Prevalence of functional food use for self-reported type 2 diabetes management in a cohort of Hispanic adults: results of an online survey

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KAM collected and analyzed the data and wrote the manuscript with contributions from KJL and ACBT. All authors reviewed and commented on subsequent drafts of the manuscript.

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Research Snapshot

Research Questions: Functional foods contain active ingredients associated with physiological health benefits. What are the types of functional foods consumed by Hispanic adults with type 2 diabetes? What are the sociodemographic and health factors associated with functional food use?

Key Findings: Participants (488) in this cross-sectional study were social media users who identified as Hispanic or Latino adults living with type 2 diabetes for an average of four years. Hispanic adults used foods to manage type 2 diabetes 2-3 times a week. Those with a college degree, lower perceived health ratings, a greater number of diabetes-related behaviors, such as blood glucose monitoring and medication adherence, and higher glycosylated hemoglobin (HgbA1c) levels used functional foods more often.

Abstract:

Background: Hispanic adults are disproportionately diagnosed with type 2 diabetes (T2DM) and are more likely to use functional foods for T2DM management as compared with non-Hispanic White adults. Functional foods contain biologically active ingredients associated with physiological health benefits for preventing and managing chronic disease. Understanding which functional foods are used for T2DM management among Hispanic adults is essential for planning interventions.

Objectives: To identify the self-reported types, frequency of use, and reasons for functional food use among Hispanic and Latino adults with T2DM; and to examine the demographic characteristics and T2DM-related health behaviors associated with using functional foods.

Design: This cross-sectional study used an online Qualtrics survey to assess the types of foods used to manage T2DM, demographic characteristics, and T2DM-related health behaviors.

Participants: Adults (n=488) were ≥18 years old, used social media, identified as Hispanic or Latino, lived in the United States, and self-reported T2DM. The study was conducted in April 2021.

Statistical Analyses Performed: Multivariable negative binomial regression models were used to assess the association between weekly functional food use, demographic characteristics, and T2DM-related health behaviors.

Results: Participants were, on average, 39.9 ± 10.3 years (mean±SD), had lived with T2DM for 4.0 ± 3.5 years, and consumed functional foods 2.6 ± 1.9 times/week. Participants with significantly higher weekly intakes of functional foods were more likely to have a college degree (Prevalence rate ratio (PrR) = 1.45, 95% CI 1.20; 1.74), lower perceived health ratings (PrR =

1.47, 95% CI 1.22; 1.78), more frequent blood glucose monitoring (PrR = 1.78, 95% CI 1.46; 2.17), and higher glycosylated hemoglobin (HgbA1c) (PrR = 1.49, 95% CI 1.24; 1.81).

Conclusions: These findings suggest that gathering information specific to functional food use and incorporating these foods into diabetes care plans, when applicable, may be beneficial for nutrition professionals working with Hispanic and Latino adults.

Introduction

Type 2 Diabetes Mellitus (T2DM) affects more than 38 million Americans, 60-70% of whom experience related complications.[1] Management of T2DM includes dietary modifications, and physical activity, often in tandem with pharmacotherapy.[2] Dietary strategies for T2DM management have centered around controlling carbohydrate intake, increasing fruit and vegetable intake, and encouraging timely, balanced meals.[2] Some common strategies, however, may not align with cultural food preferences.

Hispanic and Latino adults make up a diverse population that is disproportionately diagnosed with T2DM compared with White non-Hispanic adults (11.7%% versus 6.9%, respectively).[1] Some ethnic subgroups of Hispanic adults such as those who identify as Puerto Rican or Mexican, have a higher prevalence of T2DM, with rates climbing to 50%.[1] Hispanic and Latino groups have higher rates of unmanaged blood glucose, which poses a greater risk for complications, such as cardiovascular disease and chronic kidney disease.[3] Furthermore, deaths from T2DM in these populations is 25% higher than non-Hispanic populations.[4] Effective strategies for T2DM management are, thus, especially critical for these groups. T2DM management strategies should go beyond conventional therapies for diabetes management and consider incorporating culturally relevant foods.

