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Participant Perspectives on a Food Is Medicine Intervention for Gestational Diabetes Prevention: A Mixed-Methods Pilot Study Full Names of

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Abstract

Introduction: Gestational diabetes mellitus (GDM) affects 6–9% of U.S. pregnancies, disproportionately impacting women with obesity, low socioeconomic status, and certain racial/ethnic backgrounds. Food Is Medicine (FIM) programs embed food provision within clinical care but remain scarce for Medicaid-enrolled pregnant women at GDM risk. A prototype FIM intervention (MANGO) was feasible, acceptable, and well-received among at-risk pregnant women, though nutrition education materials were underutilized and cultural/literacy barriers limited engagement for some participants.

Methods: This mixed-methods, human-centered design pilot tested four food box types (meal kits, prepared meals, hybrid boxes, whole-food groceries) delivered weekly over 8 weeks to 10 Medicaid-eligible pregnant women in Texas and the Northeast U.S. Data included baseline/follow-up surveys (n = 7) and semi-structured interviews (n = 5), analyzed descriptively and thematically.

Results: Most participants reported easier healthy eating, increased fruit/vegetable intake, and cost/time savings; 85.7% rated the program 10/10 for recommendation likelihood. Fresh produce was most valued; prepared meals showed mixed acceptability due to cultural fit. Qualitative themes included enrollment ease, underused nutrition education, literacy/language barriers, and limited understanding of GDM risk rationale.

Conclusions: Strengths include participant-informed design process conducted across two geographically and demographically distinct U.S. regions prior to a full-scale trial. Limitations include small sample size, single-coder qualitative analysis, and language constraints during interviews. Findings suggest future FIM trials should incorporate culturally tailored foods, simplified/multilingual education, clearer risk communication, and post-program support.

MANGO demonstrates feasibility and acceptability of FIM for GDM prevention, informing design of a future fully powered randomized controlled trial.

Clinical trial number: not applicable

BACKGROUND

Gestational diabetes mellitus (GDM) is one of the most common medical complications encountered during pregnancy, affecting an estimated 6% to 9% of pregnancies in the United States, with prevalence rising over the past two decades (1–3). First diagnosed in pregnancy, GDM refers to a glucose intolerance that augments risk of severe maternal and child health outcomes such as pregnancy-related hypertension, early delivery, macrosomia, and stillbirth (4, 5). Further out, GDM increases the mother's likelihood of developing type 2 diabetes and cardiovascular disease as well as increasing the child's risk for developing obesity and glucose intolerance (5). Risk is not distributed evenly: pre-pregnancy obesity, advanced maternal age, family history of diabetes, multiple gestation, low socioeconomic status, and

membership in certain racial and ethnic groups (such as Pacific Islanders, South or East Asian populations, and Hispanic) each increase the chance of developing GDM (6–11).

A first-line strategy for preventing and managing GDM includes lifestyle modifications, such as dietary change, weight management, and physical activity. Lifestyle modifications, such as diet and exercise, are often sufficient to achieve glycemic control in many women diagnosed with the condition (12). Evidence increasingly supports intervening early. In a randomized trial, immediate treatment of hyperglycemia detected before 20 weeks of gestation led to modestly improved neonatal outcomes compared to deferring treatment until routine screening at 24–28 weeks (13). Specifically, diet-focused interventions have shown reductions in developing GDM (14, 15). Yet, most existing programs rely on individual counseling or education rather than directly addressing the cost, access to healthy food, and time barriers that often stand between at-risk women and a healthier diet during pregnancy (16, 17).

Food Is Medicine (FIM) programs, which embed the direct provision of food (through mechanisms such as medically tailored meals, produce prescriptions, or medically tailored groceries) within clinical care, have emerged as a promising complement to conventional lifestyle counseling. FIM approaches are premised on the idea that improving diet quality requires addressing consistent healthy food access and affordability directly rather than relying solely on education. While FIM programs have shown to have positive impacts on diet quality and food security, FIM programs designed specifically for pregnant women on Medicaid at risk for GDM remain scarce (18). However, before such a program can be tested for efficacy to reduce GDM risk in a full-scale trial, its content, format, and delivery need to be shaped by the perspectives of the women who would use it. This is the main idea behind human-centered design (HCD), which treats the intended user's lived experience as central to intervention development.

