

A Social Media Peer Group for Mothers To Prevent Obesity from Infancy: The Grow2Gether Randomized Trial

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Abstract

Background: Few studies have addressed obesity prevention among low-income families whose infants are at increased obesity risk. We tested a Facebook peer-group intervention for low-income mothers to foster behaviors promoting healthy infant growth.

Methods: In this randomized controlled trial, 87 pregnant women (Medicaid insured, BMI ≥ 25 kg/m²) were randomized to the Grow2Gether intervention or text message appointment reminders. Grow2Gether participants joined a private Facebook group of 9–13 women from 2 months before delivery until infant age 9 months. A psychologist facilitated groups featuring a curriculum of weekly videos addressing feeding, sleep, parenting, and maternal well-being. Feasibility was assessed using the frequency and content of participation, and acceptability using surveys. Maternal beliefs and behaviors and infant growth were assessed at birth, 2, 4, 6, and 9 months. Differences in infant growth between study arms were explored. We conducted intention-to-treat analyses using quasi-least-squares regression.

Results: Eighty-eight percent (75/85) of intervention participants (42% (36/85) food insecure, 88% (75/85) black) reported the group was helpful. Participants posted 30 times/group/week on average. At 9 months, the intervention group had significant improvement in feeding behaviors (Infant Feeding Style Questionnaire) compared to the control group ($p=0.01$, effect size = 0.45). Intervention group mothers were significantly less likely to pressure infants to finish food and, at age 6 months, give cereal in the bottle. Differences were not observed for other outcomes, including maternal feeding beliefs or infant weight-for-length.

Conclusions: A social media peer-group intervention was engaging and significantly impacted certain feeding behaviors in families with infants at high risk of obesity.

Keywords: behavior change; infant; Internet; mHealth; prevention; social media

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Introduction

Child obesity is highly prevalent, begins early, and is associated with adverse health outcomes.^{1–4} National data show that nearly 10% of infants and toddlers have an elevated weight-for-length.⁵ Infants born to obese mothers, into poverty, and those belonging to certain racial/ethnic minorities are at even greater risk for childhood obesity.^{1,5–9} Recent studies suggest that rapid growth during the first 2 years is problematic; growth velocity as early as the first 4–6 months predicts obesity later in childhood and in adulthood.^{2–4,10–13}

Given these risks, the Institute of Medicine (IOM) prioritized research on early childhood obesity prevention.¹⁴ However, interventions tested thus far, both in pediatric offices and delivered to families at home, have had mixed results.^{15–25} A common theme among these studies is the need for a high level of engagement to improve outcomes. In addition, few studies have specifically addressed the needs of very low-income families whose infants are at high risk of becoming obese and whose families lack resources.²⁵ For these families, the focus of prevention interventions has been home visiting programs, which are generally effective, but labor intensive and costly to implement on a large scale.^{20–25}

Social media may be an ideal mode of delivery for interventions that are potentially scalable and meet the needs of mothers who have difficulty regularly attending in-person meetings outside of the home. Among young adults, the age group that includes most new mothers, 90% of Internet users use social media to connect with peers.²⁶ Access to intervention content on social media is facilitated by smartphones, owned by 92% of young adults in the United States.²⁷ Smartphones are widely used even among those with low income, who increasingly rely on them for Internet access.²⁸ In addition, social media facilitates peer interaction, a meaningful benefit since peer-based interventions foster connectedness and healthy behaviors among new mothers.^{29,30}

We developed Grow2Gether, a peer-group intervention for low-income mothers of infants, delivered through private Facebook groups and designed to foster behaviors associated with obesity prevention. The intervention curriculum was video based and informed by IOM and American Academy of Pediatrics (AAP) recommendations.^{14,31} A single-group pilot study of the intervention provided preliminary evidence of feasibility.³² The present article describes a randomized controlled trial (RCT) of Grow2Gether (ClinicalTrials.gov: NCT02037490), to examine its feasibility and acceptability on a larger scale and to test impact on behaviors. We hypothesized that the intervention would improve infant feeding practices, sleep, parenting, and maternal well-being.

Methods

Study Design, Recruitment, and Randomization

All mothers participating in this RCT were recruited from two high-volume, Philadelphia obstetric clinics from

March to August 2014. The study flow is shown in Figure 1. We used limited characteristics available in the medical record (e.g., weeks of gestation) to prescreen for potentially eligible women and then approached them during appointments to complete a screening questionnaire. To reach mothers of infants at high risk of obesity,^{6–8} we enrolled women who began pregnancy overweight or obese (body mass index (BMI) ≥ 25 kg/m²) and were Medicaid insured. Women were ≥ 18 years old and English-speaking, with a singleton pregnancy between 20–32 weeks of gestation at the time of enrollment. Eligible participants owned a smartphone with a data plan and were able to take photos and videos using the phone. Women with a major mental illness (e.g., schizophrenia) or other severe morbidity (e.g., renal failure) were excluded.

