

# Developing & Testing a Food Literacy Questionnaire for Adults with Type 2 Diabetes Mellitus



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## ABSTRACT

*Food literacy*, the ability to plan, manage, select, prepare, and eat food, is a newer concept within the field of nutrition and dietetics. To date, food literacy has not examined food behaviors in individuals with chronic disease. The aim of this research was to develop a food literacy questionnaire specific to those with Type 2 Diabetes Mellitus (T2DM). This researcher developed and validated a survey known as The Eating and Food Literacy Behaviors Questionnaire for Diabetics (EFLBQ-D) with statements centered around the behaviors practiced by adults with T2DM regarding food and nutrition. These diabetes-specific statements comprise the following: carbohydrate counting, nutrition label reading, healthy food preparation methods, portion control, and the inclusion of fiber for glycemic control for T2DM care via proper nutrition. The statements were developed in conjunction with subject-matter experts as part of content validity testing and then reviewed by 5 adults with T2DM to establish face validity. The EFLBQ-D was administered via Qualtrics by a third-party provider to adults residing in the 13 states within the United States Department of Agriculture (USDA) Southern region who had been told they had T2DM. Validity was measured via exploratory factor analysis (EFA) and confirmatory factor analysis (CFA); reliability was assessed via Cronbach's alpha testing. The EFA produced 2 T2DM-specific factors with satisfactory internal structure. The CFA indicated that these 2 factors appropriately fit the data ( $\chi^2 = 584.910$ ; degrees of freedom = 254;  $P < 0.0000$ ; root mean square error of approximation = 0.065; comparative fit index = 0.912; Tucker-Lewis Index = 0.896; standardized root mean square residual = 0.058). Cronbach's alpha for the first T2DM factor was 0.865 with the second being 0.678, suggesting that the EFLBQ-D is reliable. The EFLBQ-D can be used by researchers and professionals to better understand food behaviors and food literacy skills and individualize medical nutrition therapy for those with T2DM.

## INTRODUCTION & PURPOSE

- Food literacy (FL) is considered the ability to plan, manage, select, prepare, & eat healthy foods; it is important for those with chronic disease such as Type 2 Diabetes Mellitus (T2DM)<sup>1</sup>
- No FL evaluation tool has been developed for people with T2DM
- The purpose of this investigation was to alter an existing FL questionnaire to make it appropriate for use with diabetics

## METHODS

- Adults who indicated they had T2DM residing in 13 Southern states were recruited by a third-party provider (Centiment)
- 12 diabetes-specific statements were developed by researchers & 3 registered dietitians (RD) & reviewed by 5 adults with T2DM prior to survey launch
- Behavioral statements were scored using a 4-point Likert-type scale:
  - *Never* = 1
  - *Seldom* = 2
  - *Often* = 3
  - *Always* = 4
- An Exploratory Factor Analysis (EFA) was conducted on a survey containing these 12 diabetes-specific statements
- The statements that were retained were added to an existing FL questionnaire called The Eating & Food Literacy Behaviors Questionnaire (EFLBQ)<sup>2</sup>
- Individuals also provided:
  - Age
  - Gender
  - Race
  - Ethnicity
  - Height
  - Weight
  - State of residence
- A Confirmatory Factor Analysis (CFA) was conducted with a similar population via the same third-party provider using statements from the existing questionnaire (EFLBQ) & the retained diabetes-specific statements (The Eating & Food Literacy Behaviors Questionnaire for Diabetics (EFLBQ-D))
- The above 4-point Likert scale was also used for the CFA questionnaire

## RESULTS

**Table 1: Demographic Data of EFA & CFA Testing of the EFLBQ-D**

Variable	EFA (n = 140)		CFA (n = 307)	
	n	%	n	%
<b>Gender</b>				
Female	71	50.7	166	54.1
Male	68	48.6	141	45.9
Non-Binary	1	0.7	0	0
<b>Race</b>				
American Indian or Alaska native	10	7.1	2	0.7
Asian	1	0.7	6	2
Black or African American	18	12.9	51	16.6
Mixed	3	2.1	9	2.9
White	108	77.1	239	77.9
<b>Ethnicity</b>				
Hispanic or Latino	10	7.1	26	8.5
Not Hispanic or Latino	130	92.9	281	91.5
<b>Weight Classification by BMI<sup>a</sup></b>				
Underweight	2	1.4	3	1
Healthy Weight	20	14.3	43	14
Overweight	31	22.1	78	25.4
Obese	87	62.1	183	59.6

