

Review

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Posted Date: 24 December 2025

doi: 10.20944/preprints202512.2188.v1

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Review

Population Heterogeneity of Diabetes in Indigenous Peoples of the Americas: A Systematic Scoping Review of Existing Literature

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Abstract

Background: Diabetes is a growing public health concern worldwide, with an estimated 589 million people affected in 2024. This number is projected to increase by 46% over the next 25 years. In the Americas, the prevalence of diabetes is expected to rise from 92 million in 2024 to 120 million by 2050. Indigenous populations may face unique biological, environmental, and sociocultural risk factors, yet they are traditionally considered a homogeneous group in epidemiological research, however compiled consolidated evidence on the prevalence of diabetes across diverse Indigenous populations remains limited. This systematic review examines the prevalence of diabetes among Indigenous populations in the Americas. **Methods:** Following PRISMA-ScR guidelines, we conducted a systematic scoping review of population-based studies reporting diabetes prevalence among Indigenous and mestizo adult populations in the Americas. Searches were performed in PubMed and Scopus. Data extraction focused on study location, Indigenous group, population characteristics, diagnostic criteria, and reported prevalence estimates. **Results:** Sixty documents encompassing 73 studies met inclusion criteria, representing 45,503 individuals from 16 countries between 1975 and 2025. Diabetes prevalence estimates varied widely across Indigenous populations, regions, and time periods. This heterogeneity reflected differences in diagnostic criteria, age distributions, and historical and sociocultural contexts. Mexico (17) and the United States (15), followed by the United States (15), Brazil (10), Canada (7), Chile (6), and Guatemala (5). Most participants were from North America (29,093), followed by Central America (8,144) and South America (6,911). No eligible reports were identified from Caribbean nations, Peru, or Guyana. In total, 111 Indigenous groups were represented. The most frequently used diagnostic method was fasting blood glucose (FBG), applied in 50 studies (75%), followed by the oral glucose tolerance test (OGTT) in 41 studies (61%). The combined prevalence of diabetes among Indigenous and mestizo populations was 12% overall (17% among women and 14% among men). Mean diabetes prevalence was highest in North America (17%), followed by Central America (8.9%) and South America (4.9%). Notably, five studies—from Brazil, Chile, Colombia, Mexico, and Paraguay—reported no cases of diabetes. **Conclusions:** The prevalence of diabetes among Indigenous populations in the Americas is highly heterogeneous, with considerably higher rates reported in North America compared with Central and South America. Although genetic predisposition may play an important role, environmental and lifestyle factors likely contribute substantially to these differences. The decline in published studies in recent years suggests a reduction in research focus on this topic. Further investigation into modifiable risk factors—such as diet, physical activity, and socioeconomic conditions—is essential to better understand the epidemiology of diabetes, clarify how these determinants interact, and support the development of targeted interventions to reduce risk and address health disparities among Indigenous populations across the region. Heterogeneity in the prevalence of diabetes among

Indigenous populations, underscores the importance of standardized measurement for personalized care and precision public health.

Keywords: indigenous populations; native Americans; diabetes prevalence; health disparities; population heterogeneity; personalized medicine; precision public health; ethnic diversity; Americas; scoping review; epidemiology

Introduction

The global prevalence of diabetes was estimated at 589 million people between the ages of 20 and 79 years, in 2024 and this number is projected to increase by 46% over the next 25 years. In the Americas, approximately 92 million people were living with diabetes in 2024, with forecasts predicting an increase to 120 million by 2050.

Diabetes manifests in two primary clinical forms, and although its exact cause remains unknown, each type has distinct risk factors. The rising global prevalence of diabetes is largely driven by the increasing incidence of type 2 diabetes, which is associated with both modifiable and non-modifiable risk factors. Modifiable risk factors include overweight or obesity, physical inactivity, and poor nutrition, while non-modifiable factors primarily involve age and genetic predisposition.