Our paper presents the design, implementation and findings of a formative evaluation conducted using a HCD approach preceding a planned randomized controlled trial of a FIM intervention titled *Moms Accessing Nutritious Groceries for Overall wellbeing (MANGO)* for GDM prevention among at-risk pregnant women in Texas and New England region (northeast United States).

METHODS

Study Design

This is a mixed-methods descriptive and qualitative HCD pilot study meant to inform the design of a future, fully-powered FIM trial for prevention of GDM among at-risk pregnant women on Medicaid.

A small group of pregnant women at elevated risk for GDM received a prototype FIM intervention and were subsequently interviewed about their experience. Semi-structured interviews were used to explore participants' experience with study enrollment and recruitment, quantity, quality, and cultural relevance of the food and meals received, food delivery process, and any resulting changes to eating habits. Interviews also elicited participant recommendations for improving intervention. This paper reports the qualitative findings from that pilot.

The study was approved by the UTHealth Houston Institutional Review Board (HSC-SPH-25-0800). The study was conducted over 12 months starting July 2025-June 2026.

Setting and Participants

Participants were recruited from Austin, Texas, and the Northeast US in fall 2025. Clinical partner site in Austin, Texas, included a CommUnityCare clinic. In the Northeast, participants were recruited from clinics affiliated with Tufts Medical Center, Lowell General Hospital, and MaineHealth. Recruitment strategies included flyers posted in outpatient clinic waiting rooms, in-person outreach, and outreach to clinicians familiar with the study's eligibility criteria. Eligible participants were pregnant, Medicaid-eligible or enrolled in Medicaid, presented for prenatal care at or before 14 weeks of gestation, and met clinical criteria for early GDM risk (overweight or obese body mass index plus at least one additional recognized risk factor, consistent with American College of Obstetricians and Gynecologists' guidance on early diabetes screening) (19). Women with a pre-existing diagnosis of type 2 diabetes, a hemoglobin A1c of 7% or higher, or a current prescription for insulin or metformin at intake were not eligible.

FIM Intervention pilot test:

As part of our formative testing, we were testing four differing types of FIM intervention approaches: 1) ready-to-prepare medically-tailored meal kits (pre-chopped ingredients), 2) ready-to-heat-and-eat pre-prepared medically-tailored meals (MTM) 3) MTM plus healthy pantry staples (fruits, whole grains, lean protein), and 4) Medically-tailored whole food packages (produce + staple foods that matched ingredients on provided recipe cards), each curated to align with prenatal nutrition guidance. The participating 10 women were randomly assigned to receive each of these boxes delivered weekly at home in varying order for two weeks each. Each box was paired with nutrition education delivered through a bank of online recipes sent via text.

Box order was randomly assigned, stratified by site, using a two-arm delivery schedule (Schedule A vs. Schedule B) in a web-based randomization scheme (Table 1). This schedule governed the sequence in which the four box types were delivered, as a way of guarding against the possibility that a box's position in the sequence could influence participants' acceptability ratings.

Table 1
Food Box Types and Contents

Delivery Type	Food Included	Schedule A	Schedule B
Company A's Groceries	15–18 lb produce + staple foods	Delivery 1	Delivery 3
Company A's Medically Tailored Meals + Produce	14 pre-prepared MTMs + 10–12 lb produce	Delivery 2	Delivery 4
Company B's Food Box	Produce + staple goods	Delivery 3	Delivery 1
Company A's Meal Kits	produce + staple foods, 8 servings	Delivery 4	Delivery 2

Quantitative Methods

Data Collection

Participants completed a baseline questionnaire at enrollment and a follow-up questionnaire two weeks after the final food delivery; both were administered electronically via REDCap. The baseline questionnaire captured sociodemographic characteristics (age, race/ethnicity, primary language, education, employment status, annual household income, household size, number of children in the household and food insecurity); past 30-day intake of index foods, overall mental health and well-being, and previous usage of meal kit service or online grocery delivery. The follow-up questionnaire assessed perceived ease of healthy eating during the intervention, the degree to which the food boxes helped meet household food needs, participant rankings of their preference of the four food box types, preferred program length, program suggestions, likelihood of recommending the program (0–10 scale), preference for meal kits versus groceries, food insecurity, cooking behaviors, past 30-day intake of index foods, and mental health and well-being.

