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Transcultural Diabetes Nutrition Algorithm: The Mexican Application

Alexis Bolio Galvis[1*], Osama Hamdy[2], Miguel Escalante Pulido[3], Victoria Alejandra Rajme Haje[4], Hugo Antonio Laviada Molina[5], Mario Eduardo Martínez Sánchez[6], David González Bárcena[7], Teresita Huici y de Yta[8], Albert Marchetti[9], Refaat A Hegazi[10] and Jeffrey I Mechanick[11]

[1]*La Salle University School of Medicine, CEO AIS Asesoría e Investigación en Salud A.C., Mexico City, Mexico*
[2]*Joslin Diabetes Center, Harvard University, Boston, USA*
[3]*Occident Medical Center, Guadalajara, Jalisco, Mexico*
[4]*Medica Sur Hospital, Carlos Slim Institute, Mexico City, Mexico*
[5]*Health sciences School, Marista University, Merida Yucatan, Mexico*
[6]*Instituto Coubertin A.C., Oaxaca, Oaxaca, Mexico*
[7]*Angeles Metropolitano Hospital, Mexico City, Mexico*
[8]*Abbott Laboratories, Mexico City, 04980, Mexico*
[9]*Department of Preventive Medicine and Community Health, University of Medicine and Dentistry of New Jersey, Newark, NJ, USA*
[10]*Abbott Nutrition Research & Development, Columbus, OH, USA*
[11]*Division of Endocrinology, Diabetes, and Bone Disease, Icahn School of Medicine at Mount Sinai, New York, NY, USA*

Abstract

In Mexico, Type 2 Diabetes (T2D), dyslipidemia, hypertension, and associated Cardiovascular Disease (CVD) have replaced infectious diseases as primary causes of morbidity and mortality. In less than four decades, T2D has become the foremost health problem of this middle income nation, affecting nearly one sixth of the adult population, more than 10 million people. Dyslipidemia is also problematic and widespread, with a national prevalence among the worlds highest. Contributing to these troubles, are alarming rates of weight disorders. Mexico now has one of the most overweight and obese populations in the world, where 66% of men and 72% of women over age 20 are overweight or obese. Additionally, Mexico has emerged as the country with the highest percentage of overweight and obese youth -26% of young children and 32% of teens. Among city children with weight disorders, hypertension has become more frequent, adding to the already high prevalence of hypertension in the country and contributing yet another dimension to an already complex problem with enormously detrimental clinical and economic consequences. These problems can be mitigated through lifestyle modifications that are vital components of comprehensive care for metabolic disorders and mandated in Clinical Practice Guidelines (CPG) for T2D. Unfortunately, CPG can be complicated and often lack portability. Simplification and transculturalization can enhance applicability and implementation. The transcultural Diabetes Nutrition Algorithm (tDNA) programmatically addresses these needs and concerns through an evidence-based patient-algorithm template that is amenable to cultural adaptation. Food choices, dietary practices, physical activities, and healthcare practices in Mexico were considered for the Mexican adaptation. The resultant algorithm and its underlying recommendations are herein presented and explained.

Keywords: Diabetes; Prediabetes; Metabolic Disorders; Nutrition therapy; Transcultural; Patient algorithm; Mexico

Introduction

Prediabetes, Type 2 Diabetes (T2D) and other metabolic disorders have a major global impact and impose an enormous worldwide burden of illness, clinically and economically [1]. This burden can be reduced by a variety of effective preventive and therapeutic measures. Lifestyle medicine, including daily physical activity and nutrition therapy, is a primary intervention and a recommended component of comprehensive diabetes care [2,3]. Consequently, it should be universally implemented in the management of patients with T2D, those at risk for the disorder, and those with concomitant metabolic complications.

Clinical Practice Guidelines (CPG) provide extensive and beneficial information on lifestyle modification for patients with T2D, but must be simplified for ease of application and culturally adapted for portability and success [1,4]. In response to this need, the transcultural Diabetes Nutrition Algorithm (tDNA) template was developed with the direction and consensus of an international panel of highly experienced practitioners, researchers, and academicians. It is broadly supported by scientific evidence and expert opinion and is intended to: 1) increase awareness of the benefits of lifestyle interventions for prediabetes and T2D; 2) encourage healthy eating according to regional differences in lifestyles, foods, and cultures; 3) and simplify and enhance the implementation of existing CPG [4]. Cultural adaptations according to regional variations in anthropometrics, dietary habits, available foods, and other meaningful parameters are underway on a global scale. Specific tDNA applications are already published, some are in manuscript form, and others are in development (Table 1).