Before Europeans came to America, the Indigenous population was estimated to have ranged from 43–60 million people in conservative reconstructions to 90–110 million in high-end demographic models[1,2]. They were organized into thousands of distinct peoples, speaking more than 1,000 Indigenous languages [3,4]. This period represented one of the richest concentrations of linguistic diversity in the world. The demographic collapse that followed the 16th century—driven by epidemics, warfare, forced labor, and displacement—reduced many nations to fragments of their former size, with entire language families disappearing [1,2,5,6].

Historically, an increased prevalence of diabetes has been documented among Native populations in North America. One of the highest recorded rates has been observed in the Pima Indians of Arizona [7,8]. For years, research has emphasized the critical contribution of genetic susceptibility to type 2 diabetes, especially when compounded by adverse environmental conditions [9].

Understanding the scope, trends, and risk factors of diabetes in the Indigenous populations of the Americas is crucial for identifying research gaps and guiding future studies. By summarizing existing data, this systematic review aims to provide an evidence-based foundation to improve health outcomes and reduce disparities. The objective of this study is to identify reports on the prevalence of diabetes in adult Indigenous populations across the Americas.

Materials & Methods

Registration: Registered with the **Open Science Framework (OSF)**: https://osf.io/jwshk/?view_only=faa24d3d587346f0bbf705ff1da61db0.

This systematic review was designed to address the following research question: What is the prevalence of diagnosed and undiagnosed diabetes among the adult Indigenous populations of the Americas?

The search strategy adheres to PRISMA guidelines for systematic reviews [10]. Specifically, this study follows the **Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR)**. In accordance with these guidelines, the study protocol was prospectively registered with the **Open Science Framework (OSF)**: https://osf.io/jwshk/?view_only=faa24d3d587346f0bbf705ff1da61db0.

Search strategy

The literature search was conducted using PubMed and Scopus with the following keywords:
(TITLE-ABS-KEY(indigenous) OR TITLE-ABS-KEY(aboriginal) OR TITLE-ABS-KEY(indian) AND TITLE-ABS-KEY(diabetes prevalence) AND TITLE-ABS-KEY(america) OR TITLE-ABS-KEY(mexico) OR TITLE-ABS-KEY(belize) OR TITLE-ABS-KEY(guatemala) OR TITLE-ABS-KEY(el AND salvador) OR TITLE-ABS-KEY(honduras) OR TITLE-ABS-KEY(nicaragua) OR TITLE-ABS-KEY(costa AND rica) OR TITLE-ABS-KEY(panama) OR TITLE-ABS-KEY(colombia) OR TITLE-ABS-KEY(venezuela) OR TITLE-ABS-KEY(peru) OR TITLE-ABS-KEY(bolivia) OR TITLE-ABS-KEY(ecuador) OR TITLE-ABS-KEY(chile) OR TITLE-ABS-KEY(paraguay) OR TITLE-ABS-KEY(argentina) OR TITLE-ABS-KEY(uruguay) OR TITLE-ABS-KEY(brazil) OR TITLE-ABS-KEY(guyana) OR TITLE-ABS-KEY(suriname) OR TITLE-ABS-KEY (united states) OR TITLE-ABS-KEY (canada) OR TITLE-ABS-KEY (puerto rico) OR TITLE-ABS-KEY (cuba) OR TITLE-ABS-KEY (dominican) OR TITLE-ABS-KEY (dominicana) OR TITLE-ABS-KEY (haiti) OR TITLE-ABS-KEY (jamaica) OR TITLE-ABS-KEY (trinidad) OR TITLE-ABS-KEY (grenada))

In addition, we conducted an internet search for relevant gray literature, including documents from governmental and academic institutions. We also reviewed citations from the retrieved documents to identify additional reports meeting the inclusion criteria that may have been overlooked in the systematic review. Furthermore, articles that met the inclusion criteria and were identified in a previous search [11] were also included.

