SECONDARY DATA ANALYSIS OF FOOD FARMACY INTERVENTION FOR DIABETES MANAGEMENT

by

Jillian G Devine

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Project Approved:

Supervising Professor: Gina Alexander, PhD, MPH, MSN, RN, FNAP

Department of Nursing

Lori Borchers, PhD, MSN, BSN

Department of Nursing

Gina Hill, PhD, RD, LD

Department of Nutritional Sciences

ABSTRACT

This secondary data analysis examined the effects of nutritional interventions on managing chronic health conditions in food insecure individuals living with type 2 diabetes mellitus. The "Food Farmacy" intervention employed in the primary pragmatic study provided participants (n = 50) with ten pounds of fresh produce weekly, five medically tailored meals weekly, and 20 pounds of shelf stable, pantry goods every other week. Participants could also attend a two-hour nutrition education session, led by a registered dietician, every week. This study analyzed changes to hemoglobin A1c (HbA1c), systolic and diastolic blood pressure, and produce intake to assess the effects of the Food Farmacy intervention on glycemic control, cardiovascular status, and dietary habits.

Following six months of the Food Farmacy intervention, the sample population exhibited reductions to HbA1c ($p = 0.292$), significant reductions to systolic pressure ($p = 0.003^{**}$), significant reductions to diastolic blood pressure ($p = 0.048^{*}$), significant increases to fruit intake ($p = 0.045^{*}$), and increases to vegetable intake ($p = 0.527$). The findings of the secondary data analysis emphasize the potential for nutritional interventions in managing type 2 diabetes mellitus and cardiovascular complication. Further research is needed to determine the efficacy of nutritional interventions in other chronic health conditions.

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Content

Type 2 diabetes mellitus is a chronic disease in which the body cannot make enough insulin, cannot effectively use insulin in the cells, or both; this results in high levels of circulating blood glucose (American Association of Clinical Endocrinology, n.d.). As of 2021 in America, diabetes affects 38.4 million Americans, or 11.6% of the population, and is the eighth leading cause of death (American Diabetes Association, 2023). People living with diabetes have higher all-cause mortality (Li et al., 2019). Diabetes not only impacts blood sugar but can lead to an array of complications including retinopathy, kidney disease, diabetic nerve disease, heart attacks, and strokes (American Association of Clinical Endocrinology, n.d.).

Diabetes is a chronic disease that is often managed with pharmaceutical interventions, but it can also be managed with nutrition and diet (Department of Health & Human Services, 2021). However, not everyone has access to diabetic-friendly foods, making it difficult to manage the disease through diet. The price of produce is positively correlated with blood sugar levels, meaning that higher costs for groceries is associated with higher blood glucose, and poorer diabetes management (Anekwe & Rahkovsky, 2024).

Culinary medicine is a nutritional intervention that uses a patient's diet, as opposed to conventional medical interventions, to prevent and treat diseases, as well as promoting overall health and well-being (La Puma, 2016). Culinary medicine can help people with diabetes achieve improvements to their blood glucose and prevent further complications of disease (Sami et al., 2017). The Food Farmacy intervention used in this research takes a culinary medicine approach to managing chronic illness. Food Farmacy uses dietary interventions to control disease, by providing food insecure populations with fresh produce, frozen foods, and pantry staples at little to no cost (Senko, 2022). There is currently little to no evidence on how nutritional interventions from food banks affect blood glucose measures and blood pressure in individuals with type 2

diabetes. The purpose of this study is to explore the efficacy of culinary medicine on biomarkers of diabetes and hypertension.

The research questions of the secondary data analysis are as follows: 1) Does the Food Farmacy intervention affect glycemic control? 2) Does the Food Farmacy Intervention affect cardiovascular status? 3) Does the Food Farmacy intervention affect dietary habits? 4) Does the Food Farmacy intervention affect exercise habits?

Review of Literature

Inclusion and Search Criteria

The key words used for this review of literature included ‘diabetes’, ‘HbA1c’, ‘meal plan’, ‘food bank’, and ‘diet’. Research was sourced from PubMed and CINAHL. The literature selected for review included a variety of studies such as randomized controlled trials, systematic reviews, a pilot study, and a case report. All the literature included is from the past 15 years; anything older was excluded.

Effects of Dietary Interventions on Glycemic Control

Hemoglobin A1c (HbA1c) is a test that represents average blood glucose over the past three months (American Association of Clinical Endocrinology, n.d.). This metric can be used to diagnose pre-diabetes and type 2 diabetes and is an important marker to assess glucose control (American Association of Clinical Endocrinology, n.d.). In a systematic review conducted by Jooste et. al (2023), randomized control and non-randomized trials were reviewed to evaluate the effectiveness of low-carbohydrate diet interventions, delivered via digital tools, in the prevention or management of type 2 diabetes mellitus. Of the six studies reviewed, five exhibited significant reductions in HbA1c (Jooste et al., 2023). Three of the six studies demonstrated significant rates

of remission (HbA1c < 6.5%) within a year of interventions (Jooste et al., 2023). This review highlights the efficacy of a low-carbohydrate diet to the prevention or management of type 2 diabetes.

A randomized controlled trial conducted by Mottalib et al. (2018) studied the effects of nutrition therapy and meal plans on HbA1c for overweight and obese patients with type 2 diabetes mellitus. There were not significant improvements to HbA1c in the group that only met with a registered dietitian, or RD (Mottalib et al., 2018). Significant reductions in HbA1c were observed in the group that met with a RD and followed a meal plan (-0.66%), as well as the group that met with a RD, followed a structured meal plan, and had weekly calls with the RD (-0.61%) (Mottalib et al., 2018). The research findings demonstrate that nutritional counseling can effectively reduce HbA1c in diabetes when paired with a structured dietary plan.