The Mexican tDNA adaptation (tDNA-Mexico) accommodates clinical and social circumstances in Mexico. It also conveys recommendations for lifestyle modifications that alter the natural history of T2D and incorporates a series of tables containing useful facts, figures, and perspective. This simple clinical tool is especially important in Latin American countries, such as Mexico, where disease risk is high, T2D and common metabolic comorbidities are rampant, secondary related illness is prevalent, effective management is elusive, and funding is conspicuously limited. These conditions must change for the sake of Mexican citizens and their social security institutions,

***Corresponding author:** Alexis Bolio Galvis, Av. México 700 Int. Po14, Col. San Jerónimo Lídice, Del. Magdalena Contreras, CP 10200, Mexico DF, Tel: +(5255)51354877; E-mail: abolio@ais.org.mx

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Applications In Development
Panamanian, Costa Rican, Colombian, Brazilian, and Egyptian

Table 1: Transcultural Nutrition Algorithm Adaptations.

including the Ministry of Health; otherwise, the disease burden may become unbearable and an effective public health plan non-sustainable [5,6].

Epidemiology

Over the past couple decades; Mexico has experienced a momentous shift in socio-economic conditions. Rapid urbanization, increased productivity, and expanding prosperity have improved the country in many ways, but have also contributed to the diminished health and fitness of its citizens via sedentary living and harmful eating. These deleterious changes have also been associated with an enormous epidemiologic shift that is characterized by a rapidly rising prevalence of nutrition-related, Non-Communicable Chronic Diseases (NCCD) [7,8]. In Mexico as in other parts of the developing world, T2D, hypertension, dyslipidemia, and associated Cardiovascular Disease (CVD) have replaced infectious diseases as primary causes of morbidity and mortality [7,8]. In less than four decades, for example, T2D has become the leading health problem for this middle-income nation [9], with nearly one sixth of the adult population, more than 10 million people affected [10]. These changes have placed tremendous stress on a struggling social system and its healthcare network.

Body weight and T2D

Contributing to this dilemma, Mexico now has one of the most overweight and obese populations in the world, where 16.6 million men (66%) and 20.52 million women (72%) over 20 years of age are categorized as overweight or obese [11]. Additionally, Mexico has ascended as the country with the highest percentage of overweight and obese children, where 5.54 million children between 6 and 12 years old (26%) are categorized as overweight or obese and 31.85% of teens between 11 to 19 years old are categorized as obese [8,11-13]. Among women 20 to 49 years of age, the average Waist Circumference (WC) is greater than 34.6 inches (88 cm), when the suggested cut-off point for Central and South American populations should be 31.4 inches (80 cm). For men, the average WC is 40.1 inches (102 cm), when the cut-off should be 37 inches (94 cm), according to Central and South American standards [14].

Pre-diabetes and T2D

A genetic predisposition for T2D, combined with a traditional love for food and drink, creates a challenging situation for Mexico. Currently, the nation faces the sixth highest number of T2D cases in the world [6,10]. Prediabetes is also on the rise, with a national prevalence of 20.1%, representing 16 million Mexicans over 20 years of age bear high risk of T2D progression [15]. Type 2 diabetes is the primary cause of renal failure and blindness in Mexico [9]. It has been the principal cause of death among women and the second leading cause of death among men for the past 10 years, contributing to 75% of total national mortality [9,13]. According to official figures reported by the Instituto Nacional de Estadística y Geografía INEGI (National Institute of Statistics and Geography) and the Sistema Nacional de Información en Salud SINAIS (National System of Health Information), 82,964 diabetes-related deaths occurred in 2010 and 77,699 were recorded in 2011. Yet, Mexico is not alone: according to information from the World Health Organization (WHO) in 2008, diabetes affected more than 220 million people and cost 1.26 million lives worldwide [16,17].

Dyslipidemia and T2D

With the development of a national system of health surveys, Mexico has been able to identify and monitor diverse public health problems, such as nutrition-related NCCD, and has gained a greater understanding of the critical nature of these problems as well as their potential solutions [18]. Several nationwide surveys conducted over the past 20 years have demonstrated not only a worrying level of T2D in Mexico but also an extremely high prevalence of dyslipidemia [18-20]; undisputedly, among the highest in the world. In 1992-1993, the Ministry of Health estimated the prevalence of dyslipidemia along with other NCCD via a national survey of 15,607 subjects, aged 20 to 69 years, in 417 cities [18]. The surveyed population represented typical urban adults.

