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Live Well, Eat Well, Be Active with Diabetes Curriculum Improves Type 2 Diabetes Management

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Abstract. Type 2 diabetes is a complex disease with several modifiable lifestyle factors. The Extension 'Live well, Eat well, be Active with Diabetes' curriculum provides four 90-minute sessions teaching individuals to live well, eat well, and be active with diabetes. Fourteen Extension educators implemented and evaluated the curriculum with 107 participants. Participants reported the program helped them feel better able to take care of their health. We observed significant differences in participants' retrospective pre and post 'Live well,' 'Eat well' and 'be Active' total scores. Extension has a unique opportunity to educate individuals so they may better manage their diabetes.

INTRODUCTION

Diabetes is a critical issue in Oklahoma. From 1995 to 2010, the age-adjusted prevalence of diabetes rose 226.7% in the state (Centers for Disease Control and Prevention [CDC], 2012), and Oklahoma currently has a higher prevalence of diabetes in adults than the US average (13.0% vs 10.6%) (America's Health Rankings United Health Foundation, 2022). Modifiable risk factors, such as obesity, physical inactivity, and poor nutrition have significant impacts on progression and management of type 2 diabetes mellitus (Faidon et al., 2020).

The benefits of diabetes self-management education, such as the Diabetes Self-Management Education and Support (DSMES) program, are profound (CDC, 2018). Research shows individuals who participate in diabetes self-management education are more likely to take medications as prescribed, manage their blood glucose, blood pressure, and cholesterol levels and have lower health care costs compared to those who do not receive diabetes education (Association of Diabetes Care & Education Specialists, 2021).

In Oklahoma, participation in diabetes self-management education is low. In fact, only 51.1% of Oklahoma adults with diabetes report attending a diabetes self-management class (CDC, 2017). Oklahoma has 77 counties, 16 metro and 60 nonmetro (Economic Research Service [ERS], 2021). Of 24 DSMES programs in metro counties, 67% are available to the general population and 33% are available through Tribal/Indian Health Services. Of 25 DSMES programs in nonmetro counties, 36% are available to the general population and 64% are available through Tribal/Indian Health Services (Oklahoma State Department of Health, 2022).

Extension has played an important role in diabetes education (Grenci, 2010; Kaiser et al., 2009; Williams et al., 2004). The Live well, Eat well, be Active with Diabetes (LEAD) curriculum, offered through Oklahoma Cooperative Extensive Service (OCES), has provided community-based diabetes management education to Oklahomans with type 2 diabetes at no cost, in many locations where DSMES programs may not be available.

CURRICULUM

We used the Health Belief Model as the framework for developing the LEAD curriculum. The LEAD curriculum is composed of four weekly, 90-minute lessons. Each lesson contains content on living well, eating well, and being active with diabetes. These topics build on one another each lesson, encouraging repetition and enhancing knowledge (Table 1).

Each lesson contains a PowerPoint, hands-on activities, and handouts. Participants receive the *Choose Your Foods: Food Lists for Diabetes* (American Diabetes Association [ADA] & Academy of Nutrition and Dietetics, 2019) and a diabetes plate placemat to facilitate learning the diabetes plate method and carbohydrate counting. Prior to conducting the LEAD curriculum, OCES family and consumer science (FCS) county educators attend an all-day training course covering background information on diabetes and important components of diabetes management consistent with the ADA, and curriculum implementation and evaluation. We review and update the curriculum annually to reflect current diabetes best practices (ADA, 2021) and provide yearly trainings for county educators on new ADA and curriculum updates.

EVALUATION AND RESULTS

We evaluated the LEAD curriculum using a retrospective pre-post evaluation instrument (Davis, 2003). Oklahoma State University Institutional Review Board for Human Subjects approved the evaluation instrument and protocol. The instrument consisted of two demographic items and four curriculum items with two response options (yes, no) and two self-reported health outcome items with three response options (yes, no, I do not know). The instrument also included 13 'Live well,' 18 'Eat well' and 13 'be Active' items with three response options (yes, sometimes, no). We coded 'Live well,' 'Eat well' and 'be Active' item response options as yes = 2, sometimes = 1 and no = 0. We calculated 'Live well,' 'Eat well' and 'be Active' total scores by summing the item response codes. We also calculated Cronbach alphas for the 'Live well,' 'Eat well' and 'be Active' items (Santos, 1999).