Following enrollment, there was a run-in period before randomization to allow time for recruitment of groups of women with similar due dates. During this period, participants received and responded to weekly text messages containing pregnancy advice. At 32 weeks, all participants who could be contacted by text message were randomized 1:1 to Grow2Gether or the control group. A randomly permuted randomization sequence with randomly varying block sizes of 2 and 4 was computer generated by the study statistician (Stata 14.0, College Station, TX); sealed, sequentially numbered security envelopes concealed treatment allocation from study staff involved in recruitment before enrollment. Neither the study team nor participants were blinded to group assignment.

All mothers provided written informed consent. The study was originally scheduled to end at infant age 6 months, but study procedures and outcome assessment were extended to infant age 9 months based on additional funding (no outcome data reviewed before extension). Participants continuing (80/85) completed an informed consent addendum. The Children's Hospital of Philadelphia (CHOP) Institutional Review Board (IRB) approved this study and served as the IRB of record for the University of Pennsylvania.

The Grow2Gether Intervention

Intervention participants joined a private Facebook peer group for mothers, focused on healthy parenting and infant growth. The intervention solely involved online group activities for 11 months (2 months prenatal to facilitate mothers' bonding before delivery, until infant age 9 months) with the exception of two in-person meetings (prenatally, for introductions and setting group ground rules, and at infant age 4 months). The development of this Social Learning Theory-based³³ intervention was described previously.³²

Four separate peer groups of 9–13 women were formed based on infant due date. Each group was facilitated by a psychologist specializing in obesity treatment and funded by the research study. Based on IOM obesity prevention recommendations,¹⁴ the curriculum included infant feeding practices (11 weeks), sleep (7 weeks), positive parenting (12 weeks total: 4 activity, 4 parenting expectations, 4 infant

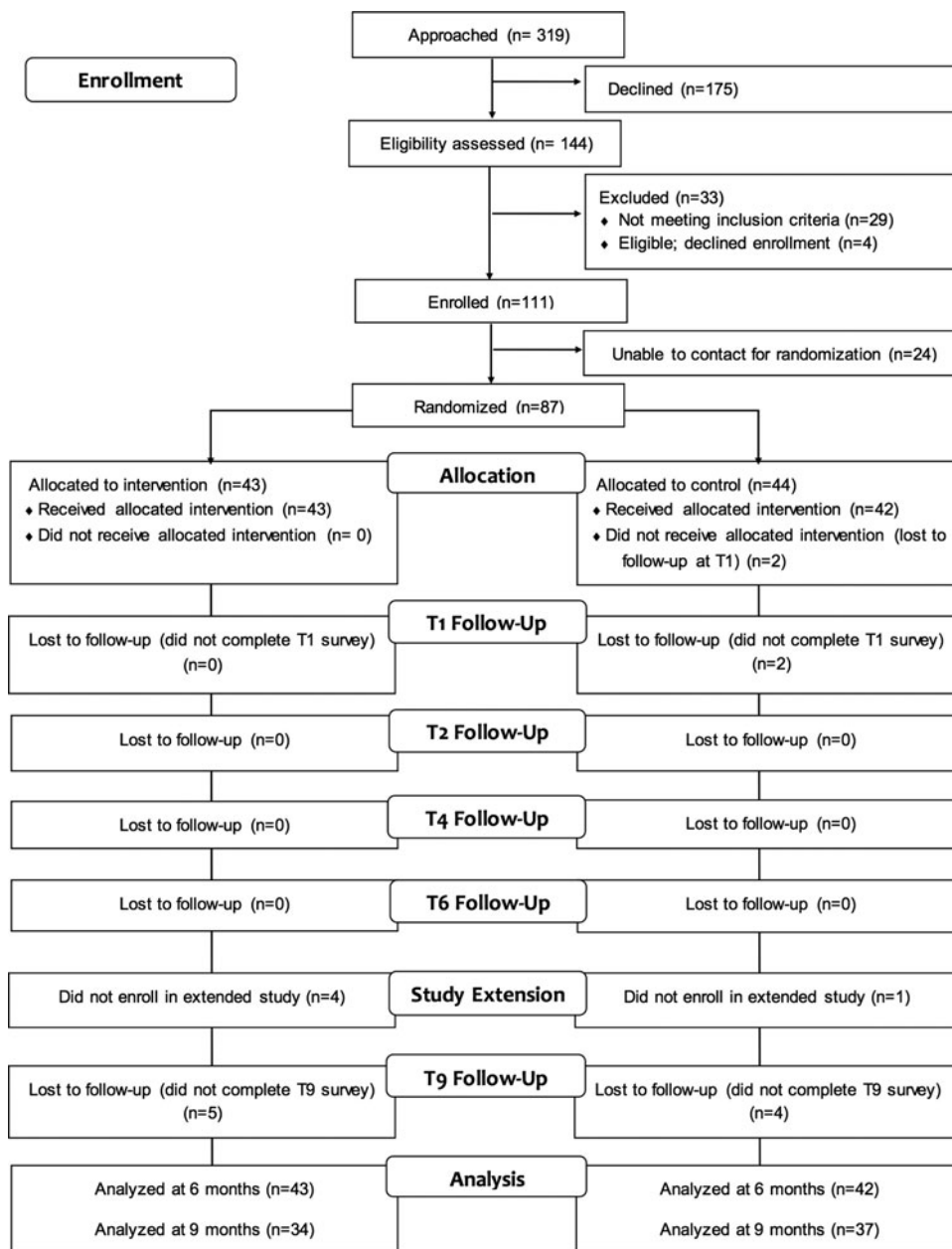


Figure 1. CONSORT diagram.