Survey results indicated that a concentration of high density lipoprotein cholesterol (HDL-C) less than 0.9 mmol/L was the most prevalent lipid abnormality, occurring in 46.2% of men and 28.7% of women, followed by hypertriglyceridemia in 24.3% of subjects, with

severe levels (>11.2 mmol/l) being observed in 0.42% of participants. Elevated levels (≥ 4.21 mmol/L) of low density lipoprotein cholesterol (LDL-C) were observed in 11.2% of study subjects. Moreover, 50% of subjects with hypertriglyceridemia had a mixed dyslipidemia or low HDL-C level. Insulin resistance was present in 59% of subjects.

Subsequent research (Encuesta Nacional de Salud y Nutricion (National Health and Nutrition Survey), ENSANUT 2006) confirmed these results, based on information and data collected from 4,040 fasting adult subjects, aged 20 to 69 years [19]. The median lipid concentrations revealed in the 2006 study were as follows: HDL-C, 39.0 mg/dL (60.5% prevalence); LDL-C, 131.5 mg/dL (46%); total cholesterol (TC), 198.5 mg/dL (43.6%); and triglycerides (TG), 139.6 mg/dL (31.5%).

In a cross-sectional study conducted in 2008 among 1,179 apparently healthy adults (71% men), age 35 to 65 years, anthropometric data, lipid profile, fasting blood sugar, and insulin levels were collected and analyzed for the prevalence of dyslipidemia and its association with insulin resistance [20]. Results indicated that hypertriglyceridemia was present in 57.3% of study subjects, abnormally low HDL-C levels were found in 52.4%, and hypercholesterolemia in 48.7%. Among individuals classified as obese by WC, 36.8% had hypertriglyceridemia/hypoalphalipoproteinemia, 35.2% had mixed dyslipidemia, and 33.4% had hypertriglyceridemia. Insulin resistance was commonly associated with hypertriglyceridemia and hypoalphalipoproteinemia.

Hypertension and T2D

Hypertension, a key cardiovascular disease risk factor, is yet another prevalent cause of morbidity and mortality in Mexico. In 2000, the prevalence of hypertension was 26.4% among the global adult population and approximately 35% among adults in Latin American countries [21]. In Mexico, hypertension is defined by blood pressure greater than or equal to 140/90 mmHg. It is commonly and significantly associated with other chronic diseases such as increased BMI, abdominal obesity, T2D, and hypercholesterolemia [21]. Results from the National Health and Nutrition Survey showed that in 2006 43.2% of 33,366 respondents, aged 20 years or greater, were hypertensive, representing a 25% increase over the previous six years [21]. The study concluded that hypertension was one of the most prevalent chronic diseases in Mexico.

Collaborating evidence was provided by the Lindavista Study, based on a sample of 2,602 middle-class urban Mexican adults, aged 50 years (mean), who were surveyed and described in 2013 [22]. Among the studied population, 32% had hypertension, with 20% controlled, 50% were classified as overweight, 24% had obesity, 32% smoked 6% had a dyslipidemia and 6% had T2D. Half of the participants suffered from metabolic syndrome.

Among children in Mexico City, hypertension is associated with increased BMI and expanded WC [23]. In an epidemiologic assessment conducted in 2009, study subjects ranged in age from 5-8 (n=474), 9-12 (n=643), and 13-17 (n=912) years and were more likely to have hypertensive if they were overweight had obesity. An increased prevalence of hypertension was discovered in both genders and correlated positively with increasing age as well as elevated BMI and WC. In light of the high prevalence of weight disorders in Mexican youths, the elevated threat of hypertension, clinically and economically, is especially disconcerting, as these individuals have a lifetime to develop the myriad of sequelae that result from the disease over time. With these thoughts in mind, a multidisciplinary committee of experts in Systemic Arterial Hypertension from the National Institute of Cardiology "Ignacio Chávez" updated recommendations for the prevention, detection, control, and treatment of hypertension [24]. The committee emphasized a multidisciplinary approach for preventive health measures-good nutrition, exercise, and lifestyle changes beginning early in life-intended to help stem the problem. "We suggest that the changes in the style of life must be vigorous, continuous and systematized… … to confront and prevent the pandemic of chronic diseases (in Mexico)" [24]. Recognizing that hypertension is not an isolated disease, the committee urged a strategy that included attention to other cardiovascular risk factors such as obesity, diabetes, dyslipidemia, and smoking. Likewise, the WHO and similar organizations advocate healthy lifestyles to protect against T2D, delay its onset, guard against its progression, and avoid its complications. Maintaining a healthy weight, being physically active, eating a healthy diet, reducing sugar and saturated fat intake, and eluding processed energy-dense foods were all cited as effective strategies.