Dietary Habits & Lifestyle Modifications Effects on Glycemic Control

A randomized controlled trial conducted by Imai et al. (2011) studied the effect of eating vegetables before carbohydrates compared to a traditional exchange-based meal plan for lowering HbA1c in patients with type 2 diabetes. At the 6-, 9-, 12-, and 24-month follow-up, there were significant reductions in HbA1c for participants who were assigned to the intervention group and ate vegetables before carbohydrates (Imai et al., 2011). There were no significant reductions in HbA1c for participants in the control group who followed an exchange-based meal plan (Imai et al., 2011). These findings suggest that eating fibrous vegetables before carbohydrates is more effective at managing blood glucose than following a traditional exchange-based meal plan.

A case study conducted by Dixit et al. (2022) observed how lifestyle modifications for a 45-year-old male diagnosed with type 2 diabetes impacted HbA1c levels. The subject followed the “Dixit diet” which advises two meals a day and a daily walk of minimum 4.5 km in 45 minutes (Dixit et al., 2022). No further diet or exercises recommendations were noted. The subject reduced his HbA1c from 14.9% to 5.1% in three months of following the Dixit diet (Dixit et al., 2022). This evidence emphasizes that the Dixit diet may be an effective intervention for diabetes management. More research will need to be done to assess if results apply to more than a single subject.

Medically Tailored Meals for Cardiovascular Complications

Belak et al. (2022) conducted a matched cohort study in which medically tailored meals were delivered to food-insecure individuals with recent hospitalization for congestive heart failure. The 39 experimental participants were delivered three medically tailored meals a day, for three months; they also received three medical nutrition therapy sessions with a registered dietitian (Belak et al., 2022). The cohort study examined participant’s blood pressure before and after the intervention. Systolic and diastolic blood pressure levels were lower in the experimental groups both before and after the intervention. After controlling for age and sex, the intervention resulted in higher odds of reduced blood pressure, but not to the extent of statistical significance (Belak et al., 2022).

Food Delivery Services for Diabetes Management

In a randomized controlled trial conducted by Berkowitz et al (2019), medically tailored meals were delivered to individuals with type 2 diabetes and food insecurity. The study evaluated the effectiveness of a meal delivery program on dietary quality of the participants. Participants

experienced significant improvements in 11 of the 12 Health Eating Index categories (Berkowitz et al., 2019). Participants also reported significant reductions in food insecurity during the intervention (Berkowitz et al., 2019). This establishes medically tailored meal plan delivery programs as an effective intervention for people with diabetes seeking to improve the quality of their diet.

Another randomized controlled trial by Seligman et al. (2018) evaluated the efficacy of dietary and self-management support for people with type 2 diabetes who were clients of a food bank. The supporting interventions were provided by participating branches of Feeding America food banks. After the 6-month intervention, significant improvements in food insecurity and fruit and vegetable intake were observed in the intervention group (Seligman et al., 2018). However, no significant improvements to HbA1c were observed in the intervention or control group (Seligman et al., 2018). These findings suggest that food bank support for individuals with diabetes may not be effective for managing diabetes, but offers benefits for the food insecure, and can improve diet quality.

Seligman et al. (2015) conducted a pilot study to assess if food banks could aid in diabetes-self management for food bank clients. Participating food banks were to provide diabetes-appropriate food and other support measures to individuals with type 2 diabetes in low-income communities for six months. Up to 80% of study participants were food insecure (Seligman et al., 2015). HbA1c was significantly reduced (mean reduction of 0.48) among all participants with a diabetes diagnosis (Seligman et al., 2015). Additionally, there were significant improvements in fruit and vegetable intake across all participants (Seligman et al., 2015). Contrary to results from Seligman's randomized controlled trial, this study supports the efficacy of food bank interventions to improve diet quality and HbA1c levels.

Although there is extensive research on diabetes management, there is no clear consensus on the most effective intervention to manage or prevent type 2 diabetes. This creates a demand for further research on effective interventions. There are studies that assess the impacts of dietary interventions and structured meal plans on HbA1c, and there are studies on intermittent nutritional interventions provided by food banks, but little is known about how nutritional and educational interventions provided by food banks affect both HbA1c and blood pressure. Additionally, the research on food bank interventions for individuals with diabetes is not recent. Therefore, it is beneficial to explore the implications of meal plans provided via food banks to individuals with type 2 diabetes in Tarrant County.

Levels of Evidence

Berkowitz et al., 2019	Dixit et al., 2022	Imai et al., 2011	Jooste et al., 2023	Mottalib et al., 2018	Seligman et al., 2015	Seligman et al., 2018	Umpierre et al., 2011
Level 1	Level 5	Level 1	Level 2	Level 1	Level 4	Level 1	Level 1

Methodology

Setting & Design

The primary research study was conducted by Tarrant Area Food Bank and funded by CVS Pharmacy. Tarrant Area Food Bank (TAFB) was founded in 1982 with a goal to address hunger in the community. The food bank believes that "…access to healthy food is a basic human right…" and that "…all people should have access to regular, nutritious meals" (Tarrant Area Food Bank, n.d.). CVS Pharmacy partnered with TAFB in the primary research study with a goal of addressing social determinants of health and improving food access amongst under resourced individuals experiencing health complications. Both CVS and TAFB recognize the role that access to nutritious food plays in health outcomes, and the primary research study was meant to meet the needs of food insecure individuals with diabetes.

The primary research study followed a quasi-experimental study design. Studies of this nature explore variables before and after an intervention. There were no experimental or control groups, meaning every participant received the same treatment. The study used mixed methods, collecting both quantitative and qualitative data. Biometric measures, surveys, and interviews were utilized to collect these data.