We analyzed data using PC SAS for Windows, Version 9.4 (SAS Institute, Cary, NC). Data were included in the analysis if participants completed all 'Live well,' 'Eat well' and 'be Active' items. Significance was set at $p < 0.05$. We used frequency procedure to analyze demographic, curriculum and self-reported health outcome data. Differences in retrospective pre and post 'Live well,' 'Eat well' and 'be Active' item rankings and total scores were analyzed using Wilcoxon matched-pairs signed-ranks test.

Fourteen county educators implemented and evaluated the LEAD curriculum in 17 counties, 13 nonmetro and 4 metro (ERS, 2021), with 165 participants from January 2017 through December 2019. However, only 107 participants completed all 'Live well,' 'Eat well' and 'be Active' items. Table 2 provides participants' gender and age ranges.

At post, 99% of participants reported "the program was helpful to me" and 98% reported "the program was easy to understand." All participants (100%) reported "overall, I feel better able to take care of my health." In addition, 68% reported "my blood glucose is in better control" (Table 3).

There was a significant ($p<0.0001$) difference in participants' retrospective pre and post 'Live well' total score, with 83% of participants increasing their 'Live well' total score (Table 4). The Cronbach alpha for 'Live well' items was 0.86.

There also was a significant ($p <0.0001$) difference in participants' retrospective pre and post 'Eat well' total score, with 91% of participants increasing their 'Eat well' total score (Table 5). The Cronbach alpha for 'Eat well' items was 0.91.

Similarly, there was a significant ($p <0.0001$) difference in participants' retrospective pre and post 'be Active' total score, with 78% of participants increasing their 'be Active' score (Table 6). The Cronbach alpha for 'be Active' items was 0.89.

Table 1. Live well, Eat well, Be Active with Diabetes Lesson Content

Lesson	'Live well' content	'Eat well' content	'Be Active' content
Lesson 1	• Understanding diabetes • Blood glucose (target ranges, impacts, and tracking)	• Healthy eating guidelines • Diabetes plate method	• Physical activity benefits and effect on blood glucose • Healthy physical activity guidelines
Lesson 2	• Weight loss benefits • Healthy and realistic weight loss guidelines	• Carbohydrate counting	• Physical activity and weight loss • Physical activity safety
Lesson 3	• Diabetes complications • Diabetes Standards of Care • Stress and diabetes management	• Healthful food choices, using labels (increase fiber; lower saturated fat, sodium, and added sugar)	• Types of physical activity • Staying motivated • Physical activity resources
Lesson 4	• Importance of the health care team • National, state, and local diabetes resources	• Modifying recipes (increase fiber; lower saturated fat, sodium and added sugar)	• Decreasing sedentary activities • Community physical activity resources

Table 2. Participants' Gender and Age Ranges

Gender	% (n)
Female	75 (79)
Male	25 (26)
Age Range	
20–39 years	1 (1)
40–59 years	21 (22)
60–79 years	57 (60)
80 years and above	21 (22)

Note. Columns may not add to 100 due to rounding.

Table 3. Participants' Live well, Eat well, be Active with Diabetes Program and Health Evaluation

Program Evaluation Items	Yes % (n)	No % (n)	
The program was helpful to me.	99% (104)	1% (1)	
The program was easy to understand.	98% (103)	2% (2)	
Would you recommend this program to others?	100% (104)	0% (0)	
Overall, I feel better able to take care of my health.	100% (101)	0% (0)	
Health Evaluation Items	**Yes % (n)**	**No % (n)**	**I Do Not Know % (n)**
I have maintained or lost weight.	76 (80)	10 (10)	14 (15)
My blood glucose is in better control.	68 (71)	2 (2)	30 (32)

Note. Rows may not add to 100 due to rounding.