Methods for the adaptation of tDNA in Mexico

Based on global epidemiologic data similar to the information presented here as well as recommendations from various professional socieities and healthcare organizations, the tDNA template was created by a team of diabetes experts to address the educational needs of practitioners and their patients with T2D and concommitant disorders like dyslipidemia and hypertension. For international applicability and relevance, the tDNA template was designed to be culturally adaptable, as recommended for other forms of medical guidance such as CPG [25,26]. To undertake the Mexican adaptation, respected healthcare professionals with an interest in nutrition and diabetes were identified from various parts of the country representing distinctly different regions. Each expert was contacted, briefed on the project, and questioned about his or her current activities and interest in participating in the initiative. Based on responses, invitations were extended to a select group of these specialists, requesting their involvement. The task force was finalized when a group (n=7), sufficient for advisory activities, was formed.

During a face-to-face meeting in the city of Cuernavaca, Morelos, Mexico on the 9th and 10th of November 2012, members of the task force reviewed the tDNA template and provided culturally meaningful data, information, and opinion to adapt the algorithm to the Mexican conditions. Members discussed the clinical evidence and influence of various risk factors (e.g., prediabetes and T2D, cardiovascular events, obesity, hypertension, and dyslipidemia) in the assignment of patients to specific algorithmic pathways. Similarly, task force members deliberated over the merits, practicality, and inclusion of specific measures (e.g., body weight vs. waist-to-hip ratio (WHR)), tests (e.g., fasting blood glucose vs. glycosylated hemoglobin (A1c)), and nutritional therapies (e.g., calorie supplementation or substitution with prepared diabetes-specific formulas) that would be cited in their final adaptations and recommendations. Transcultural factors influencing dietary practices, food choices, and T2D healthcare interventions were also considered. Thereafter, attending task force members and a tDNA executive committee reviewed summaries of the proceedings in order to finalize the algorithm (Figure 1) and this report.

The remainder of this paper represents an amalgam of their deliberations, conclusions, and recommendations and presents for the first time the tDNA-Mexico Application.

Recommendations

R1. Individual glycemic status and the risk of diabetic complications are influenced by diets, meals, and foods [2,27-29].