The focus of the current project is a secondary data analysis of data from the primary research study, including an independent statistical analysis and interpretation of the results. The secondary data analysis includes strictly quantitative data from participant biomarkers and survey results to focus on the impact of Food Farmacy interventions on the management of diabetes, as indicated by the research questions.

The research study followed fifty participants, proportionally selected from two health system partners in Fort Worth, Texas, John Peter Smith County Hospital (JPS) and North Texas Area Community Health Center (NTACHC). Both JPS and NTACHC aim to provide high quality healthcare that is accessible for under resourced members of the community.

Dr. Patricia Rodriquez, the Chief Medical Officer at NTACHC, states “We serve some of the most vulnerable patients in Tarrant County” (North Texas Area Community Health Centers, n.d.). The goal of community health centers is to “give back resources and empower communities to take care of themselves.” The NTACHC specifically strives to provide “… high quality medical services, while serving as a safety net for the lower income population, to help end health disparities in the community” (North Texas Area Community Health Centers, n.d.).

The Department of Government Relations at JPS also works to serve all members of the community by working with policymakers to advocate for the health of the community and the

health network. The Department of Government Relations at JPS reports, “We also engage with community leaders and organizations to address critical public health needs and advance equitable healthcare access for all” (JPS Health Network, n.d.).

A flyer was posted at both health centers to recruit interested persons who would be selected based on specific inclusion and exclusion criteria (see Appendix A for recruitment flyer). Inclusion criteria for the participants included a recent HbA1c measure greater than 6.5, a diagnosis of type 2 diabetes mellitus, cardiovascular complications, age greater than eighteen, and food insecurity requiring food bank resources. Exclusion criteria included an age younger than eighteen years old and being a person with type 1 diabetes.

Theoretical Framework: Knowledge-Attitude-Behavior Model

This study followed a theoretical framework. The specific model that this study followed was the Knowledge-Attitude-Behavior (KAB) Model. The KAB model suggest that health-related behaviors can be divided into three processes which include acquisition of knowledge, generation of beliefs, and formation of new behaviors (Liu, 2016). Evidence suggests that there is a positive correlation between level of information and overt behavior (Liu, 2016). Knowledge can enhance motivation, especially the motivation to take action or make changes, and therefor also influences behaviors. By providing participants with two hours of nutrition education weekly and connecting them to community resources, they were given opportunities to enhance knowledge. Through nutrition education, participants learned about the positive consequences of healthy eating and the negative consequences of unhealthy eating. The research team had a goal for participants to attain or expand knowledge, allowing it to foster positive behavior change, even following the study’s conclusion.

Ethics

This secondary data analysis protocol was reviewed completely by the Institutional Review Board and was determined to be exempt. To maintain participant confidentiality, all personal health information and data collected in the primary research was de-identified. Data was organized in an Excel spreadsheet with restricted access granted to only research team members only.

Food Farmacy Intervention

The Food Farmacy intervention used in the research aimed to improve participants' health using culinary medicine. The interventions entailed providing participants with the following: 10 pounds of fresh produce weekly, five frozen, medically tailored meals a week, 20 pounds of shelf stable pantry staples twice a month, two-hour nutrition education sessions weekly, and access to a community resource team.

The nutrition education consisted of three curricula: *Viva Bien! Live Well with Diabetes", "Be Healthy for Today, Be Healthy For Life", and "Gardening for Health". The "Viva Bien! Live Well with Diabetes"* curriculum combines education on nutrition, healthy cooking, nutrition labels, exercise, and gardening with hands-on cooking activities to facilitate learning on management of diabetes (adapted from San Antonio Community Resource Directory, n.d.).

The *Be Healthy Today; Be Healthy For Life* curriculum educates on the pathophysiology of diabetes, management tips and techniques, how medicines aid in glycemic control and the importance of medication adherence. In addition to providing a foundation on diabetes and pharmaceutical management, it teaches about calories, macronutrients, how to build a healthy

plate, how to read food labels, the benefits of physical activity, and how to safely regulate blood sugar when participating in exercise. (American Diabetes Association, 2024).

The *Gardening for Health* curriculum was developed by the Garden and Farms Manager at the Tarrant Area Food Bank Farms Manager. The curriculum educates on basic gardening skills and practices hands-on learning activities to facilitate experiential learning. *Gardening for Health* also practicing mindfulness and incorporating physical activity to decrease stress, reduce symptoms of depression, and increase focus. The curriculum incorporates community integration at each weekly education session to connect participants to resources if they need or desire additional support. See Appendix B for the *Gardening for Health* flyer.

Data Collection

Data collection occurred before, during, and after the six-month intervention. The participating health system partners provided two pre/post biometric data points: each participant's most recent measures of HbA1c (glycemic control) and blood pressure (cardiovascular status) prior to the start date of the intervention and again near the end date of the intervention.

Participants engaged in repeated surveys throughout the duration of the intervention. The survey utilized was the *Feeding Texas* survey (see Appendix C). This survey evaluated participant demographics, participant's eating habits related to fruits and vegetables, and participant's moderate and vigorous exercise habits. Questions 11 and 13 were used to assess dietary habits. Questions 17 and 19 were used to assess exercise habits.

Surveys were completed at the community centers where weekly education sessions were hosted. Therefore, participants only took surveys if they were present for the education session.

Participants completed surveys with physical paper copies, and then responses were entered by TAFB staff into a de-identified spreadsheet that was later shared with the research team.