Table 1. World Health Organization criteria for the diagnosis of diabetes mellitus, 1985, 2003-2006 and 2011.

Test	1985 WHO Criteria[12]	1999 WHO Criteria [13]	2003, 2006 WHO Criteria [14,15]	2011 WHO Criteria [16]
Fasting Blood Glucose (FBG)	≥ 140 mg/dl (7.8 mmol/l)	≥ 126 mg/dl (7.0 mmol/l)	≥ 126 mg/dl (7.0 mmol/l)	≥ 126 mg/dl (7.0 mmol/l)
Oral Glucose Tolerance Test (OGTT)	≥200 mg/dl (11.1 mm/l)	≥200 mg/dl (11.1 mm/l)	≥200 mg/dl (11.1 mm/l)	≥200 mg/dl (11.1 mm/l)
HbA1c	-	-	-	≥6.5%

Article Selection

A comprehensive search was conducted for relevant documents from all countries in the Americas, restricted to publications from 1975 through 2025. The search was completed in July 2025. The inclusion criteria required original documents that:

- (a) described a population-based survey of diabetes prevalence among adult native, indigenous, or mestizo populations of both genders (or a subpopulation);
- (b) employed an unbiased, adequate population-based sampling procedure (probabilistic sample, cluster sample, or census);
- (c) reported prevalence rates in percentage;
- (d) included total diabetes prevalence (diagnosed plus newly identified cases) using international diagnostic blood glucose standards and tests available at the time of the study (as shown in Figure 1); and
- (e) were published in English, Spanish, French, or Portuguese between 1975 and 2025.