cues and calming), and maternal well-being (8 weeks) (Supplementary Table S1; Supplementary Data are available online at www.liebertpub.com/chi). Topics rotated between these four general content areas and were matched to infant developmental age.

The Facebook group was structured around a video-based curriculum and encouraged participant interaction. Short videos were posted to the group weekly from the start of the group through infant age 6 months, then bi-weekly. Videos featured mothers and infants (many from the same community as the participants) demonstrating behaviors and discussing topics related to healthy infant growth. Information presented in videos was also provided to the group in written posts and PDFs. Mothers responded

to the curriculum, discussing parenting topics and sharing photos, videos, and questions. Participants provided feedback on one another’s posts, and received feedback from the facilitator (e.g., positive reinforcement, examples of effective parenting behavior) and each other.

Several procedures were established to protect participant privacy and safety, including use of “secret” Facebook groups, which are invisible to outsiders. At enrollment, participants were informed that the confidentiality of anything they posted in the group could not be guaranteed and that the group was not for urgent medical needs. Groups were monitored multiple times a day and new posts were delayed until they were approved by study staff. The development of the privacy and safety plan has been described previously.³²

Mothers participated in groups as frequently as they desired. However, in the rare occasion that a participant did not view the group for 2–3 weeks, the facilitator sent her a private Facebook reminder message. Participants were required to post once in the group to begin receiving a monthly stipend of \$50/month to defray the cost of a phone data plan for the first 8 months and \$10/month for the final 3 months. Participants also received a total of \$95 for completing study measures. We reimbursed study-related travel.

Participants in both the intervention and control groups received text message reminders for recommended infant primary care visits. The control group received no additional intervention.

Outcome Measures

To assess feasibility, we measured and described participation using Facebook posts/comments per individual and per peer group. We defined active engagement at the group level as at least 2 posts/comments per group per day on average (excluding those by the moderator) based on pilot trial results.³² In addition, we collected study process data on recruitment (numbers screened, eligible, and enrolled), intervention implementation (number enrolled posting in the groups), and follow-up rates.

Surveys were used to measure acceptability and behavioral outcomes. Participants completed surveys at six time points: T0 (screening/enrollment), T1 (following birth of infant), T2, T4, T6, and T9 (infant ages 2, 4, 6, and 9 months, respectively). T6 and T9 were the primary study endpoints. Follow-up surveys were completed online using REDCap, a secure web application for building and managing online surveys and databases.³⁴ At screening/enrollment and in the rare case that a participant could not access an online follow-up survey, written surveys were provided and manually entered into REDCap using double data entry.

Acceptability was measured for intervention participants using Likert-scaled and open-ended questions at T2, T6, and T9. Survey measures of feeding-related behavioral outcomes assessed parental practices related to feeding, sleep, activity, and maternal well-being (described in results). The primary focus, maternal infant feeding practices, was measured using 10 relevant items from the Infant Feeding Style Questionnaire (IFSQ)³⁵ matched to intervention content.

Although evidence suggests that 9 months would be too early to observe differences in infants' weight status, we collected growth data as an exploratory outcome. Infants' weight and length at birth were obtained from medical records. At T2, T6, and T9, infants' weight and length were obtained by trained study staff members using duplicate measures on a calibrated digital scale and standard infantometer at CHOP primary care or research sites.³⁶

Covariates

Covariates measured at baseline included demographic characteristics, health literacy,³⁷ and household food security.³⁸

Analysis

We described participant characteristics, study processes, and acceptability survey responses. Representative quotes were selected from open-ended questions. We then used linear regression to identify participant characteristics associated with group participation.

We used intention-to-treat analysis for behavioral health outcomes. We first compared the intervention and control groups at baseline using two-sample t-tests, Wilcoxon rank sum tests, chi-square tests, and Fisher's exact tests as appropriate. Next, we used quasi-least squares (QLS) regression (Stata `xtqls` command³⁹), a form of generalized estimating equations, to compare outcomes between the treatment groups at each measurement.⁴⁰ QLS allows for implementation of the Markov correlation structure that is appropriate to model association in longitudinal data that are unequally spaced in time. QLS regression models for the outcome of interest included indicator variables (for intervention group and month of measurement) and intervention by month interaction terms (constructed as the product of the indicators for intervention group and month). We performed sensitivity analyses by adding food insecurity (the only variable that differed substantially between groups at baseline) to the QLS models; results were unchanged. We used the Stata `margins` command to obtain and plot fitted values (with 95% confidence intervals).