Data Analysis

The secondary data analysis focused on participant biomarkers (HbA1c and blood pressure) to evaluate the impact of Food Farmacy interventions on the management of diabetes. These data were provided by health systems and were not linked to the Feeding Texas survey data.

Analysis of Feeding Texas survey data focused on (1) changes in dietary habits, operationalized as participant's reported fruit and vegetable intake (in cups per day) and (2) changes in physical activity levels, operationalized as participant's reported moderate and vigorous exercise (in minutes per day). With multiple measures and significant missing data over the course of the six-month study duration, the research team consulted with a statistician to determine the best strategy for analysis. After consultation, the statistician supported the completion of dependent or paired t-test analysis, using only data from participants who had a minimum of two survey data points, allowing for a simple evaluation of change over time.

Results

Sample Size

The intervention population sample began with 50 participants, selected proportionally from both health system partners: JPS and NTACHC. At the end of the six-month intervention, 40 participants remained a part of the research. The secondary data analysis analyzed only pre-intervention and post-intervention biometric data for these 40 participants. The health system partners provided these data from their patient encounters. To protect participant privacy, all

identifying factors were kept private. There were no participant characteristics available for the secondary-data analysis to analyze sample characteristics for data relevant to cardiovascular complications and glycemic control.

Participants who completed the *Feeding Texas* survey to evaluate dietary and exercise habits were also de-identified in the data collection and analysis process. The secondary data-analysis only received participant age and zip code for data points associated with the *Feeding Texas* survey responses. Only participants who completed a pre-intervention survey, and a post-intervention survey were included in the secondary data analysis of dietary and exercise habits. The age range was 33 to 70 years old; the mean age was 53.1; the median age was 54; the standard deviation was 10.4. Participants were from a wide range of Fort Worth zip codes, with a mode of 76123. See Table 1 for zip code distribution.

To analyze the results, the secondary data analysis sought to evaluate the effects of the Food Farmacy intervention on cardiovascular status, glycemic control, dietary habits, and exercise habits.

Cardiovascular Status

Biometric data was analyzed to determine if the Food Farmacy intervention produced decreases in blood pressure (systolic and diastolic) using a paired *t*-test. Systolic blood pressure had a mean decrease of 8.256 (SD = 17.620) which was statistically significant ($t(38) = 2.926$, $p = .003$). Diastolic blood pressure had a mean decrease of 2.718 ($SD = 9.929$), which was also statistically significant ($t(38) = 1.710$, $p = .048$). Results are summarized in Tables 2 and 3.

Glycemic Control

Biometric data was analyzed to determine if the Food Farmacy intervention produced decreases in HbA1c from the baseline measurement using a paired *t*-test. The mean HbA1c decrease of 0.178 (SD = 1.1927) was not statistically significant. ($t(38) = .553$, $p = .583$). Results are summarized in Tables 3 and 4.

Dietary and Exercise Habits

Participants who completed at least two surveys (one baseline and one intervention) were included in the analysis of changes in daily eating and exercising habits, yielding a final sample size of 25. Each participant had baseline results, which came from their first completed survey, and intra- or post-intervention results, which came from their last completed survey. Results indicated that the number of cups of fruit increased from 1.080 ($SD = .759$) to 1.360 ($SD = .784$), a statistically significant increase from pre- to post-intervention ($t(24) = -2.113$, $p = .045$). However, the mean number of cups of vegetables consumed, mean hours spent in moderate exercise, and mean hours spent in vigorous exercise did not significantly change from pre- to post-intervention. Results are summarized in Table 4, 5, 6, and 7.

Discussion

The current literature lacks research on how nutritional interventions provided by food banks can influence glycemic control, cardiovascular complications, and dietary habits. The finding of the secondary data analysis suggest that the Food Farmacy intervention can improve cardiovascular status, among individuals with type 2 diabetes. The secondary data analysis found statistically significant reductions in both systolic and diastolic blood pressure, suggesting that the Food Farmacy intervention is effective in improving cardiovascular health in individuals with

diabetes. In addition, the data analysis also found a statistically significant change in the number of cups of fruit consumed per day. This suggests that the Food Farmacy intervention can positively influence individuals with diabetes to include more fruit in their diet.

The Food Farmacy intervention significantly improved cardiovascular status and fresh fruit consumption in this sample. Although the Food Farmacy intervention did not produce significant improvements to glycemic control or vegetable intake, related literature does support that culinary interventions are effective. Jooste et al. (2023) and Seligman et al. (2015) found significant reductions to HbA1c in patients with type 2 diabetes after following diet interventions. Belak et al. (2022) also found significant reductions to systolic and diastolic blood pressure after food bank provisions for health management. Research by Berkowitz et al. (2019), Seligman et al. (2015), and Seligman et al. (2018) all exhibited significant improvements to dietary habits in individuals with type 2 diabetes when provided support from food banks.

The secondary data analysis found a small decrease in HbA1c from before and after the Food Farmacy intervention. The data also found that participants also reported eating more vegetables. Although these data were not statistically significant, they are both clinically relevant to the Food Farmacy intervention and its implications on glycemic control and dietary habits.

Improvements to cardiovascular status and glycemic control are beneficial to an individual's health, whether they are statistically significant or not. Reductions to blood pressure can protect from chronic health diseases and lower risk for all-cause mortality (Brunstrom & Carlberg, 2018). Improvements in glycemic control can decrease an individual's risk for adverse cardiovascular events (Fralick et al., 2020). Increases in produce consumption are also beneficial to an individual's wellness and improve health status, regardless of statistical significance (Slavin & Lloyd 2012). While the data only supported significant findings related to

cardiovascular status and fruit consumption, this does not mean the Food Farmacy intervention does not have implications on glycemic control, vegetable consumption, or exercise habits. A more regulated Food Farmacy intervention may lend way to significant improvements in glycemic control, vegetable intake, and exercise habits.