Data Analysis

Given the small sample size (n = 10 enrolled; n = 7 completing follow-up) and that the results would be used primarily to inform future FIM intervention design, analyses were descriptive only (Table 2). Continuous variables (e.g., age, household size) are reported as medians with interquartile ranges (IQR); categorical variables are reported as frequencies and percentages. No inferential statistical comparisons were performed between delivery schedule arms, as the pilot was not powered for such comparisons and box order was not intended as a substantive study grouping. All analyses were conducted in R (R Core Team, 2022).

Qualitative Methods

Codebook Development

An initial coding framework was developed based on major domains included in the semi-structured interview guide, including recruitment and enrollment experiences, food access challenges, intervention experiences, dietary and household behavior changes, nutrition knowledge, use of educational resources, and opportunities for program improvement. The full interview guide is available in the **Supplementary Materials**.

Data Collection

Semi-structured interviews were conducted virtually by two trained members of the project team. Interviews were offered in English or Spanish, based on participant language preference, and lasted approximately 30 to 60 minutes. The interview guide explored participants' experiences with the study enrollment process, food box quality and delivery, food box engagement, dietary changes since program participation, and suggestions for program improvement. All interviews were recorded and transcribed, and when needed, translated into English. Upon interview completion, participants received a $50 gift card as compensation for their time.

Data Analysis

Interview transcripts were analyzed using thematic and content analysis. The transcripts were reviewed and coded systematically; codes were initially generated by one investigator and were subject to in-depth review and revision by a team of four other investigators. Codes were then grouped into broader themes reflecting participants’ experiences with the intervention. Representative quotations were selected to illustrate key findings and themes.

RESULTS: Quantitative

Participants

A total of 10 participants were enrolled in the MANGO pilot study. While all 10 participants completed baseline demographic and enrollment data collection, seven completed the follow-up survey conducted two weeks after the last food delivery, approximately 10 weeks after baseline.

Demographics

Baseline characteristics of the 10 enrolled participants are summarized in Table 1. Median age was 28.0 years (IQR: 26.3–35.3). Eight of 10 participants identified as belonging to a racial or ethnic group historically underrepresented in research (American Indian/Alaska Native, Asian, Black or African American, Native Hawaiian, Other Pacific Islander, or Hispanic/Latino). Seven participants identified English and three identified Spanish as their primary language on the survey. Fifty percent of participants reported an annual household income below $15,000, and 60.0% were enrolled in WIC or SNAP at baseline.

Table 1
Demographics and Baseline Characteristics of Enrolled participants, n = 10

Characteristic	**Overall, N = 10**
Age, median [IQR]	28.0 [26.25, 35.25]
Race/ethnicity,* n (%) – Underrepresented group	8 (80)
Primary language, n (%)	
English	7 (70)
Spanish	3 (30)
Education, n (%)	
High school/GED	5 (50)
Greater than high school	3 (30)
Not reported	2 (20)
Employment, n (%)	
Employed (full/part time)	4 (40)
Out of work (< 1 year)	2 (20)
Out of work (> 1 year)	2 (20)
Homemaker/stay-at-home parent	1 (10)
Not reported	1 (10)
Annual household income, n (%)	
< $15,000	5 (50)
$15,000–<$30,000	1 (10)
$30,000–<$45,000	3 (30)
Prefer not to answer/Don’t know	1 (10)
Household size, median [IQR]	3.0 [2.0, 5.0]
Number of children in household, n (%)	
0	2 (20)
1–2	5 (50)
≥ 3	3 (30)

*Underrepresented racial/ethnic group includes American Indian or Alaska Native, Asian, Black or African American, Native Hawaiian, Other Pacific Islander, or Hispanic/Latino. Values are collapsed across delivery-schedule assignment (Schedule A vs. B)