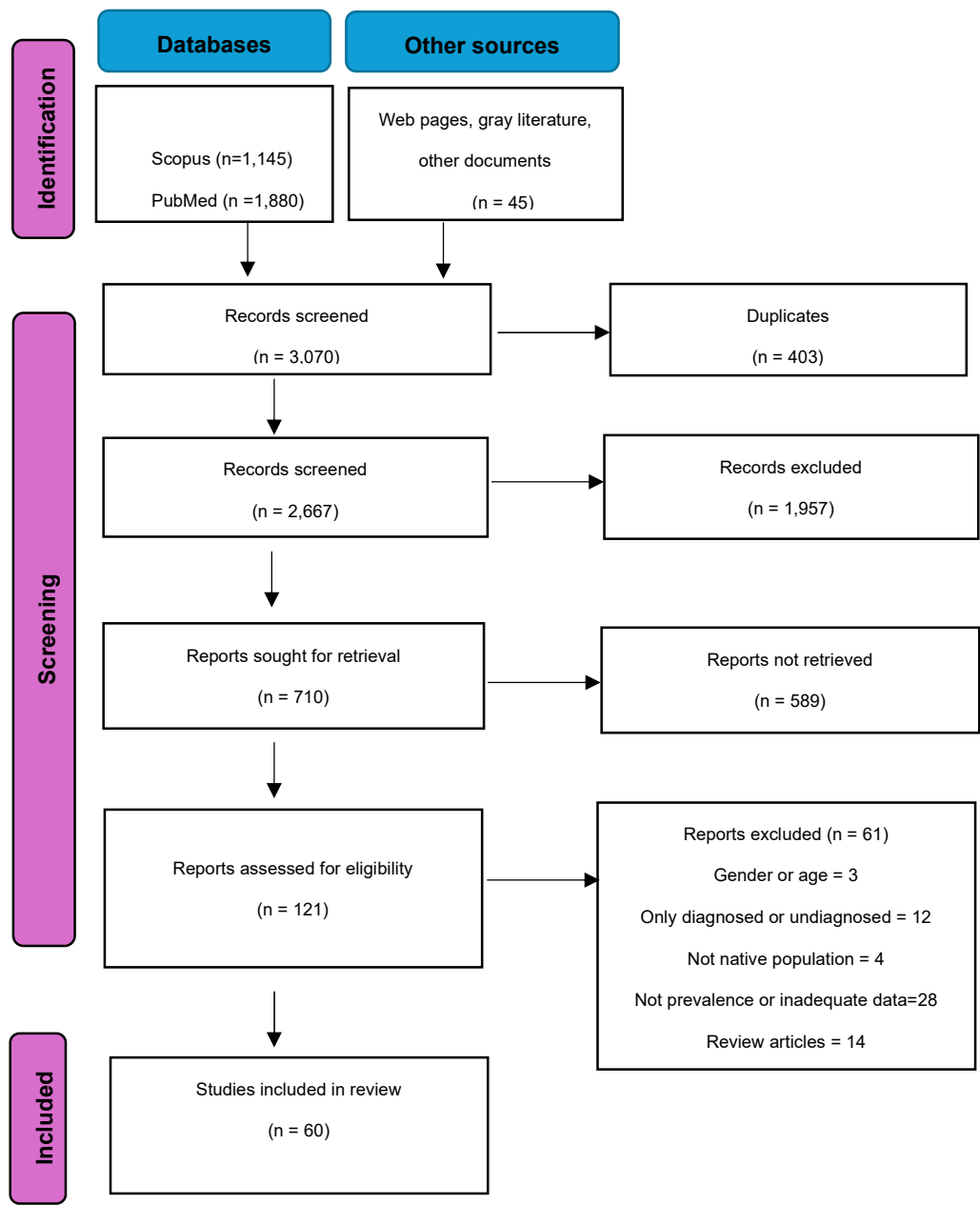


Figure 1. Source: Modified from Page MJ, et al. BMJ 2021;372:n71. doi: 10.1136/bmj.n71. This work is licensed under CC BY 4.0. To view a copy of this license, visit <https://creativecommons.org/licenses/by/4.0/>.

Studies were excluded if they exhibited any source of selection bias, such as non-random samples or clinical series. All retrieved articles were independently reviewed by three reviewers.

Data Extraction

Data were independently extracted using a predefined template by the two reviewers (ES, FC, RWM, NCB). Discrepancies were resolved by a third reviewer (AB) before finalizing the dataset. Extracted data points included country, author, study site, year of study, year of publication, ethnic group, age, sample size, diagnostic test, diagnostic method and values, and prevalence rate.

Data Analysis

The extracted data on the prevalence of diabetes among indigenous populations in the Americas were analyzed descriptively. Prevalence rates were compared by study year (or publication year if

the study year was unavailable), country, subregion, diagnostic test, diagnostic criteria and values, and gender.

To address measurement heterogeneity, all summaries were stratified by diagnostic test Fasting Blood Glucose (FBG), Oral Glucose Tolerance Test (OGTT), Casual (or random) Glucose Test (CGT) or Hemoglobin A1c (HbA1c) and diagnostic criteria (WHO 1985/1999/2003–06/2011).

Primary Effect Measure

The primary effect measure in this review was the prevalence of diabetes mellitus, expressed as the percentage of participants with diabetes in each included study population (diagnosed and undiagnosed combined). Where available, we reported sex-specific prevalence (men, women, both), as well as 95% confidence intervals provided in the original studies. We did not calculate pooled effect sizes because of substantial heterogeneity across populations, diagnostic tests, and time periods. Instead, we present prevalence estimates descriptively and stratify by country, region, sex, diagnostic test, and diagnostic criteria.

Results

Ascertainment

The search across Scopus, PubMed, and additional sources identified 2,267 documents. After screening and eligibility assessment to identify valid population-based surveys reporting both diagnosed and undiagnosed diabetes among Indigenous and mestizo populations in the Americas, 60 documents—representing 73 distinct studies—met the inclusion criteria (Figure 1).