Limitations

The survey size of this research study was 50 participants, and the research study did not maintain all participants for the six-month duration. Due to the small sample size, results cannot be directly applied to the general population of people living with diabetes.

Participation in the education sessions was voluntary. Since attendance was not mandatory, participants only received as much of the curriculum as they were able to access. Education was only provided at the health centers, so if participants were unable to attend the education session for that week, they were not provided with supplemental information.

The Feeding Texas Survey was only accessible in person at educational sessions, and survey completion was voluntary. Some participants completed the survey multiple times, while some participants only had a baseline survey. Of the 50 participants, only 25 had a baseline and post-intervention survey. As a result, dietary habits and activity levels were only able to be analyzed for half of the research participants. Due to study design constraints and small sample size, the effects of the Food Farmacy intervention on dietary habits and activity levels cannot be applied to the entire research population, nor can results be directly applied to the general population of people living with diabetes.

The health system partners provided biometric data for the research, including HbA1c and blood pressure. The biometric data provided was not measured immediately before and after

the Food Farmacy intervention. This data was provided by the health partners who provided the nearest measure they had in participant charts to the start and end date of the intervention. As a result, other dietary and lifestyle choices outside of the intervention timeline could have influenced the biometric data, not giving a completely accurate representation of the impact of the Food Farmacy intervention.

Since the primary research study was a pragmatic study and quasi-experimental study, the intervention fidelity was low. In other words, the complexity of the Food Farmacy intervention design made it difficult to comply with or utilize all components of the intervention. Due to the nature of the intervention components, some participants may have been able to achieve full compliance, while other participants may have been limited in their ability to comply with all components of the intervention.

Participants in this intervention were provided with the shelf stable groceries, fresh produce, and medically tailored meals. The intervention did not control for participants entire diet, and there was no way for participants to report whether they chose to eat their groceries, produce, or meals, or if they shared the provided food with their family members. Additionally, participants only had the option to have shelf stable groceries delivered to their residence. If a participant was homeless, lacked adequate transportation, or had conflicting commitments that prevented them from making it to their health center, they would not be able to acquire their produce or medically tailored meals for the week.

Inclusion criteria for participating in this research study required that participants have some level of validated food insecurity. The research study was designed to address social determinants of health, specifically providing resources to people with limited access to food, transportation, and healthcare. The research also recruited participants from only two health care

centers in Fort Worth, TX. Since the recruiting process was intended to produce a participant population with similar characteristics, results may not be directly applied to the general population of people living with diabetes.

Clinical Implications

Implications for clinical practice may include the use of food as a means of medicine and control for diabetes and cardiovascular complications. Using culinary interventions to manage chronic health conditions has proved to be effective in significantly lowering blood pressure and in reducing HbA1c (Jooste et al., 2023; Belak et al., 2022). Nutritional education and counseling coupled with food service provisions from a food bank have proven to be effective in increasing fruit consumption, as indicated in this study. The use of culinary medicine and nutritional education may reduce or slow the growth of total healthcare costs for individuals with diabetes (Bansal et al., 2018). There is a need for further research to determine if such interventions would be effective for other chronic health conditions.

Conclusion

The use of culinary medicine, employed through the Food Farmacy Intervention, improved health outcomes in this sample of individuals living with diabetes. Increasing accessibility to fresh produce and engaging in nutritional education with a registered dietitian may influence individuals with diabetes to make more health-conscious food selections. Including culinary interventions and lifestyle changes in diabetes management may improve healthcare costs and health outcomes for people living with diabetes. This secondary data analysis and the existing research support the efficacy of dietary interventions in improving glycemic control, cardiovascular status, and dietary habits.

In summary, the Food Farmacy intervention significantly improved cardiovascular status and fruit consumption in this sample population. The intervention also produced clinically important, but statistically nonsignificant improvements to glycemic control and vegetable consumption. There is still need for further research on the effects of culinary medicine with a larger and more diverse sample size. There is also a need for further research on how culinary medicine may be used to control chronic health conditions other than type 2 diabetes mellitus.

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Appendix

Table 1

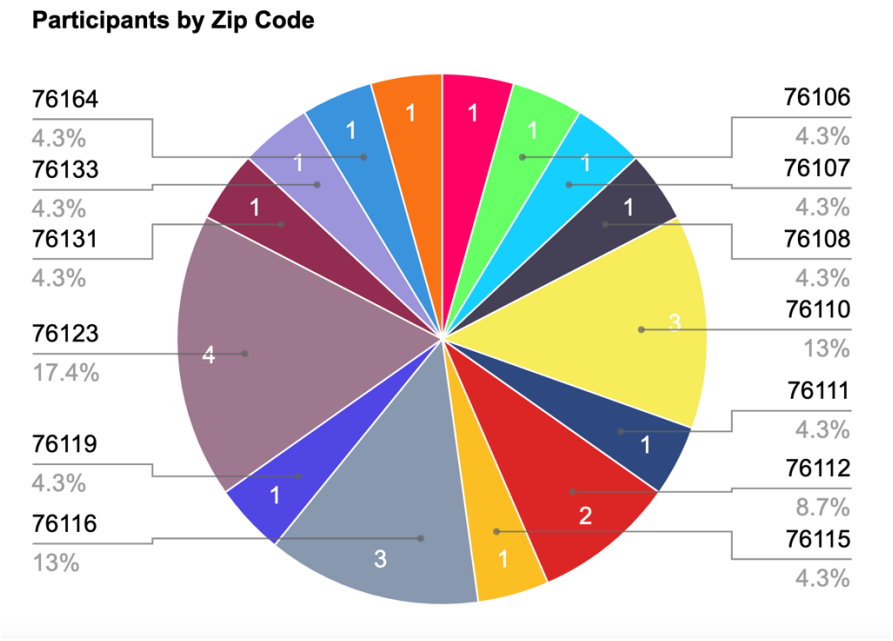


Table 2

	Change in Biometrics (Pre – Post)		
	M	*SD*	*t*
A1c	.178	1.927	.553
Systolic BP	8.256	17.620	2.926
Diastolic BP	2.718	9.929	1.710