Functional foods contain biologically active ingredients that promote physiological health benefits for preventing and managing chronic disease.[5–7] Certain plants have been studied for their euglycemic effects with promising results. For instance, nopal, a type of cactus, has been shown to have a blood glucose lowering effect when consumed as part of a balanced diet.[8] Bitter melon has been consumed extensively for its glucose-lowering ability.[9] In a randomized clinical

trial, bitter melon reduced glycosylated hemoglobin (HbA1c), 2-hour glucose concentration, weight, and body mass index (BMI) after 3 months.[9]

Previous studies have shown that it is more common for Hispanic and Latino groups to use functional foods compared with their White counterparts for many reasons, including cultural beliefs, traditions, and folk practices.[10–13] However, information on specific foods used by this population for the treatment of T2DM in the U.S. is limited, possibly due to underreporting the use of these foods.[14] This cross-sectional study examines the types of functional foods and frequency of use, specifically to manage T2DM among a Hispanic and Latino population. The second aim of this study is to investigate sociodemographic characteristics and T2DM-related health behaviors associated with the weekly frequency of functional food consumption.

Materials and Methods

Participants

An online cross-sectional survey was designed and disseminated using Qualtrics to assess the use of functional foods to manage T2DM among Hispanic and Latino adults. Two versions of the survey were generated; one in English and one in Spanish, and the two respective Qualtrics survey web links were posted on the social media website Reddit to recruit participants. Recruitment through Reddit was chosen due to feasibility for reaching a wide audience given its popularity in the United States.[15] The criteria provided to Reddit to reach the target audience were Hispanic and Latino adults who use functional foods to manage T2DM. Reddit posted the advertisement and survey links free of charge on a general subreddit platform designed for surveys. The researchers did not recruit on Facebook due to the inability to target specific groups. Other recruitment methods included advertisements in a prominent New York City

Hispanic newspaper, and snowball sampling, in which the researchers sent the survey links to five diabetes professionals who distributed the links to eligible individuals.[16] The study was advertised in Spanish and English, recruiting participants to take an online survey about using medicinal foods to manage type 2 diabetes, along with compensation post-survey completion. Diabetes professionals who received the link worked in Bronx, New York communities with dense Hispanic and Latino populations, including Kingsborough and Hunts Point neighborhoods.[17] These professionals reported sharing the survey links on their personal Facebook and LinkedIn accounts. All recruitment occurred between April 11 and April 30, 2021. To be eligible, respondents self-reported Hispanic or Latino identity, an age of 18 years or older, and selected "Yes" to the question: "Have you ever been told by a doctor that you have type 2 diabetes?" Only participants who provided informed consent and met eligibility criteria proceeded with the survey.

Respondents who completed the survey received a $5 electronic gift card. To receive the $5 honorarium, respondents clicked on a link within the survey directing them to a separate form not linked to their original survey responses. The amount of $5 for the incentive was determined based on recommendations from researchers who had conducted similar online, cross-sectional surveys.

Pilot Testing

The pilot test survey participants included five Hispanic individuals with T2DM known to the researcher and five registered dietitians from New York City hospitals and community health centers working with Hispanic and Latino patients with diabetes. Based on their feedback, the survey was revised by rewording questions for appropriate interpretation, and elimination of unnecessary questions. Additionally, "medicinal foods" was reworded to "functional foods" for

clarity. Pilot testing also provided an estimated average survey time of 20-25 minutes. Participants taking the survey were able to move back and forth in the survey freely.

Survey Design

The online survey consisted of 27 multiple-choice and six open-text questions. Participants were asked about their demographic characteristics, including age, gender (male, female, and other), race (American Indian or Alaskan Native, Asian, Black or African American, Native Hawaiian or Pacific Islander, White, or Other), ethnicity ("Do you consider yourself to be of Hispanic, Latino or of Spanish origin?" Options were yes or no), participant and parents' country of birth, years of education, languages spoken at home, and employment status. Questions derived from the National Health and Nutrition Examination Survey (NHANES) included participant ethnicity, language proficiency, and most recent HbA1c value.[18]

The survey included questions about T2DM-related health behaviors derived from the California Health Interview Survey,[19] including years living with T2DM, perceived severity of T2DM, diabetes-related symptoms, (increased thirst, frequent urination, increased hunger, and/or neuropathy), frequency of blood glucose self-monitoring, number of T2DM medications prescribed, and adherence to medication regime.

The use of functional foods was assessed by asking an open question: "What foods, beverages or herbs do you consume that you believe help regulate your diabetes?" Participants were asked how often they consume functional foods on a seven-point scale ranging from "Never" to "Every day." Perceived efficacy of functional foods was measured by asking if the respondents believed the functional food(s) they consumed helped regulate their T2DM (yes, no, or I don't know). The seven options for using functional foods included: the food is more affordable, more natural, safer than taking medication, has fewer side effects, is closer to cultural

tradition, will cure their diabetes and will help them regulate their blood sugar. All data collected in this survey is reported here. This study was deemed exempt under federal regulation 45 CFR 46 104(d) Category 2(iii) by the New York University Institutional Review Board (IRB-FY2021-5221).