Characteristic	Overall, N = 10
General health, n (%)	
Poor	1 (10)
Fair	2 (20)
Good	5 (50)
Very Good	1 (10)
Excellent	0 (0)
Don’t know/Prefer not to answer	1 (10)
Little interest or pleasure in doing things, n (%)	
Not at all	6 (60)
Several days	4 (40)
More than half the days	0 (0)
Nearly every day	0 (0)
Don’t know/Prefer not to answer	0 (0)
Depressed or hopeless, n (%)	
Not at all	8 (80)
Several days	2 (20)
More than half the days	0 (0)
Nearly every day	0 (0)
Don’t know/Prefer not to answer	0 (0)
Food insecure, n (%)	5 (50)
Nutrition insecure, n (%)	2 (20)
Nutrition security score, median [IQR]	2.62 [2.25, 4.00]
WIC/SNAP enrolled, n (%) – Yes	6 (60)
*Underrepresented racial/ethnic group includes American Indian or Alaska Native, Asian, Black or African American, Native Hawaiian, Other Pacific Islander, or Hispanic/Latino. Values are collapsed across delivery-schedule assignment (Schedule A vs. B)	

Follow-Up Survey Findings (Table 2)

Among the seven participants who completed the follow-up survey, five (71.4%) reported that it was easy to eat healthy foods during the intervention period, and all seven described the program as having helped meet their household's food needs, either "a lot" (57.1%) or "some" (42.9%). Fresh fruits and vegetables were identified as the most helpful program component by all seven respondents (100%), followed by pre prepared meals (28.6%). All seven participants reported that the program increased the variety of foods they and their family ate, and most reported it saved money on food (85.7%) and time shopping or cooking (57.1%). When asked which they preferred, more than half (57.1%) said they preferred groceries over meal kits, and the remainder (42.9%) liked both equally; no participant preferred meal kits alone. Recommendation likelihood was high: six of seven participants (85.7%) rated the program a 10 out of 10 ("very likely to recommend"). The most common suggested change was to include more fruit (57.1%), followed by inclusion of more vegetables (28.6%). Two participants (28.6%) recommended no changes at all. Full survey results are presented in Table 2.

Table 2
Summary of Follow-up Survey Responses, n = 7

Item	Summary
Program made it easier to eat healthy food, yes, n (%)	5 (71.4)
Program helped meet household food needs, n (%)	
Helped a lot	4 (57.1)
Helped some	3 (42.9)
Did not help at all	0 (0.0)
Ideal program length, n (%)	
1–3 months	1 (14.3)
4–6 months	1 (14.3)
7–9 months	3 (42.9)
10–12 months	1 (14.3)
> 12 months	1 (14.3)
Program recommendation likelihood (0–10 scale), mean (sd)	9.7 (0.76)
Program component preference, n (%)	
Preferred meal kits	0 (0)
Preferred groceries	4 (57.1)
Liked both equally	3 (42.9)
Did not like either	0 (0)
Program benefits noted*, n (%)	
Increased variety of foods eaten	7 (100.0)
Saved money on food	6 (85.7)
Saved time shopping or cooking	4 (57.1)
Supported efforts to prevent gestational diabetes (GDM)	0 (0)
Most helpful components*, n (%)	
Fresh fruits and vegetables	7 (100.0)
Prepared meals	2 (28.6)
Recipes	1 (14.3)
*Note. *A participant may select more than one.*	

Item	Summary
Pre-chopped ingredients	1 (14.3)
Recommended change*, n (%)	
Include more fruit	4 (57.1)
No changes	2 (28.6)
Include more vegetables	2 (28.6)
*Note. *A participant may select more than one.*	

RESULTS: Qualitative

All ten participants were invited for an interview and five accepted and completed the interview.

Demographics

Demographic characteristics of the interviewed subsample were similar to the full enrolled sample. The median age of interviewed participants was 27.0 (IQR: 24.0–35.0), and 80% were from an underrepresented racial/ethnic group. English was the primary language for the majority, as 40% chose Spanish. 40% of participants reported an annual household income below $15,000, and 60% were enrolled in WIC and/or SNAP at baseline. All interviewed participants had at least 1 child in the household, and the median household size was 5 people.