Note. Systolic and Diastolic: N = 39; A1c: N = 36. *$p < .05$; **$p < .01$

Table 3

Paired Samples Test

		Paired Differences					t	df	Significance	
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			One-Sided p	Two-Sided p
Pair 1	Baseline HgbA1c - End HgbA1c	.1778	1.9273	.3212	-.4743	.8299	.553	35	.292	.583
Pair 2	baseline systolic - end sys	8.256	17.620	2.821	2.545	13.968	2.926	38	.003	.006
Pair 3	baseline diastolic - end dia	2.718	9.929	1.590	-.501	5.936	1.710	38	.048	.096

Table 4

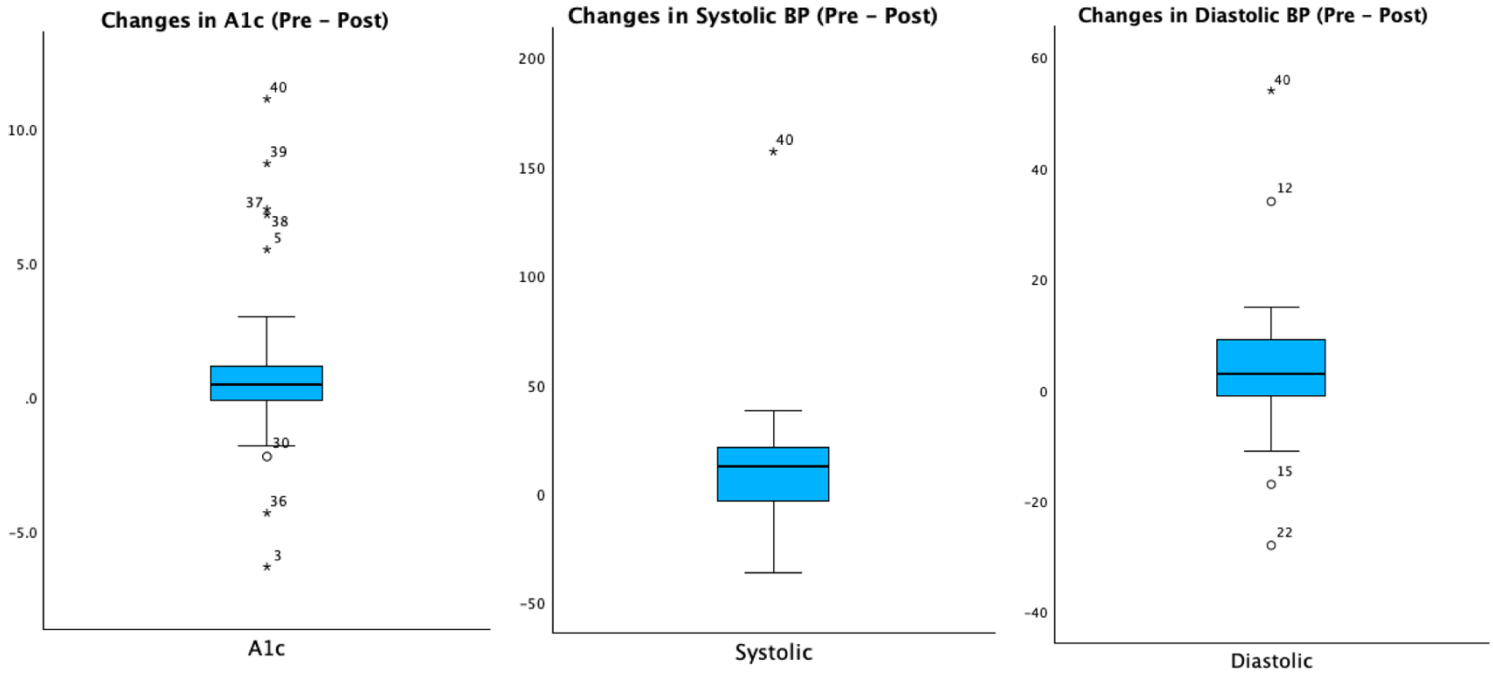


Table 5

	Pre		Post		Difference (Pre - Post)		*t*-test	
	M	*SD*	*M*	*SD*	*M*	*SD*	*t* (24)	*p*
Cups of Fruit					-.280	.663	-2.113	.045*
Cups of Vegetables					-.080	.624	-.641	.527
Moderate Exercise					.040	1.338	.149	.882
Vigorous Exercise					.280	1.061	1.319	.200