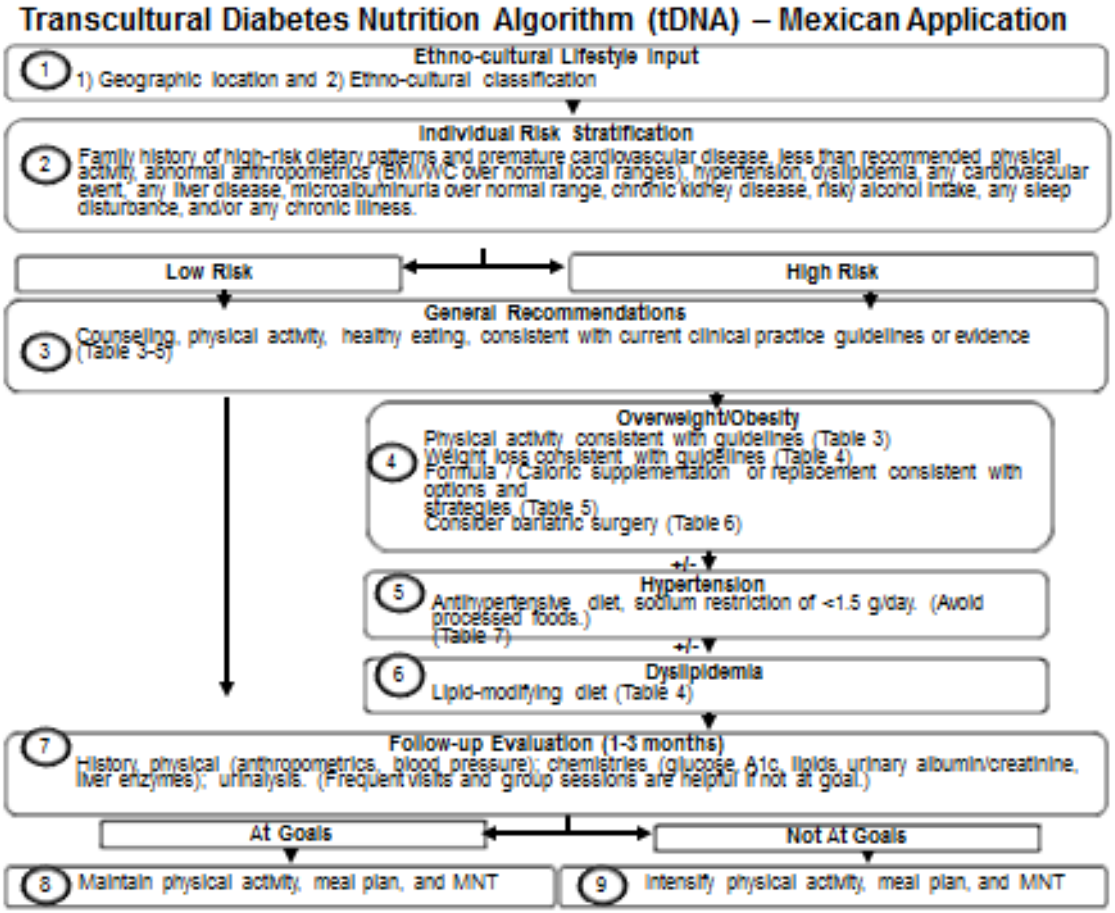

Figure 1: The transcultural Diabetes Nutrition Algorithm (tDNA) for prediabetes and type 2 diabetes.

AACE: American Association of Clinical Endocrinologists; ADA: American Diabetes Association; BMI: Body mass index; DASH: Dietary Approaches to Stop Hypertension; FPG: fasting plasma glucose; A1c: glycosylated hemoglobin A1c; IFG: Impaired Fasting Glucose; IGT: Impaired Glucose Tolerance; MNT: Medical Nutrition Therapy; OGTT: Oral Glucose Tolerance Test; PG: Plasma Glucose; WC: Waist Circumference; WHR: Waist-To-Hip Ratio.

R2. Medical Nutritional Therapy (MNT) has been shown to be a vital component of comprehensive management programs for dysglycemic patients with prediabetes and Type 2 diabetes. Therefore, it should be universally implemented in patients with dysglycemia or at risk for the disorder [30-37].

R3. Diets should be customized according to individual risk factors such as glucose tolerance, obesity, hypertension, and dyslipidemia [32-34].

R4. Local foods and meals should be selected based on cultural factors in observance with general nutrition recommendations from the American Association of Clinical Endocrinology (AACE) and the American Diabetes Association (ADA) [1,30,31].

R5. Glycemia-Targeted Specialized Nutrition (GTSN) may be used for calorie replacement or supplementation as part of MNT [30,31,38-40]. Ready-to-use GTSN formulas are made with nutrients designed to improve glycemic control, e.g., modified maltodextrin, fructose, monounsaturated fatty acids, and antioxidants [40]. Reduction in disease complications and improvement in glycemic profiles have been demonstrated in clinical studies among patients consuming GTSN as part of MNT [30,31,38-40]. Caloric replacement is helpful to achieve weight loss in at-risk people who are overweight or obese, improve metabolic and glycemic control, and prevent possible vitamin or nutrient insufficiencies secondary to caloric restriction in patients who are overweight or obese [40-42]. In order to meet individual patient goals based on clinical evaluation, an increase or reduction of the number of supplements or replacements consumed daily should be achieved in a step-wise process [43]. Caloric supplementation with GTSN has value improving nutritional deficiencies, facilitating weight gain in at-risk people who are underweight, and preventing diabetes-related complications in patients, such as the elderly and/or those with low BMI experiencing nutritional insufficiency states [40-42] (Table 2).

R7. Anthropometric measures (Body Mass Index (BMI), Waist Circumference (WC), and Waist-To-Hip Ratio (WHR)) have different values and interpretations globally, depending on phenotypes and cultural differences. Although they are not globally standardized, various anthropometric measures have merit in clinical practice depending on specific objectives, such as assessment of body composition, diagnosis of obesity, and risk stratification and progression [31]. In the Mexican adaptation of tDNA, BMI and WC are the recommended measures of body composition. Ethnocultural adjustments can be made in the values for local applicability [44,45] (Table 3).

R8. Lifestyle interventions specifically require healthy eating patterns, adequate physical activity, and professional counseling, consistent with current practice guidelines or evidence [30,31]. Both

Overweight and Obese	Use calorie replacements* as part of a reduced-calorie meal plan. Calorie Goals<113 kg = 1200 to 1500 calories>113 kg = 1500 to 1800 calories Calorie Replacement Goals2 to 3 calorie replacements per day to be incorporated into a reduced-calorie meal plan, as a meal replacement, partial meal replacement or snack.	
Normal Weight	Controlled Diabetes A1c ≤ 7%	Use of calorie replacement/calorie supplement should be based on clinical judgment and individual assessment**
	Uncontrolled Diabetes A1c>7%	1 to 2 calorie replacements per day to be incorporated into a reduced-calorie meal plan, as a meal replacement, partial meal replacement or snack.
Underweight	Use nutrition supplement*** 1–3 units/day per clinical judgment based on desired rate of weight gain and clinical tolerance.	