Online Survey Security Measures

The survey link was anonymous, and the reCAPTCHA function was activated to minimize non-human answers. Cookie technology was initiated to prevent multiple submissions from one participant. The bot detection function was selected in Qualtrics before opening the survey. Within two days, survey completion jumped from 5 to more than 20,000. As a result, the survey was stopped and reviewed to identify computer-generated responses or bots. An NYU Qualtrics specialist assisted with developing criteria to identify and eliminate surveys completed by bots. Using the bot detection function, surveys given a score of severe (highly likely bot-generated) were eliminated (n=19,776, 86%). Of the remaining 3,210 English and 114 Spanish surveys, 2,836 were excluded for the following bot-associated reasons: completing the survey in under three minutes (determined to be the cutoff time for completion; n=726), unintelligible responses (n=293), and duplicate entries, or identical responses throughout the entire survey (n=109). Survey respondents that self-identified as non-Hispanic (n=1269), completed the survey in a language other than English or Spanish (n=14), reported a birth country other than the U.S. or a Latin American country (n=48), and surveys with at least one missing value (n=377; 1.6%) were also excluded [Supplementary Figure 1]. Survey responses written in Spanish were translated into English by the first author who is bilingual in English and Spanish.

Statistical Analysis

Stata software version 17.0 (College Station, Texas, USA) was used for all statistical analyses.[20] Descriptive analyses for frequencies (n%), means and standard deviations (mean ± SD) of participants' demographic characteristics and the type and frequency of functional food use reported were performed. The frequency of functional food use variable was changed from categorical to numerical by averaging ranges of times per week to numbers (1-2 times per week = 1.5 times per week, etc.) for model analysis before analyzing the data. Kernal density plots and Shapiro-Wilk W tests indicated that data were non-linear with overdispersion of count data ($p < 0.001$). Cameron & Trivedi's decomposition test and the Breusch-Pagan/Cook-Weisberg tests showed data homoscedasticity or equal variances in different groups being compared ($p < 0.11$). Based on these tests, parametric testing was appropriate. After a variance inflation factor (VIF) test was conducted, no collinearity was shown among variables (mean VIF = 1.33). The outcome variable, weekly functional food use, violated the linearity assumptions and was characterized as count.

Functional food data showed that conditional variance exceeded the conditional mean, violating assumptions of a Poisson model. Thus, multivariable negative binomial regression models, a generalization of Poisson models that loosens the variance assumptions, were deemed appropriate for both demographic and diabetes-related behavior models. Regression models assessed the association between weekly functional food intake, demographic characteristics and T2DM-related health behaviors, adjusting for age, education, gender, employment status, language spoken at home, years with T2DM, severity of disease, number of T2DM symptoms, blood glucose monitoring, medication and insulin use to determine the prevalence rate ratios (PrR).

PrR measured the prevalence of weekly use of functional foods comparing the demographic characteristics or diabetes-related behaviors to a reference group within the same categorical variable. A PrR of 1.0 indicated there was no difference in prevalence of use between the groups. A PrR greater than 1.0 indicated a higher prevalence than in the comparison group. A PrR lower than 1.0 indicated a prevalence lower than the comparison group. Statistical significance is determined when the PrR falls outside of the confidence interval (CI) and does not contain 1.0.[21] All statistical tests were two-sided, and significance was set at alpha-level < 0.05.

Results

Table 1 shows participants' self-reported demographic characteristics (n=488). Most were male (64.8%), identified as White (52.3%), had a college degree (79.5%), and were employed full-time (69.1%). All participants self-reported Hispanic or Latino ethnicity. Almost all were born in the U.S. (98.6%) and most spoke only English in the home (44.9%) or more English than Spanish (26.0%).

Participants reported living with diabetes for a mean 4.0 ± 3.5 years, and only 20.7% rated their diabetes severe or very severe (Table 2). The most common diabetes-related symptom was increased thirst (64.3%). Participants monitored their blood glucose a mean of 2.1±1.4 times per day and took on average 2.9±1.8 diabetes medications. Ninety-seven percent took their prescribed medications regularly, and 82.8% were prescribed insulin. The 97.1% of participants who used functional foods reported a mean intake of 2.6±1.9 times per week. Of functional food users, 54.1% reported using these foods because they perceived them to be a natural remedy and 92.6% believed in the efficacy of foods in managing T2DM. Bitter melon, onion, and oats were the top three functional foods consumed (Figure 2).