An overview of themes and representative quotations is found in Table 3, with more detailed results presented in the qualitative analysis section below.

Table 3
Qualitative Themes and Representative Quotations

Theme	Representative Quotation
Enrollment & Referral	“It was all very fast.”
Food Quantity & Storage	“all [food eaten that came in boxes].”
Food Acceptability	“I was like, oh wow, this is good because it had chicken breasts and some shrimps and then beef”
Food Use & Household Dynamics	“With my partner and my son.” (shared equally)
Delivery & Logistics	“FedEx dropped it off, which made it easier. I hate going to the store.”
Nutrition Education & Materials	“They brought me recipes, but as for nutrition, no.”
Behavioral Impact	“Eating a lot of salad… healthy things for the baby.”
Program Value	“I don’t have the money, so the food is lovely.”
Program Improvements	“Maybe for like 3 months… or six.”

Enrollment and Referral

Enrollment into the study was described as straightforward and efficient by all five participants. One participant noted, "And then they [doctor’s office] told me that someone was going to call me. And then basically that was how everything started", while another described the process as “very simple to apply”. A third participant similarly reported that being contacted about the study “was not challenging at all, and it was very welcoming”.

Although materials were provided in both English and Spanish, one participant identified a language barrier. This participant, who identified Mandingo as her primary language, stated at the outset of her interview, “I don’t speak English that much, so that’s very difficult.”

When asked about the purpose of the MANGO pilot study, one participant shared that she was told “...the food is good…” and was unable to explain its relevance to preventing GDM. Another participant suggested she was “…at risk for blood pressure or something…”. A third interviewed participant simply replied “No” when asked if she knew the health requirements to join the study.

Food Quantity and Storage

All five participants described the quantity of food provided as adequate: “I think it is the right amount, yes”. However, one participant reported having food from a previous box in her fridge because some items were “food that I don't really use at home,” but that she will “try and see if I can make some recipe

out of it". Limited home storage capacity, particularly small freezer space, was identified by one participant as a constraint affecting utilization of MTMs: "It's too much for me… my freezer is not too big".

Food Acceptability

Overall satisfaction with food quality was high, with all five participants expressing general approval of the food received. All five preferred fresh foods, specifically highlighting "fresh fruits and vegetables" and "salads" as favorites; canned items were less favored by at least one participant. Acceptability with prepared meals was more mixed for three participants, with one reporting a cultural mismatch, "I'm African… it's not what I eat". This same participant later described her specific difficulty with the ready-to-eat microwave meals in more detail: "I don't like that one… the taste… potato and the vegetable in this, in the seasonings", while affirming that the fresh grocery and meal-kit boxes were "good quality." Another participant described a related but distinct acceptability barrier: several unfamiliar vegetables, including kale, went unused because "it's so difficult for me to try new recipes, which I don't really do."

Food Use and Household Dynamics

Four of five participants shared the food with other household members, most often partners and children; one participant did not share food with others. One participant shared food "equally" with her partner and son, while another shared with her husband and 6-year-old son but reported eating "most of it," attributing this to her own dietary priorities during pregnancy. And one participant shared meals primarily with her three children.

Selective consumption was reported by two participants, who described using familiar items while avoiding unfamiliar ingredients with one having difficulty with trying "new recipes".

Delivery and Logistics

Delivery processes were described positively overall, with participants noting effective text notifications and convenient drop-off at their home. Two participants reported minor communication issues, and one described a delivery error in which the first box was misdelivered to a neighbor. This misdelivery was reported by one participant stating, "the first one they leave here for my neighbors… but the second one's at the front of my door". Another described a delivery that was missed entirely due to weather, which she resolved by communicating directly with study staff: "I got back to her that I didn't receive it at the approach time that it was. She contacted them and they said because it was snowing that week." This same participant also noted the physical burden of retrieving boxes: "I couldn't [lift it], so sometimes I had to ask either my mom or someone to help me get it inside."

Nutrition Education and Materials

All five participants reported not using the recipes provided, instead relying on their own cooking methods and preferences. One participant identified literacy challenges as a barrier to engaging with the recipes: “For the reading, it’s difficult for me”.