Table 2: Glycemia-targeted Specialized Nutrition (GTSN) for Prediabetes and Diabetes.

Body Mass Index			
Low weight	<18.5		
Normal weight	18.5 – 24.9		
Overweight	25.9 – 29.9		
Obesity, class I	30.0 – 34.9		
Obesity, class II	35.0 – 39.9		
Extreme obesity, or class III	>40		
Waist Circumference			
Men	High>90 cm		
Women	High>80 cm		
Hip-Waist Ratio			
Men	Low<0.90	Moderate 0.90-0.95	High>0.95
Women	Low<0.80	Moderate 0.80-0.85	High>0.85

Table 3: Anthropometrics in Mexico – Body Mass, Waist Circumference, and Hip-Waist Ratio.

Low	Patients should be encouraged to achieve an active lifestyle and to avoid sedentary living, because physical activity and exercise provide many health benefits and facilitate glycemic control. Participation in any physical activity provides some health benefits
	For substantial benefits: ≥ 150 min/week of moderate-intensity activity, or ≥ 75 min/week of vigorous-intensity aerobic activity, or some combination of equivalent moderate/vigorous activity
Medium	Aerobic activity should be performed in episodes of ≥ 10 min and preferably spread throughout the week For additional, more extensive benefits: ≥ 300 min/week of moderate-intensity activity, or ≥ 150 min/week of vigorous-intensity aerobic activity, or some combination of equivalent moderate/vigorous activity Additional health benefits are gained beyond this amount
High	Moderate- or high-intensity resistance exercise training for all major muscle groups, as a separate modality from aerobic exercise, has been shown to increase muscle mass and strength, alter body composition, and improve glycemic control; therefore, it should be combined with aerobic activity in each individual ≥2 days per week
Exercise should be undertaken only after cardiac clearance has been obtained.	

Although Mexico has no official physical activity guidelines, physicians generally use the above recommendations from the US Department of Health. In the near future, country-specific guidance is likely in order to accommodate the types of exercises and activities that are common among Mexicans.

Table 4: Physical Activity Guidelines for the Management of Patients with Diabetes.

low-risk and high-risk patients should observe recommended lifestyle behaviors; however, high-risk patients should be encourage to comply with expanded recommendations that are consistent with their specific needs and conditions.

R9. Behavior changes are difficult to achieve for many patients [31]. Research has shown that healthcare professionals with experience in behavior-modification techniques and registered dietitians who are familiar with MNT can help patients with Type 2 diabetes achieve their goals and improve their outcomes [46-48]. , Patients in some cultures, however, prefer to receive advice solely from physicians, who must therefore be encouraged to develop greater knowledge and skill in nutrition. It must also be recognized that time constraints placed on physicians during clinical encounters, compounded by the unavailability of allied healthcare professionals well-versed in behavioral medicine, can create regional limitations.

R10. Patients should be encouraged to change sedentary living for a lifestyle including physical activity and exercise that provide health benefits and facilitate glycemic control [49-52]. Moderate aerobic activity for ≥ 150 minutes per week or vigorous aerobic activity for ≥ 75 minutes per week are associated with considerable benefits [50,53]. Furthermore, a progressive resistance training increase muscle mass, improve body composition, and facilitates glycemic control. A combined physical activity program with progressive resistance training and aerobic activity is recommended in all individuals [54] (Table 4).

R11. In 1994 the term Medical Nutrition Therapy (MNT) was introduced by the Academy of Nutrition and Dietetics, (formerly the

American Dietetic Association) in an effort to explain the concept of therapeutic nutrition [33,55]. In patients with prediabetes or Type-2 Diabetes (T2D), MNT connotes a specific nutritional intervention integrated into daily living by assessment, counseling, and dietary modification that may or may not include a Glycemia-Targeted Specialized Nutrition (GTSN) formula for calorie supplementation or replacement [33]. Diabetes-specific MNT can improve glycemic profiles and reduce the risk of disease complications [33,34,56]. In the literature, the recommendations for T2D include:

- Carbohydrates, preferentially from low–glycemic-index foods, for 45% to 65% of daily energy intake and not less than 130 g/day in patients on low-calorie diets [30,31,57]
- Fats for <30% of daily energy intake [30,31,57]
- Saturated fat for <7% of daily energy intake [30,31,57,58]
- Protein for 15%–20% of energy intake and not less than 1 g/kg in patients with normal kidney function [30,31]
- Cholesterol restricted to <200 mg daily [30,31,57,58]
- Trans-fats eliminated or reduced to minimal intake [30,31,57,58]
- Fiber for 25g–50 g daily [30,31,57] (Tables 5 and 6).