The results displaying the association of functional food use and diabetes are shown in Table 3. Those who reported good health were more likely to consume functional foods compared with those who reported their health as excellent or very good (PrR = 1.47, 95% CI = 1.22; 1.78). Participants who reported their disease severity as mild were more likely to consume functional foods than those who reported their disease severity as very mild (PrR = 1.31, 95% CI = 1.05; 1.64). Those who checked their blood glucose 3 or more times daily were more likely to consume functional foods (PrR = 1.78, 95% CI = 1.46; 2.17) compared to participants who checked their blood glucose less than once per day. Participants who self-reported a HgbA1c of ≥6.0 were more likely to consume functional foods (PrR = 1.21, 95% CI = 1.01;1.44 and 1.49, 95% CI = 1.24; 1.81, respectively) than those with a HgbA1c <6.0%. Those who were prescribed insulin were less likely to consume functional foods (PrR = 0.70, 95% CI = 0.60; 0.83). Participants with more than a high school education were more likely to consume functional foods (PrR = 1.31, 95% CI = 1.08; 1.58) (Supplementary Table 4).

Discussion

Almost all Hispanic and Latino adults with T2DM in this study used functional foods to help manage T2DM. A systematic review of 33 studies investigating the use of functional foods (reported as botanical supplements) among Hispanic and Latino individuals found a prevalence of 4.7 – 80%, with sample sizes ranging from 30 to 29,990 participants.[22] The wide range of functional food use in these studies may be due to differences in food availability across the U.S. and reluctance to disclose functional food use to healthcare providers.[14,22] One study conducted in a Mexican American community near the Texas-Mexico border found that 64% of participants reported using herbal or home remedies to treat T2DM.[23] In a multiethnic study of adults with T2DM, Mexican Americans were found to use functional foods more frequently (53%) than non-

Hispanic Whites (29%) or Vietnamese Americans (18%).[13] Many of these participants described the use of functional foods recommended by alternative medicine practitioners as closer to their cultural traditions than Western recommendations,[13] suggesting that functional foods and alternative treatments may be preferred over conventional treatments. The sample from the present study likely had a higher prevalence of functional food use due to the advertisement's focus on functional foods consumed for T2DM management.

Related literature among Hispanic adults with T2DM found a higher use of different foods compared to the present study, most notably nopal and aloe vera.[24–29] In a study among Hispanic women with diabetes, 31% reported the use of nopal licuado (cactus shake).[26] In another study, Mexican-American participants reported nopal as the main food choice used to treat T2DM along with fresh herbal mixtures and herbal teas.[30] Amirehsani et al. found that 69.3% of Hispanic participants with T2DM reported the use of herbal remedies containing nopal and aloe vera, while bitter melon, onion and oats were reported by less than 4% of participants.[14,24] The differences in foods reported in other studies may be due to a high representation of Mexican participants. Although ethnic heritage was not assessed in this study, it is conceivable that participants had Hispanic heritage from countries other than Mexico. This survey was shared with registered dietitians who reported distributing the survey links to patients mainly from the Dominican Republic, Mexico, and Puerto Rico, but it is not known how many took the survey. Hispanic subgroups are diverse, making foodways, social contexts, identities, cultural values, and functional food selection variable among groups.[31]

Education was associated with greater functional food use in this study. Consistent with current study findings, previous literature showed higher prevalence of functional food use with higher levels of education.[32] Eighty percent of the 488 participants in this study had at least some

college education, whereas in the general Hispanic American population, 32% have completed a college degree.[33]

Specific T2DM-related health behaviors were also more prevalent among participants who reported functional food use, including more frequent blood glucose monitoring and insulin use. Participants who had T2DM for longer were more likely to consume functional foods. Similar to these findings, some studies show an association between functional food use and longer duration of diabetes.[26,27,34] Studies assessing characteristics associated with alternative medicine practices suggest that chronic conditions may be associated with functional food use.[32] Studies that found an association between functional food use and poorer health-related quality of life suggest participants may use them to improve their health.[32,34] The findings from this study indicate that participants who rated their health as excellent were less likely to use functional foods. Previous literature shows that there may be a perceived effect of functional food consumption related to the belief in the effect of the product consumed.[35,36] Given the high percentage of participants who believed in the efficacy of foods consumed to manage T2DM, it is possible that perceived effect of functional food use may have contributed to lower self-rated T2DM severity in the present study.