Note. N = 25. *$p < .05$

Table 6

Paired Samples Statistics

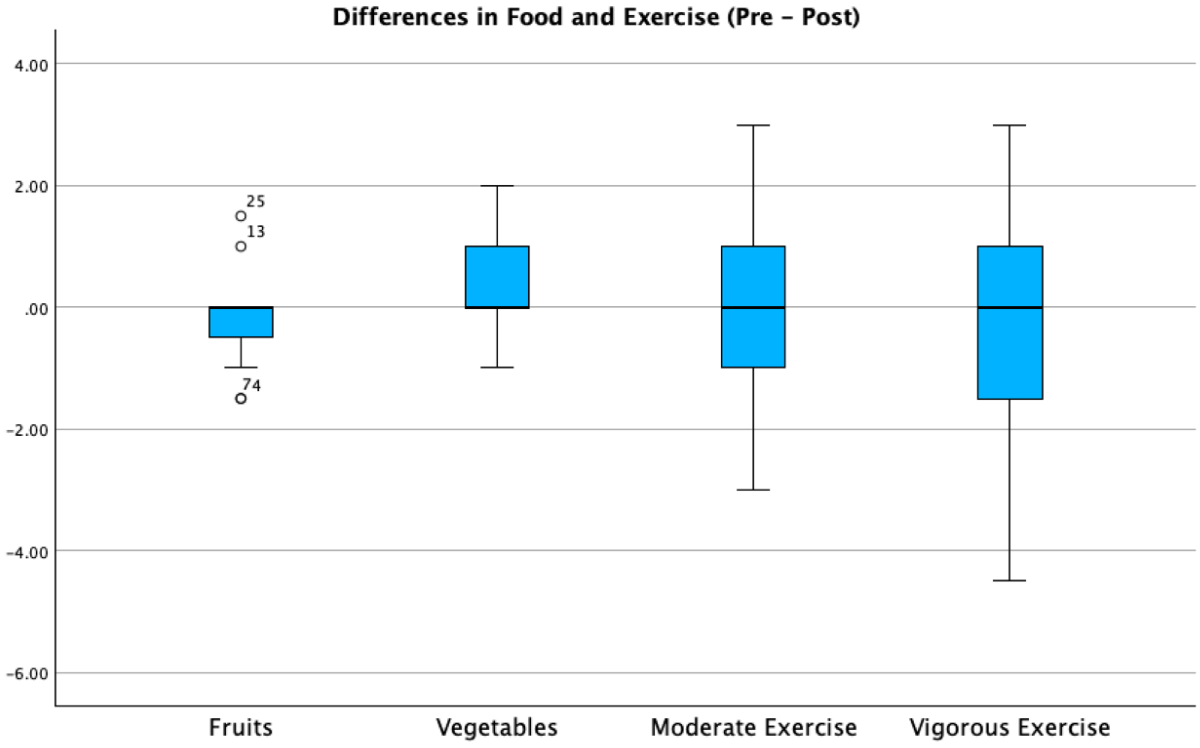
		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Fruits_Pre	1.080	25	.7594	.1519
	Fruits_Post	1.360	25	.7842	.1568
Pair 2	Vegetables_Pre	1.400	25	.8036	.1607
	Vegetables_Post	1.480	25	.8098	.1620
Pair 3	Moderate_Pre	3.24	25	1.943	.389
	Moderate_Post	3.20	25	1.848	.370
Pair 4	Vigorous_Pre	1.88	25	1.764	.353
	Vigorous_Post	1.60	25	1.732	.346

Table 7

Paired Samples Test

		Paired Differences					t	df	Significance	
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			One-Sided p	Two-Sided p
Pair 1	Fruits_Pre - Fruits_Post	-.2800	.6627	.1325	-.5535	-.0065	-2.113	24	.023	.045
Pair 2	Vegetables_Pre - Vegetables_Post	-.0800	.6238	.1248	-.3375	.1775	-.641	24	.264	.527
Pair 3	Moderate_Pre - Moderate_Post	.040	1.338	.268	-.512	.592	.149	24	.441	.882
Pair 4	Vigorous_Pre - Vigorous_Post	.280	1.061	.212	-.158	.718	1.319	24	.100	.200

Table 8


Differences in Food and Exercise (Pre – Post)
4.00
2.00
.00
-2.00
-4.00
-6.00
25
13
74
Fruits
Vegetables
Moderate Exercise
Vigorous Exercise

A. Recruitment flyer for Food Farmacy Intervention

B. *Gardening for Life* curriculum flyer

TARRANT AREA FOOD BANK

GARDEN & FARM PROGRAMS

THERAPEUTIC HORTICULTURE

GARDENING FOR HEALTH

WELCOME!

TAFB is pleased to offer garden education for adults, delivered in a therapeutic horticulture format. This four-part garden series is designed to address wellness needs commonly present for people experiencing food insecurity. Each session will include the following elements in order to focus on the correlated goals.

GARDEN EDUCATION

INCREASE SELF-EFFICACY

This series provides education on planning a food garden, growing seedlings indoors, container gardening, and other basic gardening skills to a group of 8-15 adult participants at your site. Participants will enjoy facilitated conversations, and interactive activities that build healthy connections to growing food, self, and community.

MINDFUL MOMENTS

REDUCE STRESS

Each session will begin with a different garden themed mindfulness moment to help participants decrease their stress level and increase focus. Participants will receive a card for each mindfulness activity so they can continue to benefit from them throughout their week.

HANDS-ON ACTIVITY

INCREASE PHYSICAL ACTIVITY

Participants will engage in a hands-on gardening project that will solidify learning and allow them to practice a simple physical activity that they can incorporate into their week. Increasing physical activity can improve health and reduce symptoms of depression. Each session will culminate in a garden resource for each participant or for the host site.

COMMUNITY BUILDING

INCREASE SOCIALIZATION

Each session will incorporate a community integration activity to help participants form connections and build skills to form connections in the community. The series will provide reference materials for additional community resources that participants can connect to as needed.

TRAUMA-INFORMED

INCREASE RESILIENCY

Garden education with therapeutic horticulture delivery will be led by an educator who has completed trauma sensitive service training. Trauma informed practice creates an environment of safety, transparency, peer support, collaboration, voice & choice, and sensitivity to cultural, historical, and gender experiences.