R12. Patients who are overweight or obese should achieve a gradual loss of 5% to 10% of body weight in 3 months by reducing caloric intake for a total daily deficit of 250–1000 kilocalories [2,3,30,31,39,59,60]. Individuals with class 3 obesity should achieve a 15% decrease in body weight in 6 months [2,3,30,31,39,59,60]. BMI should be decreased by 2 to 3 units in 6 months to ameliorate risks associated with excessive body weight [30,31,39,59,60]. Metabolic benefits are related to any amount of weight loss even if clinical goals are not met.

R13. Patient with Type 2 diabetes and obesity who fail to respond to lifestyle and pharmacologic interventions; who fit the criteria of body composition, comorbidities, and surgical risk; and who are anticipated to adhere with lifestyle changes and follow-up evaluations are bariatric surgery candidates [61-63] (Table 7).

R14. Further nutritional management is needed for patients with hypertension complicating prediabetes and Type 2 diabetes. In accordance with recent recommendation in the Dietary Guidelines for Americans 2010, such patients should limit sodium intake to 1,500 mg/day [64-69] (Table 8).

R15. Closer attention to fat intake, based on individual dyslipidemic profiles, is needed in comorbid patients with lipid abnormalities.

Hypocaloric (weight loss) diet: 250 - 1000 kcal/day deficit • Target: decrease weight by 5% to 10% for overweight/obesity, 15% for class 3 obesity • Target: decrease BMI by 2 to 3 units
Carbohydrates (preferably low-glycemic index): 45% to 65% daily energy intake and not less than 130 g/day in patients on low calorie diet
Protein: 15% to 20% daily energy intake
Dietary fat: <30% daily energy intake
Saturated fat: <7% daily energy intake
Cholesterol: <200 mg/day
Fiber: 25-50 g/day
Trans fats: minimize or eliminate

BMI: Body Mass Index.
Consistent with guidelines from the American Association of Clinical Endocrinologists (AACE) and the American Diabetes Association (ADA)

Table 5: General Nutritional Guidelines for Healthy Eating (Principal Nutrients).

Food	Portion	Glycemic Index
Raw chard	2 cups	64.0
Cooked chard	1/2 cup	64.0
Raw pea	1/5 cup	48.0
Cooked pea	1/2 cup	48.0
Potato Purée	1/2 cup	74.0
Germinated bean	1 1/2 cup	0.0
Cooked beans	1/2 cup	43.0
Canned beans	1/2 cup	45.0
Cooked chickpea	1/2 cup	31.0
Broad bean	1/4 cup	0.0
Cooked lentil	1/2 cup	26.0
Cooked soy	1/3 cup	18.0
Ate sweet	13 g	51.0
White sugar	2 tea spoon	68.0
Powder chocolate without sugar	2 tea spoon	51.0
Honey	2 tea spoon	55.0
Soft-drinks	1/4 can	66.0
Carrots	1/2 cup	47.0
Apricot	4 piece	57.0
Chicozapote	1/2 piece	40.0
Peach	2 piece	42.0
Strawberry	17 piece	40.0
Orange juice	1/2 cup	46.0
Grapefruit juice	1/2 cup	48.0
Kiwi	1 1/2 piece	53.0
Mango	1/2 piece	51.0
Apple	1 piece	38.0
Melon	1/3 piece	65.0
Papaya	1 cup	59.0
Banana	1/2 piece	52.0
Grape	18 piece	43.0
Cooked rice	1/4 cup	64.0
Oatmeal	1/3 cup	59.0
Baguette bread	1/7 piece	95.0
Rye	5 tea spoon	41.0
Yellow corn	1 1/2 piece	53.0
Tortilla dough	45 g	0.0
Popcorn	2 1/2 cup	55.0
White bread	1 piece	70.0
Whole grain bread	1 piece	54.0
Boiled potato	1/2 piece	65.0
Corn tortilla	1 piece	52.0
Flour tortilla	1/2 piece	30.0
Gradient guide to the glycemic index (GI) of food: low (GI ≤55), medium (GI 56 – 59), high (GI >70).		