There were some limitations in this study. Many surveys were incorrectly or partially completed, limiting the number of responses that could be included in the analysis. Survey responses were self-reported and may be subject to information and recall bias. Additionally, the online survey asked about functional food use but did not measure serving sizes of the functional foods. Current dietary practices were also not assessed, eliminating the ability to assess dietary management of T2DM beyond functional food use.

In this study, 82.6% of participants reported being prescribed insulin. This is considerably higher than the national prevalence of insulin use in the U.S. for patients with diabetes (all types) of 29.1%.[37] Since insulin is used more frequently in patients with a greater number of complications,[38,39] it is possible that there were a large number of participants with diabetes-related complications, although data about health complications were not collected. Findings from the Centers for Disease Control and Prevention show that younger age is associated with higher HbA1c levels.[1] Thus, it is possible that the younger sample from this study may have been prescribed insulin and oral hypoglycemic agents as a way to lower HbA1c levels.[40] Additionally, a review examining initiation of insulin among Hispanic and Latino adults with diabetes found that low education was a barrier to initiation.[41] The participants in this study had higher levels of education than Hispanic and Latino groups in general[42], which may play a role in higher insulin use. The number of diabetes medications were measured in this study, but the types of medications were not collected.

Requiring internet access and using social media to access and complete the survey may have resulted in a younger, more highly educated, acculturated, and technologically proficient population than the general Hispanic and Latino population. The participants completing this survey was a convenience sample, demographically different from the general U.S. Hispanic population and inferences cannot be made beyond this study sample.

The survey infiltration by bots was a major limitation in this study. Offering a $5 reward for survey completion and limited bot safety measures in Qualtrics may have encouraged bot infiltration. Additionally, the method of recruitment on social media cast a wide net, further attracting bots. Future online surveys should be designed with security questions that could help identify bots, such as repeating questions throughout to determine consistency of survey answers.

Despite the limitations, the final sample was relatively large compared to previous studies,[14,23,24,26–30] allowing for a broad view of functional foods used for T2DM. This study is unique in that only food consumption was investigated, rather than in combination with oral nutrition supplements or complementary and alternative medicine practices. This allowed a focus solely on the use of whole foods and characteristics associated with functional food use.

Many of the self-reported functional foods in this study have been shown to elicit health benefits, making them sound dietary recommendations.[6–9] Providers should practice ongoing self-reflection and be willing to learn from patients of various cultural backgrounds,[43] along with building client-provider rapport to promote discussion and disclosure of culturally based functional foods.[44]

Conclusions:

Study findings indicate that functional foods were widely used among Hispanic and Latino adult participants to treat T2DM. This can inform future dietary guidance for diabetes management in this population. Nutrition and dietetics professionals should evaluate dietary assessments for functional foods that may offer health benefits and deliver medical nutrition therapy that both aligns with existing dietary habits and complements pharmaceutical treatments. More studies assessing functional food use for T2DM are needed and should be further investigated for efficacy and safety. Future studies should also include the ethnicity of participants to better understand cultural food selection for disease management.

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Table 1. Self-reported demographic characteristics of Hispanic adults with type 2 diabetes completing an online survey on functional food[a] use (n = 488)

Demographic Characteristics	
Age in years, Mean ± SD[b]	39.9 ± 10.3
Sex, n (%)	
Male	316 (64.8)
Female	172 (35.3)
Race, n (%)	
American Indian or Alaskan Native	97 (19.8)
Asian	22 (4.5)
Black or African American	57 (22.4)
Native Hawaiian or Pacific Islander	41 (8.4)
White	255 (52.3)
Other	16 (3.2)
Ethnicity, n (%)	
Hispanic or Latino	488 (100)
Non-Hispanic or Latino	0 (0)
Education, n (%)	
High school graduate or less	100 (20.5)
Some college	169 (34.6)
Two-four-year degree	181 (37.1)
Master's or doctoral degree	38 (7.8)
Employment Status, n (%)	
Unemployed or retired	51 (10.5)