To provide sufficient statistical power, we specified an *a priori* sample size of at least 30 mother–infant dyads per study arm at each measurement time point. Power calculations done via simulation using PASS 11 software (NCSS, Kaysville, UT) and using a mixed effects model for analysis of simulated data suggested that with four measures per family over time, and assuming an autoregressive correlation structure with correlation parameters ranging from 0.5 to 0.8, power would range from 0.82 to 0.85 to detect a difference in study outcomes (*e.g.*, feeding behaviors) measured between treatments of 0.6 standard deviation.

Results

Study Population and Enrollment

Overall, of 319 women who were prescreened and approached, 144 were assessed for eligibility, 115 were eligible to enroll, and 111 enrolled in the study (Fig. 1). Eighty-seven pregnant women (43 intervention; 44 control) completed the run-in period and were randomized; 85 provided evaluable data. Participants had a mean age of 27 years and 88% (75/85) were black (Table 1). Seventy-eight percent (66/85) reported an annual household income under \$15,000, 66% (56/85) had a possibility or likelihood of limited health literacy, and 42% (36/85) were at risk of household food insecurity.

Feasibility of a Prevention-Oriented Peer Group

Demonstrating feasibility, all 43 intervention participants successfully joined and posted in their assigned Facebook group. Group members posted a mean of 30

Table 1. Participant Characteristics Measured at Enrollment

	Intervention group	Control group	Total
N	43 (100%)	42 (100%)	85 (100%) ^a
Age (years)			
Mean (SD)	25.8 (5.2)	27.3 (5.6)	26.5 (5.4)
Range	18–41	19–45	18–45
Race/ethnicity ^b N(%)			
Hispanic/Latina	2 (5%)	0	2 (2%)
Black/African American	36 (84%)	39 (93%)	75 (88%)
White	3 (7%)	2 (5%)	5 (6%)
Other (including Asian; American Indian/Alaska native)	3 (7%)	3 (7%)	6 (7%)
Education level N (%)			
Less than high school	9 (21%)	2 (5%)	11 (13%)
High school graduate	18 (41%)	25 (60%)	43 (51%)
Some college/associate degree	14 (33%)	14 (33%)	28 (33%)
Bachelor's degree or higher	2 (5%)	1 (2%)	3 (3%)
Employment status at enrollment N(%)			
Employed	20 (46%)	18 (43%)	38 (45%)
Stay-at-home parent	9 (21%)	8 (19%)	17 (20%)
Unemployed	14 (33%)	16 (38%)	30 (35%)
Annual household income N (%)			
Less than \$10,000	25 (60%)	29 (69%)	54 (64%)
\$10,000–\$14,999	8 (19%)	4 (10%)	12 (14%)
\$15,000–\$24,999	4 (9%)	5 (12%)	9 (11%)
≥ \$25,000	5 (12%)	4 (9%)	9 (11%)
Number of children before current pregnancy ^c N(%)			
0	8 (19%)	6 (15%)	14 (17%)
1–2	26 (62%)	25 (61%)	51 (61%)
≥3	8 (19%)	10 (24%)	18 (22%)
Social support ^d (N%)			
Living with partner	14 (33%)	14 (33%)	28 (33%)
Partner will help care for child	34 (79%)	38 (88%)	72 (84%)
At least one other person will help care for child	41 (95%)	43 (100%)	84 (98%)
Baseline health literacy ^e N(%)			
Adequate health literacy	14 (33%)	15 (36%)	29 (34%)
Possibility or likelihood of limited literacy	29 (67%)	27 (64%)	56 (66%)
Household food security ^f			
Food insecure	11 (26%) ^e	25 (60%) ^g	36 (42%)
Gestational age at birth (weeks) ^h			
Mean (SD)	38.8 (1.7)	38.7 (1.9)	38.8 (1.8)

^aTwo of 87 total participants (both assigned to the control group) were lost to follow-up before providing complete enrollment data.

^bParticipants were instructed to select all applicable categories; hence, the total is more than 100%.

^cNumbers do not add to total due to incomplete data.

^dCategories were asked separately and are not mutually exclusive.

^eMeasured using the newest vital sign.³⁷

^fMeasured using a validated 2-item household food security screener.³⁸

^gIntervention and control groups differed in rates of food insecurity at enrollment.

^hMeasured at birth, not at enrollment.

times per group per week, which is more than twice the rate of posting that we had defined as “active engagement” (an average of 2 posts/group/day, or 14/week). Although individual engagement varied by group, these differences were not significant [Group 1: median 2.3 posts or comments per individual per week, with IQR 0.6–3.3, Group 2: 2.3 (1.9–6.8), Group 3: 1.5 (1.0–2.5), Group 4: 3.6 (2.5–4.4)]. In regression analyses, individual participation was inversely associated with weight-for-length z-score ($p=0.007$), but not other parent or child characteristics.