Typical Mexican foods and their glycemic indices are presented so that diets can be tailored to the needs and preferences of individual patients. Low glycemic index foods foster better glycemic control. An understanding of this concept and familiarity with the glycemic index of every food will help to reduce the need for insulin or other medical therapies for T2D and prediabetic patients. This list should be updated frequently with additional typical foods.

Table 6: Glycemic Indices of Common Mexican Foods.

Clinical benefit can be derived from viscous fibers and plant sterols [70-77]. In patients with hypertriglyceridemia, it is important to reduce the consumption of simple sugars and alcohol.

R16. When treating a patient with prediabetes or Type 2 diabetes who has multiple comorbidities, multi-modal interventions can be utilized concurrently with higher levels of intensity. Capacity for

Heart disease (coronary disease, pulmonary hypertension, congestive heart failure, cardiomyopathy)
Type 2 diabetes mellitus
Chronic obstructive pulmonary disease (obstructive sleep apnea, asthma, hypoventilation, Picwickian)
Cerebral Pseudotumor
Gastroesophgeal reflux disease
Hypertension
Dyslipidemia
Articular or discopatía disease with decrease of daily activity

*Mexico criteria are based on the AACE guidelines

Table 7: Selection Criteria for Bariatric Surgery in Mexico* (BMI >35 and any of the following conditions).

Cholesterol ≤ 200 mg
Sodium ≤ 1,500 mg
At least 30gr of dietary fiber should be consumed on a daily basis with a content distribution of 10g soluble fiber and 20g insoluble fiber
Avoid processed foods

Although the DASH diet is widely used as nutritional therapy for hypertensive patients, in Mexico it is more important to specify acceptable intake of cholesterol, sodium, and fiber because typical Mexican diets are very high in salt, cholesterol, and saturated fats, with almost no fiber. Deleterious Mexican diets and food choices occur in part due to high consumption of processed foods and insufficient patient understanding of the nutritional contents of those foods.

Table 8: Antihypertensive Diet – Focus for Patients with Hypertension.

adherence and adverse effects, as well as dietary customs and practices, are taken into account.

R17. Patients should be scheduled for a follow-up visits that are timed according to their needs. Assessments should include a history and physical exam (e.g., anthropometrics, blood pressure); blood chemistries (e.g., glucose, A1c, lipids, renal function, and liver enzymes depending on clinical status); and urinary microalbumin determination. Improvements in disease status noted during follow-up assessments provide an opportunity to diminish the intensity of interventions and thus spare resources. Worsening of clinical status provides the opportunity to intensify interventions and look for different approaches to improve care and adherence [78-89].

Conclusion

In many developing countries, such as Mexico, the incidence and prevalence of T2D and other NCCD are rising rapidly. Moreover, these disorders are occurring at increasingly younger ages. These trends imply a rapidly increasing burden of illness that affects all healthcare stakeholders, including patients, providers, payers, and the society at large. They also demand a cradle-to-grave approach to patient management and a focus on therapeutic lifestyles that can prevent or ameliorate not only T2D but also the concomitant metabolic disorders that common occur with T2D. To maximize the clinical and economic benefits derived from lifestyle interventions, widespread changes are needed, not only in community outreach programs but also in overall healthcare policies and approaches. Guidance must emphasize the importance of nutritional and lifestyle interventions for the overweight and obese, for dysglycemic patients, and for those with other NCCD, such as dyslipidemia and hypertension. Such an approach should also provide benefit and value in the management of downstream sequelae, for instance, cardiovascular, renal, and ophthalmic complications.

As with other regional adaptations, the Mexican version of tDNA focuses on lifestyle differences between cultures and within the Mexican society. tDNA-Mexico recommendations are evidence-based and emphasize various anthropometric, physiologic, epidemiologic, nutritional, cultural, and sociologic factors that influence the development and progression, as well as the management of T2D, its comorbidities, and its sequelae. The goal of the adaptation is to provide practice and patient guidance in a less complicated but more systematic and effective way. Specifically, the adaptation is intended to assist healthcare professionals incorporate therapeutics lifestyles into routine clinical care. By allocating innovative resources such as tDNA-Mexico, health may be promoted and T2D, along with its complications, may be prevented or delayed through relatively inexpensive yet effective lifestyle modifications. Costs could be saved by stemming the demand for more expensive healthcare services.

Following initial use in daily practice, a validation of the clinical impact of tDNA-Mexico is planned to demonstrate outcomes that justify continued and expanded utilization of this unique clinical tool.

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