Table 4. Participants' 'Live well' Evaluation (n=107)

'Live well' Question Items	Retrospective Pre Median (Q1, Q3)[a]	Post Median (Q1, Q3)[b]	Difference Median (Q1, Q3)[c]	p Value[d]	% Increased[e]
I understand what type 2 diabetes is.	2 (1, 2)	2 (2, 2)	0 (0, 1)	<0.0001	43%
I understand the long-term effects of high blood glucose.	1 (1, 2)	2 (2, 2)	1 (0, 1)	<0.0001	52%
I understand what can increase or decrease my blood glucose.	1 (1, 2)	2 (2, 2)	1 (0, 1)	<0.0001	61%
I understand how to manage my diabetes.	1 (1, 2)	2 (2, 2)	1 (0, 1)	<0.0001	60%
I feel I have an important role with my health care team.	2 (1, 2)	2 (2, 2)	0 (0, 1)	<0.0001	43%
I check my blood glucose regularly	2 (0, 2)	2 (1, 2)	0 (0, 1)	<0.0001	32%
I check my feet regularly.	1 (0, 2)	2 (2, 2)	1 (0, 1)	<0.0001	51%
I feel it is important to have regular diabetes check-ups.	2 (1, 2)	2 (2, 2)	0 (0, 1)	<0.0001	32%
I feel it is important to have regular eye exams.	2 (2, 2)	2 (2, 2)	0 (0, 0)	<0.0001	20%
I feel it is important to have regular dental exams.	2 (2, 2)	2 (2, 2)	0 (0, 0)	<0.0001	24%
I feel it is important to know what to do when I am sick.	2 (1, 2)	2 (2, 2)	0 (0, 1)	<0.0001	32%
I feel it is important to know what to do when my blood glucose goes too high or too low.	2 (1, 2)	2 (2, 2)	0 (0, 1)	<0.0001	39%
I feel because I have diabetes it is important to manage stress.	1 (1, 2)	2 (2, 2)	1 (0, 1)	<0.0001	54%
'Live well' Total Score	**18 (15, 22)**	**26 (24, 26)**	**6 (2, 10)**	**<0.0001**	**83%**

[a]Retrospective pre median (1st and 3rd quartiles).

[b]Post median (1st and 3rd quartiles).

[c]Difference retrospective pre to post median (1st and 3rd quartiles).

[d]P values for difference retrospective pre to post Wilcoxon matched-pairs signed-ranks test.

[e]Percent of participants who increased retrospective-pre to post question item rank or total score.

Table 5. Participants' 'Eat well' Evaluation (n=107)

'Eat Well' Question Items	Retrospective Pre Median (Q1, Q3)[a]	Post Median (Q1, Q3)[b]	Difference Median (Q1, Q3)[c]	p Value[d]	% Increased[e]
I understand the plate method.	0 (0, 2)	2 (2, 2)	1 (0, 2)	<0.0001	73%
I understand carbohydrate counting.	1 (0, 2)	2 (2, 2)	1 (0, 2)	<0.0001	69%
I am comfortable with diabetes meal planning.	1 (1, 2)	2 (1, 2)	1 (0, 2)	<0.0001	63%
I am aware of appropriate food portion sizes.	1 (0, 2)	2 (2, 2)	1 (0, 1)	<0.0001	57%
I choose lots of non-starchy vegetables.	1 (0, 2)	2 (1, 2)	1 (0, 1)	<0.0001	56%
I choose high fiber starches (breads, cereals, etc.).	1 (0, 2)	2 (1, 2)	0 (0, 1)	<0.0001	42%
I choose lean protein foods.	1 (1, 2)	2 (2, 2)	1 (0, 1)	<0.0001	39%
I choose whole fruits more than juice.	2 (1, 2)	2 (2, 2)	0 (0, 1)	<0.0001	36%
I choose low-fat or fat-free milk products.	1 (1, 2)	2 (2, 2)	0 (0, 1)	<0.0001	43%
I choose foods with less added sugar.	1 (1, 2)	2 (2, 2)	0 (0, 1)	<0.0001	43%
I choose beverages with less added sugar.	2 (1, 2)	2 (2, 2)	0 (0, 1)	<0.0001	35%
I choose foods with less sodium (salt).	1 (1, 2)	2 (2, 2)	0 (0, 1)	<0.0001	43%
I read food labels to make more healthful choices.	1 (0, 1)	2 (2, 2)	1 (0, 1)	<0.0001	52%
I prepare foods with less solid fats.	1 (1, 2)	2 (2, 2)	0 (0, 1)	<0.0001	50%
I prepare foods with less added sugar.	1 (1, 2)	2 (2, 2)	0 (0, 1)	<0.0001	46%
I prepare foods with less salt.	1 (1, 2)	2 (2, 2)	0 (0, 1)	<0.0001	48%
I prepare healthy meals at home.	1 (1, 2)	2 (1, 2)	1 (0, 1)	<0.0001	52%
I make healthy food choices when eating out.	1 (0, 1)	2 (1, 2)	1 (0, 1)	<0.0001	61%
'Eat well' Total Score	**21 (15, 27)**	**34 (30, 36)**	**11 (6, 17)**	**<0.0001**	**91%**