Posts included questions, information, photos, videos, and support or feedback in response to other participants. Mothers used the group to support and encourage each other’s healthy behaviors (Fig. 2). They frequently discussed curriculum topics, both in response to curriculum prompts and independently initiated. These included conversations about feeding (63 total conversations across all groups; 31 of which were mother initiated, as opposed to moderator initiated), infant sleep (29 total, 9 mother initiated), infant activity (40 total, 12 mother initiated), and maternal well-being (51 total, 19 mother initiated). More than 99% of posts centered on infant- and parenting-related topics, while a small number were unrelated, such as humorous videos.

Participants were most active in the groups around the perinatal period. During the prenatal curriculum (7 weeks), there were 1953 participant posts across the 4 groups; then 1802 from 0 to 3 months postnatal, 1074 from 3 to 6 months, and from 6 to 9 months, when curriculum content was posted less frequently, there were 553.

Acceptability

Demonstrating acceptability, when mothers were asked, “What do you think of the peer group?” all responses were positive; most described the group as “helpful” or “fun.” Eighty-eight percent of Grow2Gether participants responded “agree” or “strongly agree” on a Likert scale to the statements, “I would recommend this program” and “The program was helpful.” Mothers appreciated the peer-group approach (“I think it’s helpful because the advice is coming from other mothers like myself.”). When asked about the group facilitator, responses were consistently positive (“...she is a big help and very involved and supportive. I love it.”) When asked, “What could be improved about the group?” 60% (25/42) responded “nothing,” while 24% (10/42) suggested additional in-person meetings.

Behavioral and Health Outcomes

Infant feeding. Mothers in the intervention group reported significantly healthier infant feeding behaviors. At 9 months ($n=71$), mothers in the intervention group had higher IFSQ healthy feeding behavior scores (10 items; $\alpha=0.70$) compared to the control group ($p=0.01$, effect size 0.45) (Table 2 and Fig. 3) and were less likely to pressure their child to finish food ($p=0.02$, effect size 0.47). At 6 months ($n=85$), mothers in Grow2Gether were less likely to feed their infant cereal in the bottle ($p=0.03$,

effect size 0.60). At 6 and 9 months, there were no differences between the control and intervention groups in infant feeding *beliefs* on the IFSQ or the timing of solid food introduction. These outcomes did not differ between the four peer groups.

Infant sleep. No significant differences between groups were observed on measures of infant sleep, including sleep duration (mean 8.5 hours per night in both groups at 9 months), consistent bedtime routines, and whether mothers perceived their child’s sleep to be a problem (Table 2).

Infant activity. Infants in the control and intervention groups had similar amounts of screen time (mean 1.7 hours per weekday across both groups at 9 months) and household television use. The groups also did not differ on infants’ age at initiation of regular “tummy time” (Table 2).

Maternal well-being. Although some intervention participants reported on surveys and in Facebook posts that they felt supported by the group, participation did not translate into measurably higher scores on the Maternal Scale of Perceived Social Support (MSPSS)⁴⁴ (Table 2), which measures support across the categories of friends, family, and significant other. Other measures of maternal well-being (including self-care behaviors, stress,⁴⁵ and parenting self-efficacy⁴⁶) did not differ significantly between the intervention and control groups.

Infant growth (exploratory outcome). Infants in both groups significantly increased in weight-for-length z-score over the course of the study (Fig. 4). There were no significant differences between the control and intervention groups in infant weight-for-length or weight-for-length z-score at any time point.

Discussion

The literature includes few strategies for effectively preventing obesity among infants. The Grow2Gether intervention proved to be a feasible and acceptable method of engaging low-income mothers in a peer intervention with impact on feeding behaviors, a primary intervention target. All participants assigned to the intervention successfully joined, posted in their peer group, and interacted frequently compared to other social media peer interventions in the literature.^{32,47–49} Nearly all had positive feedback on Grow2Gether. The intervention group’s feeding behaviors significantly improved compared to the control group; intervention group mothers were less likely to pressure infants to finish food or put cereal in the bottle. No differences were observed between intervention and control groups for other behavioral outcomes or the exploratory outcome of infant growth.

To our knowledge, Grow2Gether is the first intervention to target infant feeding behaviors in very low-income mothers of infants using Facebook. Of the small number of

Grow2Gether!

Grow2Gether - May/June Group
 Secret Group

Joined ▾ ✓ Notifications ...

Discussion Members Events Photos Files

▼

August 8, 2014

Hey mommies

So me and [REDACTED] are learning as a team to breast feed. It was rough these last few days. Especially last night. My milk came in completely around 3am. And my boobies were hurting so bad and it was time to feed [REDACTED]. I cried so bad because I didn't want to feed. I felt so bad. But I latched her on anyway and it felt so much better afterwards. Today we had a great day she's latching on perfectly and she getting her feed on lol. How are you ladies doing with feeding?