REQUEST HERE: SELECT ADULTS / TAFB LED / YES TO THERAPEUTIC HORTICULTURE

tafb.org

C. Feeding Texas survey

Feeding Texas – FY24 Adult PRE-Survey

We are requesting that participants in this program complete this survey.

- This survey includes questions about your eating habits, physical activity (exercise), food security, and your household.
- This form will be completed during the first session, and again during the last session.
- There are no right or wrong answers.
- Participation is voluntary. You can skip any questions that you do not want to answer, or you may stop answering questions at any time.
- There is no risk in completing this survey.
- Your choice to participate or not will not change any services you are currently receiving.
- The information collected is private and will be kept in a secure location.
- The results of the survey may be used for research, but your name or other personal details will not be shared with any researchers.

Thank you in advance for completing this survey!

1. What is the date today? (MM/DD/YYYY)

   _____

2. What is the first letter of your **FIRST NAME**?

   _____

3. What is the first letter of your **LAST NAME**?

   _____

4. What is your **BIRTH MONTH**, using two-digits?

   (01-12) _____

5. What is your **BIRTH YEAR**, using four digits?

   (ex: 1975) _____

6. What is your age?

   ☐ 5 – 17 years

   ☐ 18 – 59 years

   ☐ 60 – 75 years

   ☐ 76+ years

7. What is the zip code where you live?

   _____?

8. You are being asked to complete this survey because you are participating in a nutrition or physical activity program. Are you completing this survey at the **BEGINNING** of this particular program or at the **END** of the program?

   ☐ Beginning

   ☐ End

9. Do you eat more than one kind of fruit each day?

   ☐ No
   ☐ Yes, sometimes
   ☐ Yes, often
   ☐ Yes, always

10. Do you eat more than one kind of vegetable each day?

    ☐ No
    ☐ Yes, sometimes
    ☐ Yes, often
    ☐ Yes, always

11. **FRUIT**: How much do you eat each day?

- ☐ None
- ☐ 1/2 cup
- ☐ 1 cup
- ☐ 1 1/2 cups
- ☐ 2 cups
- ☐ 2 1/2 cups
- ☐ 3 cups or more

Examples of what counts as **1 cup of fruit**:


1 large banana


8 large strawberries


1 small or ½ large apple


22 seedless grapes


1 large orange


3 medium or 2 large plums

12. During the past 7 days, how many times did you eat fruit? Examples of fruits are apples, bananas, oranges, grapes, raisins, melons, and berries. Include fresh, frozen, dried, or canned fruit. Do not include juice.

- ☐ I did not eat fruit during the past 7 days
- ☐ 1 to 3 times during the past 7 days
- ☐ 4 to 6 times during the past 7 days
- ☐ 1 time per day
- ☐ 2 times per day
- ☐ 3 times per day
- ☐ 4 or more times per day

13. **VEGETABLES**: How much do you eat each day?

- ☐ None
- ☐ 1/2 cup
- ☐ 1 cup
- ☐ 1 1/2 cups
- ☐ 2 cups
- ☐ 2 1/2 cups
- ☐ 3 cups or more

Examples of what counts as **1 cup of vegetables:**


2 medium carrots


1 large tomato


1 ear of corn


1 large bell pepper


1 avocado


1 medium white potato

14. During the past 7 days, how many times did you eat vegetables? Examples of vegetables are green salad, corn, green beans, carrots, potatoes, greens, and squash. Include fresh, canned, and frozen vegetables. Do not count French fries, potato chips, or rice.

- ☐ I did not eat vegetables during the past 7 days
- ☐ 1 to 3 times during the past 7 days
- ☐ 4 to 6 times during the past 7 days
- ☐ 1 time per day
- ☐ 2 times per day
- ☐ 3 times per day
- ☐ 4 or more times per day

15. How often do you use the Nutrition Facts on food labels?

- ☐ Never
- ☐ Rarely
- ☐ Sometimes
- ☐ Often
- ☐ Always
- ☐ Does Not Apply

16. Think about all the **moderate** activities that you did in the **last 7 days**. **Moderate** activities refer to activities that take moderate physical effort and make you breathe somewhat harder than normal. Think only about those physical activities that you did for at least 10 minutes at a time.

During the **last 7 days**, how many days did you do **moderate** physical activities like brisk walking, carrying light loads, bicycling at a regular pace, or doubles tennis?

- ☐ 0 days
- ☐ 1 day
- ☐ 2 days
- ☐ 3 days
- ☐ 4 days
- ☐ 5 days
- ☐ 6 days
- ☐ 7 days

17. How much time did you usually spend doing **moderate** physical activities on one of those days?

- ☐ Less than 15 minutes
- ☐ 16 – 30 minutes
- ☐ 31 – 45 minutes
- ☐ 46 – 60 minutes
- ☐ More than 1 hour

18. Think about all the **vigorous** activities that you did in the **last 7 days**. **Vigorous** physical activities refer to activities that take hard physical effort and make you breathe much harder than normal. Think only about those physical activities that you did for at least 10 minutes at a time.

During the **last 7 days**, on how many days did you do **vigorous** physical activities like heavy lifting, heavier gardening or construction work, chopping wood, aerobics, jogging/running or fast bicycling?

- ☐ 0 days
- ☐ 1 day
- ☐ 2 days
- ☐ 3 days
- ☐ 4 days
- ☐ 5 days
- ☐ 6 days
- ☐ 7 days

19. How much time did you usually spend doing **vigorous** physical activities on one of those days?

- ☐ Less than 15 minutes
- ☐ 16 – 30 minutes
- ☐ 31 – 45 minutes
- ☐ 46 – 60 minutes
- ☐ More than 1 hour