Employed part-time	100 (20.5)
Employed full-time	337 (69.1)
Born in the United States, n (%)	
Yes	481 (98.6)
No	7 (1.4)
Parents born in the United States, n (%)	
No	5 (1.0)
Yes, 1 parent	136 (27.9)
Yes, both parents	347 (71.1)
Primary Language Spoken at Home, n (%)	
Only English	219 (44.9)
More English than Spanish	127 (26.0)
More Spanish than English	32 (6.6)
Both Spanish and English equally	96 (19.7)
Only Spanish	14 (2.9)

[a]Functional foods are defined as foods that contain biologically active ingredients associated with physiological health benefits for preventing and managing chronic disease.
[b]Standard deviation

Table 2. Self-reported diabetes-related characteristics of Hispanic adults with type 2 diabetes completing an online survey about functional food[a] use (n=488)

Characteristic	
Self-rated Health, n(%)	
Excellent or very good	156 (32.0)
Good	169 (34.6)
Fair or poor	163 (33.4)
Years Living with Type 2 Diabetes, *mean ± SD*	4.0 ± 3.5
Self-reported severity of diabetes, *n(%)*	
Very mild	76 (15.6)
Mild	124 (25.4)
Moderate	187 (38.3)
Severe or very severe	101 (20.7)
Number of diabetes-related symptoms, *mean ± SD*	2.7 ± 1.3
Most frequently reported symptoms, *n(%)*	
Increased thirst	314 (64.3)
Frequent urination	297 (60.9)
Extreme hunger	191 (39.1)
Daily Blood glucose monitoring frequency, *n(%)*	
<1 time	152 (31.1)
1-3 times	270 (55.0)
3-5 times	51 (10.5)
>5 times	15 (3.1)

Self-reported HgbA1c Value (within the last 12 months), *n(%)*	
<6.0%	92 (20.9)
6.0-7.0%	205 (46.5)
≥7.1%	144 (32.7)
Did not report	47 (9.6%)
Taking Prescribed Medications, *n(%)*	
Yes	475 (97.3)
No	13 (2.7)
Number of diabetes medications (range: 0-10), *mean ± SD*	2.9 ± 1.8
Prescribed Insulin, *n(%)*	
Yes	404 (82.8)
No	84 (17.2)
Number of participants using functional foods, *n(%)*	474 (97.1)
Number of times weekly functional foods are used [(Never (0) to Everyday (7)], *mean ± SD*	2.6± 1.9
Top three reasons for functional food consumption, *n(%)*	
Natural	264 (54.1)
Safe	250 (51.2)
Fewer side effects than medications	196 (40.2)
Belief in efficacy of functional foods, *n(%)*	
Yes	452 (92.6)
No	10 (2.0)

Unsure/No response	26 (5.3)

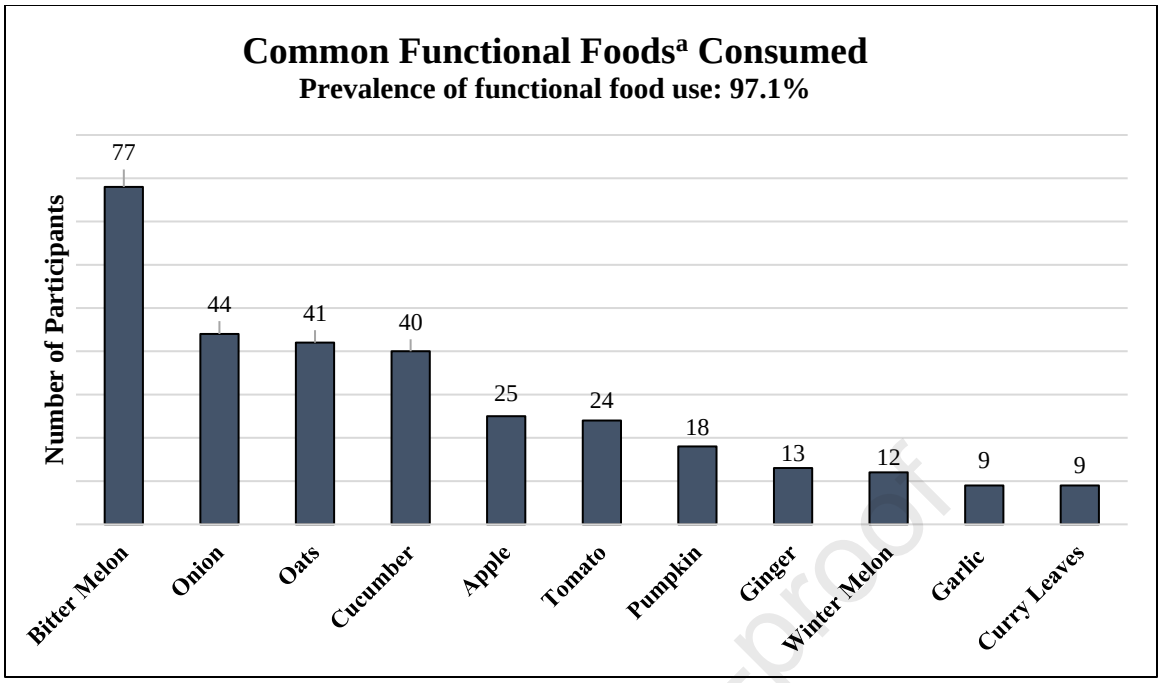
[a]Functional foods are defined as foods that contain biologically active ingredients associated with physiological health benefits for preventing and managing chronic disease.