👍 Like 💬 Comment

[REDACTED] and 4 others

✓ Seen by 13

[REDACTED] Keep up the good work!!!! In the beginning I felt like all I did was feed my baby, it was like breastfeeding was consuming my life lol. But overall I'm glad I stuck in there because [REDACTED] is now 6weeks old and we're doing great with the feedings. He has finally mastered latching on.

August 8, 2014 at 8:23pm · Like · 👍 4

[REDACTED] It's been getting better each feeding.

August 8, 2014 at 9:15pm · Like · 👍 4

[REDACTED] Aww I'm so proud of you both! Stay positive and know it gets better! This is a challenge but as you see she is latching and doing her thing!

August 8, 2014 at 9:37pm · Like · 👍 2

[REDACTED] [REDACTED] I feel the same exact way I feel like all I do is feed every moment! but her diapers aren't dirty which worries me. At first feeding was simple then our first night home was terrible! I had dad run to CVS in the middle of the night to buy nipples because I was SOO CLOSE to quitting and giving her formula. [REDACTED] and I are starting to get a system going so I'm becoming more positive.

August 8, 2014 at 9:42pm · Like · 👍 2

[REDACTED] I'm glad your milk came in. That I think is the toughest part when that is going slow.

August 8, 2014 at 9:43pm · Like · 👍 1

[REDACTED] Just keep your system going and don't quit. I'm already 6weeks in and now that I think back to all the pain and engorgement, I feel like it was all worth it! In 3weeks you'll be a pro at breastfeeding 😊

August 8, 2014 at 9:45pm · Like · 👍 1

Figure 2. Participant-initiated conversation about breastfeeding. All comments are from participating mothers, not the facilitator. Participant information redacted.

Table 2. Health and Behavioral Outcomes

Outcome Measure	Month 6				Month 9				Fitted SD ^b
	Intervention N = 43	Control N = 42	Effect size (CI) ^a	Intervention N = 34	Control N = 37	Effect size (CI) ^a			
Feeding									
Infant feeding total score (10 IFSQ items): ^c Mean	40.1	39.1	—	40.7	38.2	0.45 (0.01,0.92)		5.7	
IFSQ 1. I let my child decide how much to eat. Mean	3.6	3.4	—	3.5	3.1	—		1.4	
IFSQ 2. I pay attention when my child seems to be telling me that s/he is full or hungry. Mean	4.9	4.9	—	4.7	4.8	—		0.4	
IFSQ 3. I allow my child to eat when s/he is hungry. Mean	4.7	4.7	—	4.6	4.7	—		0.7	
IFSQ 4. When s/he got fussy, was feeding him/her the first thing you would do? Mean	3.2	3.2	—	3.6	3.1	—		1.2	
IFSQ 5. To make sure s/he did not get fussy, did you feed him/her even if you did not think he was hungry? Mean	4.0	4.0	—	4.2	4.2	—		1.2	
IFSQ 6. I try to get my child to finish his/her food. Mean	3.4	3.3	—	3.4	2.8	0.47 (0.06,0.88)		1.4	
IFSQ 7. If my child seems full, I encourage him/her to finish his/her food anyway. Mean	4.5	4.6	—	4.7	4.2	—		1.0	
IFSQ 8. I try to get my child to finish his/her breast milk or formula. Mean	3.5	3.4	—	3.6	3.4	—		1.5	
IFSQ 9. I try to get my child to eat even if s/he seems not hungry. Mean	4.5	4.5	—	4.5	4.4	—		1.0	
IFSQ 10. I give/gave my child cereal in the bottle. Mean	3.9	3.1	0.60 (0.09,1.17)	4.1	3.5	0.52 (0.04,1.03)		1.2	

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Table 2. Health and Behavioral Outcomes continued

Outcome Measure	Month 6			Month 9			Fitted SD ^b
	Intervention N = 43	Control N = 42	Effect size (CI) ^a	Intervention N = 34	Control N = 37	Effect size (CI) ^a	
Feeding beliefs (IFSQ 10-item total score). ^d Mean	26.0	26.5	—	23.9	26.8	—	5.1
Ever breastfed infant (yes/no) Yes N(%)	34 (79.1%)	34 (81.0%)	—	—	—	—	—
Exclusively breastfeeding (yes/no) Yes N(%)	4 (9.3%)	2 (4.8%)	—	—	—	—	—
Age (months) at introduction of solid foods. Mean	—	—	—	5 ^e	5	—	—
Age (months) at first sugar sweetened beverage. Mean	—	—	—	7 ^e	7	—	—
Sleep^f							
Nighttime sleep duration, hours. Mean	8.1	7.9	—	8.5	8.5	—	2.0
How often child has same bedtime routine, number of days per 7-day week. Mean	5.5	5.4	—	5.7	5.9	—	1.6
Do you consider your child's sleep as a problem? Yes (N%)	9 (20.9%)	3 (7.1%)	—	2 (5.9%)	4 (10.8%)	—	—
Activity							
Infant average weekday screen time, ^g hours. Mean	1.9	1.4	—	1.7	1.7	—	1.5
Household average daily TV use, ^g hours. Mean	7.3	6.8	—	6.0	5.5	—	5.4
Age infant started "tummy time," months. Mean	2.5	2.8	—	—	—	—	1.5
Maternal self-care and well-being							
Maternal self-care behaviors ^h							
I try to sleep or rest when my baby is sleeping. Mean	2.3	2.8	—	—	—	—	1.2