Notably, one participant did not appear to recognize the recipe cards as nutrition education at all, stating that she had received recipes “but as for nutrition, no,” suggesting the educational content may not have been perceived as educational by its intended audience. When asked what format she would find useful, another participant suggested “some education on some healthy foods that helps in pregnancy” delivered via “emails, with maybe… pictures of those kinds of foods.”

Behavioral Impact

Three participants explicitly described improved dietary habits during the intervention period, including increased fruit and vegetable intake and healthier eating practices: “Eating healthier… different types of fruit, food, and having the vegetables”; “Yes, I learned how to eat healthy”; and “Eating a lot of salad, you know, healthy things for the baby and being very careful with grease/fats”. Four participants described general or implicit health benefits, such as feeling healthier overall. Two participants also reported changes in household-level eating behaviors among family members. By contrast, one reported no change.

Household-level spillover also varied: one participant described active changes in how she prepared food for her family (“I am the one who cooks and… everything with not much salt, not much sugar”) and in household purchasing (“We buy organic things too”). In contrast, another explicitly noted that her dietary changes did not extend to the rest of her household (“Only me… they eat the same”).

Program Value

All five participants expressed gratitude for the program and described it as valuable and supportive during pregnancy. Four participants specifically noted financial relief or money savings. One participant described the financial impact directly in the context of her employment status: “When I’m not working, I’m still home. So I don’t have the money, so the food is lovely”. Another emphasized the combined value of cost savings and convenience: “It really saved some money and convenience because I didn’t have to go all the way to the grocery store”.

Program Improvements

Participants offered several suggestions for future iterations of the program. Three participants recommended increasing the quantity or variety of fresh fruits and vegetables. Two participants

suggested modifying or reducing microwave meal offerings. Extending the program's duration was suggested by two participants, and three participants identified a need for post-program support, such as assistance with SNAP/WIC enrollment and providing a baby car seat.

Regarding duration, one participant suggested extending the program “throughout the whole nine months” of pregnancy if possible, or at minimum three to six months, while another felt the original 8-week duration and biweekly delivery schedule worked well as designed.

DISCUSSION

The MANGO pilot study suggests that the FIM intervention was feasible and well-received among pregnant participants. Our mixed-methods formative evaluation approach implemented as part of a planning grant for a larger, fully powered trial was successful in providing critical insights for feasibility and design of the FIM intervention for this population across two diverse geographies and demographics, workflows and communication plans for successful recruitment and retention of study participants, and finalize approaches related to primary outcome measures.

Lessons learned related to recruitment and retention showed that participants did not tend to frame the MANGO intervention in terms of GDM prevention or risk management, and it was not always clear that participants understood why they had been enrolled in the study in regards to their health condition (i.e. risk for GDM). A larger trial should incorporate a more substantial education and communication component during the recruitment process, one that clearly communicates participants’ individual GDM risk and explains why dietary intervention is a meaningful strategy for prevention.

Secondly, nutrition education materials (recipes) provided as part of the FIM intervention were underutilized, as participants generally preferred their own cooking methods. Recipes were delivered via text-based links to online content, a format that assumes a level of reading fluency and smartphone/data access; one participant’s comment that she had not recognized the recipes as nutrition education at all further suggests that the educational content, as designed, may not have been perceived by participants as “education” in the first place. This gap is difficult to contextualize against the broader FIM literature because reporting on education-component design and uptake is itself inconsistent across programs (20). The Nurture program, for example, paired monthly grocery gift cards with printed recipe cards and live telephonic nutrition consultations delivered by a bilingual nutrition specialist, rather than self-directed digital content (21). Nurture’s education component offers an alternative model worth testing against MANGO’s text-link approach in future iterations. This low utilization of nutrition education materials could also be a result of language and literacy barriers also affected some participants' experience. During an interview, one participant reportedly chose “English” as her primary language on intake because her native language was not provided as a response option. This was made clear during the interview when the participant struggled with the conversation, and revealed limitations she may have experienced with the written materials. For some who were English- or Spanish-literate, the reading level of the recipes and surveys was also reportedly challenging. One

participant suggested she preferred verbal communication to ease the literacy burden she experienced. In the future, FIM studies should consider developing materials in multiple languages, outside English and Spanish, and providing all written materialsat a 6th grade or lower reading level to improve accessibility and comprehension (22).