Table 3. The association between perceived health, diabetes-related behaviors, and weekly functional food[a] use among Hispanic adults with type 2 diabetes taking an online survey (n=488)

Diabetes Related Behavior	**Functional Food Use (number of times weekly; adjusted values)**	
	Prevalence Rate Ratio[b] (SE)[d]	**95% CI[c]**
Perceived Health Rating		
Excellent or very good	Reference	
Good	1.47 (0.14)	1.22;1.78
Fair or poor	1.21 (0.11)	1.02;1.45
Severity of Disease Rating		
Very mild	Reference	
Mild	1.31 (0.15)	1.05;1.64
Moderate	1.16 (0.13)	0.92;1.45
Severe or very severe	1.00 (0.14)	0.76;1.30
Frequency of daily blood glucose monitoring		
< 1 time	Reference	
1-3 times	1.09 (0.08)	0.95;1.27
>3 times	1.78 (0.18)	1.46;2.17
Self-reported HgbA1c Value		
<6.0%	Reference	
6.0-7.0%	1.21 (0.11)	1.01;1.44

≥7.1	1.49 (0.15)	1.24;1.81
Prescribed insulin		
No	Reference	
Yes	0.70 (0.06)	0.60;0.83

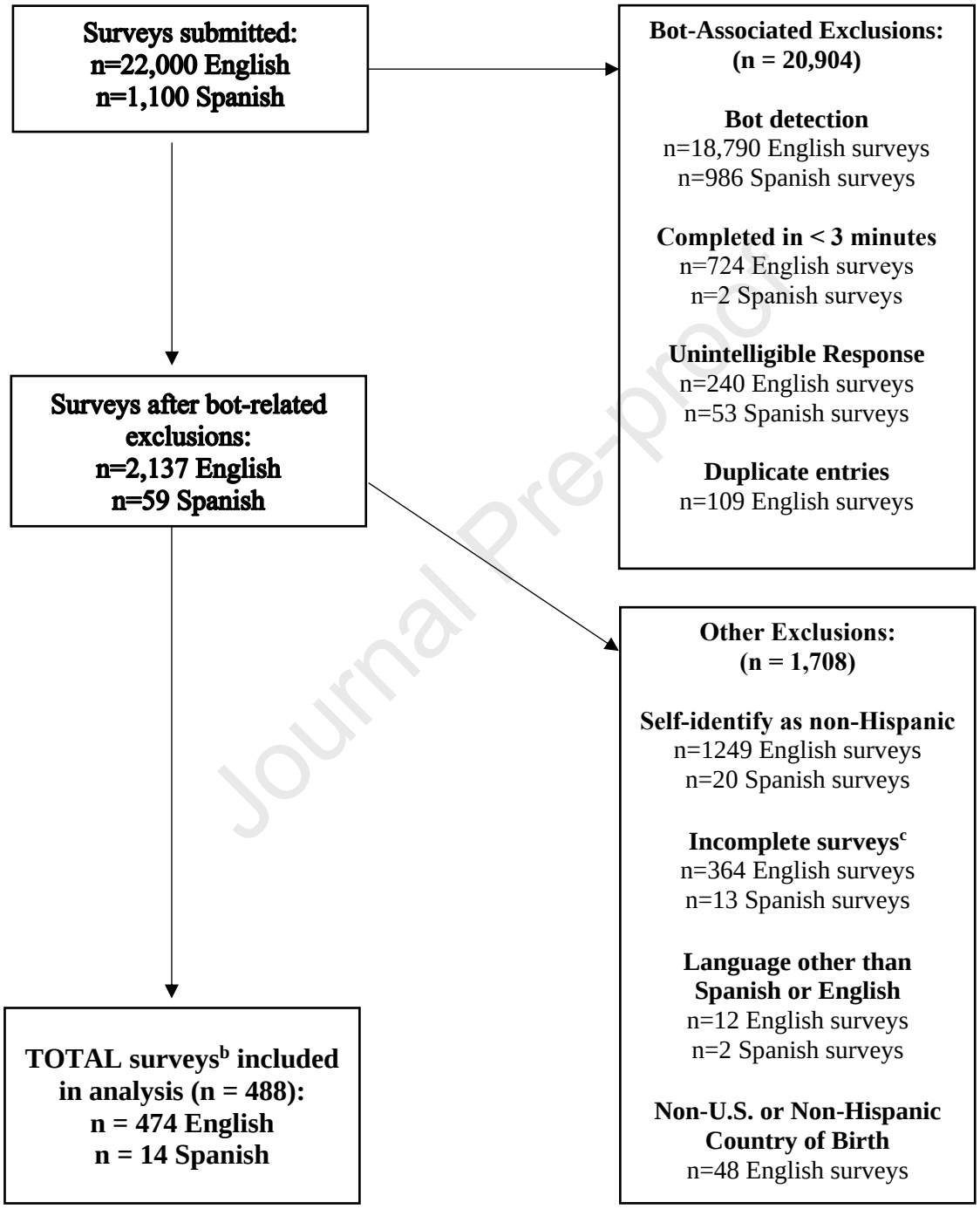
[a] Functional foods are defined as foods that contain biologically active ingredients associated with physiological health benefits for preventing and managing chronic disease.
[b]Prevalence rate ratios indicated the proportion of the population that engaged in a specific behavior. In this table, weekly functional food use and diabetes-related behaviors were measured and compared to a reference group within the same categorical variable. Statistical significance was determined when the PrR fell outside of the confidence interval (CI) and did not contain 1.0.
[c] Confidence Interval
[d]Standard Error
*All models were controlled for age and sex