[a]Retrospective pre median (1st and 3rd quartiles).

[b]Post median (1st and 3rd quartiles).

[c]Difference retrospective pre to post median (1st and 3rd quartiles).

[d]P values for difference retrospective pre to post Wilcoxon matched-pairs signed-ranks test.

[e]Percent of participants who increased retrospective-pre to post question item rank or total score.

Table 6. Participants' 'be Active' Evaluation (n=107)

'be Active' Question Items	Retrospective Pre Median (Q1, Q3)[a]	Post Median (Q1, Q3)[b]	Difference Median (Q1, Q3)[c]	p Value[d]	% Increased[e]
I understand I should check with my health care provider before increasing my physical activity.	2 (1, 2)	2 (2, 2)	0 (0, 1)	<0.0001	34%
I understand how physical activity can affect blood glucose.	1 (1, 2)	2 (2, 2)	1 (0, 1)	<0.0001	50%
I understand the importance of checking my blood glucose if I am going to be physically active.	1 (1, 2)	2 (2, 2)	1 (0, 1)	<0.0001	55%
I know the signs of low blood glucose during physical activity.	1 (0, 2)	2 (2, 2)	1 (0, 1)	<0.0001	50%
I understand I should check with my health care provide about what to do if my blood glucose goes too low during physical activity.	1 (1, 2)	2 (2, 2)	0 (0, 1)	<0.0001	49%
I understand why I should drink plenty of fluids while being physically active.	2 (1, 2)	2 (2, 2)	0 (0, 1)	<0.0001	26%
I understand why I should wear appropriate shoes for physical activity.	2 (1, 2)	2 (2, 2)	0 (0, 0)	<0.0001	24%
I understand why I should check my feet after physical activity.	1 (0, 2)	2 (2, 2)	1 (0, 2)	<0.0001	54%
I understand why I should choose a safe place to be physically active if I have diabetes.	2 (1, 2)	2 (2, 2)	0 (0, 0)	<0.0001	23%
I understand that if I feel sick, dizzy, or out of breath to stop physical activity.	2 (2, 2)	2 (2, 2)	0 (0, 0)	<0.0001	23%
I am physically active.	1 (1, 2)	2 (1, 2)	1 (0,1)	<0.0001	42%
I do strengthening activities.	1 (0, 1)	2 (1, 2)	0 (0, 1)	<0.0001	47%
I do balance and stretching activities.	1 (0, 1)	2 (1, 2)	1 (0, 1)	<0.0001	53%
'be Active' Total Score	**16 (12, 23)**	**25 (23, 26)**	**6 (2, 13)**	**<0.0001**	**78%**

[a]Retrospective pre median (1st and 3rd quartiles).

[b]Post median (1st and 3rd quartiles).

[c]Difference retrospective pre to post median (1st and 3rd quartiles).

[d]P values for difference retrospective pre to post Wilcoxon matched-pairs signed-ranks test.

[e]Percent of participants who increased retrospective-pre to post question item rank or total score.

CONCLUSIONS

Research indicates understanding information related to diabetes self-care can help people with diabetes management (Siopis et al., 2021). Evaluation of the LEAD curriculum signifies the program was well received by participants and enhanced their understanding of diabetes management.

LIMITATIONS

This study is not without limitations. One limitation is we did not ask participants if they had diabetes. Knowing if participants had diabetes would be beneficial in evaluating future diabetes curriculums. In addition, all participants being from Oklahoma limits the generalizability of the findings. Further, participants' willingness to attend indicates a desire to receive diabetes management education, which could influence their perception of the curriculum.

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