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Table 2. Health and Behavioral Outcomes continued

Outcome Measure	Month 6			Month 9			Fitted SD ^b
	Intervention N = 43	Control N = 42	Effect size (CI) ^a	Intervention N = 34	Control N = 37	Effect size (CI) ^a	
	I make time to do things I enjoy every week. Mean	2.1	2.1	—	—	—	
How many times per week are you physically active for 30 minutes or more at a time? Mean	2.2	2.0	—	—	—	—	1.2
Perceived social support score, ⁱ Multidimensional Scale of Perceived Social Support Mean	66.1	68.1	—	—	—	—	18.1
Parental stress score, ^j Parental Stress Scale. Mean	30.2	29.6	—	—	—	—	10.8
Parenting self-efficacy score, ^k Karitane Parenting Confidence Scale. Mean	41.9	40.6	—	—	—	—	5.4

^aPresented where significant ($p < 0.05$). The effect size was estimated using the fitted means and standard deviations (SD) from the QLS models. The 95% confidence intervals (CI) are bootstrapped percentile confidence intervals.

^bIf outcomes were measured at both months 6 and 9, the SD shown is the fitted SD from the QLS models. If measurements were not available at month 9, then the pooled estimate of the SD is provided.

^cThe infant feeding total score (sum of 10 relevant IFSQ³⁵ items) was the primary feeding outcome. Fitted means and SDs are shown for individual IFSQ items to provide additional detail. Each individual item had Likert-style response categories ranging from 1 (never) through 5 (always). Items 4–10 scores have been reverse coded, so that higher scores on all items as shown indicate a more desirable response. The total infant feeding score could take value between 10 and 50.

^dPossible values for IFSQ³³ infant feeding beliefs total score ranged from 10 to 40, with higher scores indicating beliefs more consistent with medical evidence.

^eThe median time until introduction of solid foods and sweetened beverages was estimated using the Kaplan–Meier product-limit estimate of the survivor function.

^fMeasured using items from the Brief Infant Sleep Questionnaire.^{41,42}

^gMeasured using items adapted from the Infant and Toddler Home Observation for Measurement of the Environment measure.⁴³

^hEach maternal self-care item could take value between 0 (never), 1 (rarely), 2 (sometimes), 3 (often), and 4 (always).

ⁱThe Multidimensional Scale of Perceived Social Support⁴⁴ is a validated scale consisting of 12 items that range from 1 (very strongly disagree) to 7 (very strongly agree); potential score range is from 12 (low perceived social support) to 84 (high perceived social support).

^jThe Parental Stress Scale⁴⁵ is a validated 18-item scale using a 5-point Likert rating scale (“strongly disagree” to “strongly agree”); potential values range from 18 to 60, with higher scores indicating greater stress.

^kThe Karitane Parenting Confidence Scale⁴⁶ is a 15-item validated scale assessing the frequency of certain beliefs, skills, and abilities related to successful parenting, with item responses from 0 (No, hardly ever) to 3 (Yes, most of the time) producing a scale score range of 0–45, with higher scores indicating greater parenting self-efficacy.

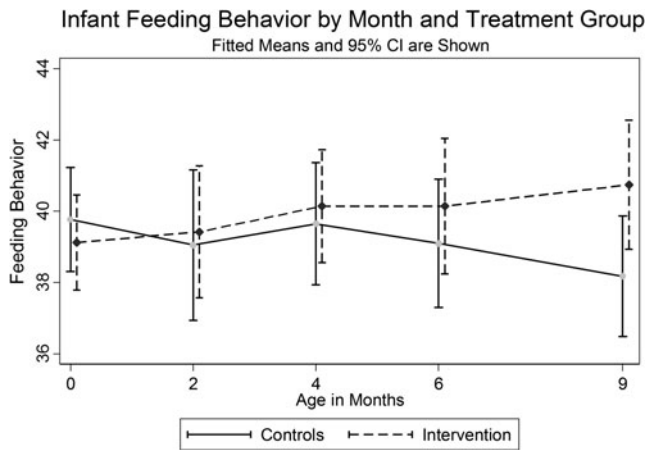


Figure 3. Infant feeding behavior by month and treatment group.