[a] Functional foods are defined as foods that contain biologically active ingredients associated with physiological health benefits for preventing and managing chronic disease.

Figure 2. Common Functional Foods consumed by Hispanic adults with type 2 diabetes (n =474)

Supplementary Figure 1. Flowchart of study participation in an online survey[a] examining functional food[b] use among Hispanic adults with T2DM



[a]Online surveys were accessed through a Qualtrics link on social media sites, LinkedIn and Reddit
[b]Functional foods are defined as foods that contain biologically active ingredients associated with physiological health benefits for preventing and managing chronic disease.
[c] Surveys were accessed online through LinkedIn and Reddit
[d]Incomplete surveys were defined as having any missing data (with the exception of HbA1c)

Supplementary Table 4. The association between demographic characteristics and functional food[a] use among Hispanic adults with type 2 diabetes taking an online survey (n=488)

Characteristic	**Functional Food Use (number of times weekly-adjusted values)**	
	Prevalence Rate Ratio[b] (SE)[d]	**95% CI[c]**
Sex		
Male	Reference	
Female	0.96 (0.07)	0.84; 1.10
Highest level of education		
High school graduate or less	Reference	
Some college	1.31 (0.13)	1.08; 1.58
Completed college degree	1.45 (0.14)	1.20; 1.74
Master's or doctoral degree	1.38 (0.19)	1.05; 1.82
Employment Status		
Employed full-time	Reference	
Employed part-time	0.99 (0.08)	0.84; 1.17
Unemployed or retired	1.18 (0.13)	0.95; 1.45
Primary Language Spoken at Home		
Only English	Reference	
More English than Spanish	0.93 (0.07)	0.80; 1.09
English and Spanish equally OR more Spanish	0.87 (0.07)	0.74; 1.02

[a] Functional foods are defined as foods that contain biologically active ingredients associated with physiological health benefits for preventing and managing chronic disease.
[b]Prevalence rate ratios indicated the proportion of the population that engaged in a specific behavior. In this table, weekly functional food use and demographic characteristics were measured and compared to a reference group within the same categorical variable. Statistical significance was determined when the PrR fell outside of the confidence interval (CI) and did not contain 1.0.
[c] Confidence Interval
[d]Standard Error
*All variables were controlled for age and sex