Third, acceptability was more mixed for MTMs, and one participant noted a cultural mismatch between the foods offered and their typical diet. A comparable FIM pilot for pregnant women with food insecurity and gestational diabetes ("Fresh Funds for Moms") used an online grocery-ordering model that let participants select their own items, allowing for participants' preferences and agency (23). While not a direct comparison, an increase in overall spending on produce is at least suggestive that giving participants control over food selection may mitigate the acceptability and cultural-fit issues MANGO pilot observed with prepared meals. Future FIM studies should explore diverse, culturally relevant food or meal options and giving participants agency to choose their own food or meals.

Fourth, behavior change was not uniform across participants. While most interviewed participants described concrete dietary improvements, one reported no change at all, and household-level spillover to other family members was reported by some but explicitly denied by others. While the aim of the MANGO pilot study was feasibility, recruitment, and determination of a food vendor, secondary outcomes included intake of fresh produce among pregnant women who are at risk of gestational diabetes. As consumption of nutrient-rich foods increased among the target population, it's worth noting that a home-delivered FIM intervention alone may not be sufficient to uniformly shift household food culture. Furthermore, some participants may benefit from an intervention with an explicit behavior-change or household-engagement component layered on top of food provision.

Finally, participants expressed interest in continued support after the program ends, such as help with SNAP/WIC enrollment. Even where the intervention was well received, free food provision addressed acute food access needs during the study period without resolving the underlying affordability pressure that will persist after the program ends. This distinction between short-term access and longer-term affordability is relevant to the design of post-program support and should be included in the off-ramping protocols in FIM interventions.

LIMITATIONS

Our UCD pilot involved a small sample (n = 10 enrolled; 7 surveyed; 5 interviewed), so the findings should be considered hypothesis-generating and exploratory. Participants were recruited from multiple clinical sites and geographic regions, but the small sample size did not allow for examination of potential differences in experiences across sites, demographic groups, or cultural backgrounds. Qualitative analysis was conducted by a single researcher using a predetermined coding framework. Although this approach facilitated systematic analysis, the absence of independent double-coding may have limited opportunities to assess coding consistency and challenge analytic interpretations.

Several additional limitations should be noted. Given that 7 of 10 completed post surveys and 5 of 10 completed interviews, these responders may have differed as compared to the non-responders in program satisfaction, availability, or English/Spanish proficiency. Second, interviews were offered only in English or Spanish, yet at least one interviewed participant's primary language was neither; her interview was conducted in English despite reported difficulty, which may have constrained the depth, accuracy, or nuance of her responses and may have disproportionately affected how her experience was captured relative to other participants.

CONCLUSION

The primary purpose of the pilot was to assess the different feasibility and acceptability of several prototype FIM interventions in this population of pregnant women across Texas and Northeast US which was successfully achieved. Results will be used to inform study protocols and intervention design for a fully-powered larger trial to assess the efficacy of FIM for GDM prevention among at-risk pregnant women.

Abbreviations

FIM
Food is Medicine
GDM
Gestational diabetes mellitus
HCD
human centered design
MANGO
Moms Accessing Nutritious Groceries for Overall wellbeing
MTM
medically tailored meals
SNAP
Supplemental Nutrition Assistance Program
WIC
Special Supplemental Nutrition Program for Women, Infants and Children

Declarations

Ethics approval and consent to participate

This study was conducted in accordance with the Declaration of Helsinki and was approved by the UTHealth Houston Institutional Review Board (HSC-SPH-25-0800). Informed consent was obtained from all participants prior to data collection.

Consent for publication

Not applicable

Competing interests

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Author Contribution

KHH, NR, AVDB, JMY, and SS designed the research study. SJ interviewed participants. NT provided insights into classifying and naming themes, and contributed to the creation of quantitative and qualitative tools. JMY and KHH analyzed the data. AN, KHH, SJ wrote the manuscript. All authors critically reviewed the manuscript.

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Data Availability

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

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