studies that previously addressed obesity-related behaviors with mothers of high-risk infants, all were in person and three involved home visits. A Baltimore study found that mothers were less likely to introduce solid food by 3 months of age after a series of home visits from peer mentors.²³ In Chicago, community doulas provided 22 weekly home visits and telephone support beginning prenatally, and participating mothers breastfed longer and were less likely to introduce solid foods by infant age 4 months.²⁴ Similarly, an Australian intervention resulted in later introduction of solid foods following eight home visits by a community nurse with telephone support.²⁰ A fourth study, using only a single group session through the Women, Infants, and Children (WIC) Program, had no impact on feeding behaviors.¹⁸ Finally, guidance on maternal and infant nutrition delivered by pediatricians at well child visits resulted in mothers feeding less juice at age 1 year.¹⁹

The mothers in the intervention group showed improvements in feeding behaviors, including significantly reduced pressuring of infants to finish food, a change associated with reduced obesity⁵⁰⁻⁵⁴; we found no differences in sleep, positive parenting (including activity), or maternal well-being between the groups. Other studies among mothers of infants have had mixed results for these outcomes.^{16,20,22,55}

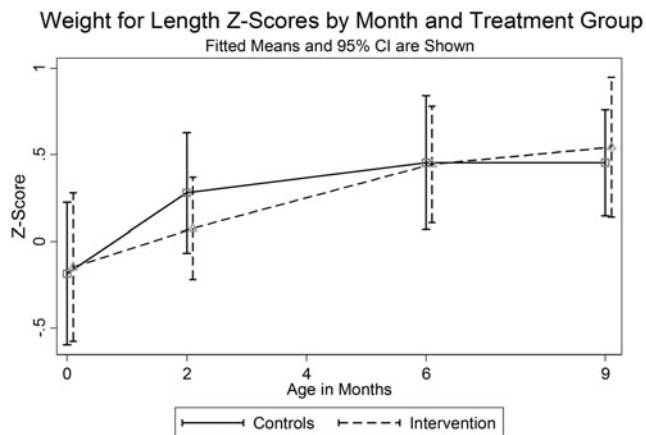


Figure 4. Weight-for-length z-score by month and treatment group.

Our findings may reflect the curriculum design, which addressed feeding more (11/44 weeks) than other measured outcomes. In addition, discussions of feeding behaviors may have resonated most strongly with participants. Previous work by our team found that, among these topics, feeding was prioritized highest as an obesity prevention strategy by mothers similar to those in Grow2Gether.⁵⁶

The results of this study suggest that social media peer groups may be an effective way to engage low-income families whose children are at high risk for obesity. Our finding that all participants joined a group and that participants posted frequently in all groups underscores the feasibility and acceptability of using social media to deliver peer-group interventions to low-income and low-health-literacy groups. Posts were nearly all curriculum related with >99% of posts related to parenting. Although few comparable studies exist, levels of participation in our study were higher than reported elsewhere and the present study was unique in targeting multiple behavioral outcomes related to infant growth.⁴⁷⁻⁴⁹ To compensate participants for the costs of data plans, we provided a monthly incentive. However, these incentives only required a single post at the start of the group; ongoing participation was not required to continue receiving the incentive. That posts continued at a high level suggests that the incentive itself did not drive overall participation. Nonetheless, it is possible that some participants might not have joined without the incentive.

Given the intervention’s modest impact on feeding behaviors and lack of effect on feeding beliefs and other behaviors, complementary strategies may be needed to effectively promote the adoption of obesity prevention behaviors. Further study is needed to know if home visits, proven effective at preventing infant obesity in a middle-income group,^{15,57} might be synergistic with Grow2Gether, which benefits from the efficiency of online interactions. In the future, social media-based interventions such as Grow2Gether also could be paired with existing home visitation programs, such as Early Head Start or other obesity prevention interventions to maximize impact. In addition, with many mothers wanting additional in-person meetings, more “live” sessions added to the virtual curriculum might bolster outcomes.

This study has several limitations. Grow2Gether was implemented with a very low-income, low-literacy population in a single urban area. As such, it is unclear how it would be received by mothers with different characteristics or from other regions. In addition, study participants (both intervention and control) were limited to women who consented to eligibility screening and responded to text messages at the end of the run-in period; these individuals may have been more easily engaged than others in the general population. Groups were all moderated by one psychologist. Although mothers uniformly found her role helpful, it is not clear how much our results depended on her facilitation style, or whether similar results could be achieved by a facilitator with a lower level of professional training. Social desirability bias may have influenced participants’ self-reported behaviors. Finally, our measures of group engagement captured only

participants' posts and comments in the group, not "likes" or views, which may have caused us to underestimate group engagement for some.

Conclusion

A social media intervention resulted in high engagement and modestly improved feeding behaviors in a high obesity risk, low-income population. Future research should address strategies to maximize impact on behaviors associated with healthy growth. Based on our results, the Grow2Gether methodology may hold promise as an approach to influence health behaviors in high-risk populations.

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Author Disclosure Statement

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