0)	Obese & Obese	3 (6.8)	Obese & Obese	21 (80.7)

\*3 parents with underweight BMI are not included in the analysis.

- From baseline, 91% of parents with normal BMI maintained their normal BMI status, 71% of baseline overweight parents maintained their overweight status, and about 81% of baseline obese parents maintained their obese status.
- Parents with normal baseline BMI presented three patterns of change in BMI class over the study period, six patterns of change were observed for baseline overweight class and four patterns of change were observed among the baseline obese class. Thus, among all three baseline BMI classes the highest variability occurred among the overweight parents, although it was still relatively stable.
- Parent BMI remained stable over study period, even after controlling for student cohort, parent treatment groups, parent gender, sociodemographic and psychosocial behaviors.

## Conclusions and Recommendations

- Higher (BL) BMI is associated with lower education and income, lower eating competence, and higher stress.
- Weight change or fluctuations (cycling) increases risk for chronic diseases.<sup>6,8</sup> In this study, the parents of 4th graders had relatively stable BMI over the intervention period. However, numerous sociodemographic and psychological factors were associated with BMI status at baseline. No significant changes in parents' BMI classes from baseline to follow-up 2 were observed, although the most variability occurred among the overweight parents.
- About half of the parents had normal BMI and 91% of these parents maintained their BMI class. Because we observed a non-significant but higher variability in weight change patterns among parents with baseline BMI classified as overweight, overweight parents may be the priority group for healthy weight nutrition and physical activity interventions. Further research is however recommended to confirm this.

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## Funder



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