EFA – Exploratory Factor Analysis; CFA – Confirmatory Factor Analysis; EFLBQ-D – Eating & Food Literacy Behaviors Questionnaire for Diabetics; BMI – Body Mass Index (kg / m<sup>2</sup>); <sup>a</sup>Underweight = BMI < 18.5 kg / m<sup>2</sup>; Healthy weight = 18.5 – 24.9 kg / m<sup>2</sup>; Overweight = 25.0 – 29.9 kg / m<sup>2</sup>; and Obese = ≥ 30.0 kg / m<sup>2</sup>

### Exploratory Factor Analysis (EFA) of the 12 DM-Specific Statements

- After 7 EFA rounds, 6 statements that clustered into 2 new T2DM-specific factors were retained
  - Each T2DM factor contained 3 items

### Confirmatory Factor Analysis (CFA) of the EFLBQ + 6 DM-Specific Statements (EFLBQ-D)

- The CFA was performed to examine the proposed 7-factor model
- The 19 EFLBQ statements & the 6 DM-specific statements were retained
- The 7-factor model had good model fit / validity:
  - $\chi^2 = 584.91$  ( $p < 0.001$ )
  - Root Mean Square Error of Approximation (RMSEA) cut-off = 0.06 (0.058 – 0.072)
  - Comparative Fit Index (CFI) = 0.91
  - Tucker Lewis Index (TLI) = 0.896
  - Standardized Root Mean Square Residual (SRMR) = 0.058
- The EFLBQ-D had good point estimate reliability (all factors ≥ 0.65)



**Table 2: Statements of the 7-Factor Model**

<b>Factor 1 – Health &amp; Nutrition</b>	<b>Factor 5 – Convenience</b>
I buy foods that are healthy.	I eat foods that are convenient to me.
I choose nutritionally balanced meals.	I prepare foods that can be made quickly.
I cook healthy foods.	I purchase foods that are convenient for me.
I select foods that are healthy.	<b>Factor 6 – Counting Carbs &amp; Reading Labels</b>
I eat a balanced diet.	I count carbs in food and drinks.
I read nutrition information before purchasing foods.	I read the food label to find the carb content of an item.
I consume healthy foods.	I read the food label to find the serving size of an item.
<b>Factor 2 – Taste</b>	<b>Factor 7 – Food Selections for Diabetes</b>
I buy foods that are tasty.	I bake, roast, broil, grill, sauté, steam, and boil foods to help manage my diabetes.
I choose foods that taste good to me.	I choose the right amount of food to control my diabetes.
I eat foods that taste good to me.	I eat high-fiber foods such as fruits, vegetables, and whole grains daily.
<b>Factor 3 – Food Preparation</b>	
I follow recipes when preparing food.	
I accurately measure dry ingredients when preparing food.	
I accurately measure liquid ingredients when preparing food.	
<b>Factor 4 – Planning &amp; Decision-Making</b>	
I decide what I want to eat before a meal.	
I plan what I will eat.	
I eat foods that I have previously planned to eat.	
Factors 6 & 7 in the yellow box are the 2 T2DM-specific factors produced by the CFA	



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## CONCLUSIONS

- The EFLBQ-D is valid & reliable instrument that can be used to estimate FL in adults who have been told they have T2DM
  - The ability to evaluate FL in individuals with a chronic disease T2DM population, a dimension new in the investigation of FL being geared toward a population with a chronic disease
  - Study strengths:
    - Was conducted with a national group currently residing in the 13 USDA Southern region states
    - Population was evenly distributed among males & females with all age groups represented
    - Nearly all races were represented
  - Study limitations:
    - A convenience sample was used
    - All responses are self-reported as per a subjective instrument
    - Participants were primarily Caucasian yet other ethnic groups were represented in the sample
- The EFLBQ-D has demonstrated it can be an aid to further cultivate appropriate T2DM nutrition education & counseling.

## REFERENCES

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