Articles published between 1975 and 2025 were included. Although studies predating 1975 were reviewed, they were excluded because standardized blood glucose thresholds aligned with the 1979 American Diabetes Data Group (ADDG) and 1985 WHO diagnostic criteria were not systematically applied before the mid-1970s.

As summarized in Table 2, Mexico contributed the largest number of studies (n=16), followed by the United States (n=15), Brazil (n=10), Canada (n=7), Chile (n=6), Guatemala (n=5), and Colombia (n=3). Two studies were conducted in Bolivia and Panama respectively, while seven other countries each contributed one study. Altogether, 44,148 individuals were screened between 1975 and 2025. Most study participants were from North America (n=29,093), followed by Central America (n=8,144) and South America (n=6,911). No eligible studies were identified from Caribbean nations, Costa Rica, El Salvador, Guyana, Peru, Uruguay, or Venezuela.

Table 2. Prevalence of diabetes mellitus in indigenous populations of the Americas.

	Countr y	Site	Year	A g e	N	Ethnicity	Test	Method	Value	Me n	Wom en	Both
	USA[17]	Arizona	1975	2 5 +	1,4 14	Pima	OGT T	Laborat ory	≥200mg /dl/	32.6	37.2	34.9* *
	Chile [18]	Community	1983	2 0 +	510	Mapuche	OGT T	Laborat ory	≥200 mg/dl	0.4	1.4	1.0
	Canada [19]	Ontario	1986-87	2 0 -	671	Cree, Ojibwa	FBG	Laborat ory	≥126 mg/dl	10.0	11.0	

				64								
	USA [20]	Tribe, Minnesota	1988	20+	346	Chippewa	FBG OGT T ¹⁰	Laboratory	≥140mg/dl ≥200mg/dl	13.4	16.1	14.8
	USA [21]	Arizona	1987	20-74	275	Navajo	FBG	Laboratory	≥140mg/dl	9.1	10.5	9.9
	USA [22]	Arizona	1988	20+	231	Navajo	FBG OGT T	Laboratory	≥140mg/dl ≥200mg/dl	10.8	14.3	12.4
	USA [23]	Rural reservation, Arizona	1989-90	20-74	419	Navajo	FBG OGT T	Laboratory	≥140mg/dl ≥200mg/dl	13.9 (9.2-18.5)	18.4 (14.0-22.8)	16.5 (13.2-19.7)
	USA [24]	Multiple	1989-91	45-74	3,638	Akimel O’odham, Pee-Posh, Tohono O’odham, Ak-Chin Community, Apache, Ft. Sill Apache, Caddo, Comanche, Delaware, Kiowa, Wichita, Oglala Sioux, Cheyenne River Sioux, Spirit Lake Sioux	OGT T	Laboratory	≥200mg/dl/	42.1	52.7	
	USA [25]	Tucson, Arizona	1990	25-	230	Pascua Yaqui	FBG OGT T ¹¹	Laboratory	≥140mg/dl	35.4	38.9	

				65					≥200mg/dl			
	USA [22]	Rough Rock community	1992	20+	827	Navajo	FBG OGT T	Laboratory	≥140mg/dl ≥200mg/dl	10.8 (4.4, 17.2)	14.3 (8.5, 20.1)	12.4 (8.1, 16.7)
	USA [26]	Southwestern US	1991-92	20+	575	Navajo	FBG OGT T	Laboratory	≥140mg/dl ≥200mg/dl	19.4	24.6	22.9
	USA [27]	Minnesota	1992-94	25+	981	Chippewa and Menominee	FBG OGT T	Laboratory	≥140mg/dl ≥200mg/dl	27.00	29.00	28.00
	Mexico [28]	Community, Sonora	1994	20+	224	Pima	FBG OGT T	Laboratory	≥140mg/dl ≥200mg/dl	5.6	8.5	6.9
	USA [28]	Arizona	1995	20+	888	Pima	FBG OGT T	Laboratory	≥140mg/dl ≥200mg/dl	34.2	40.8	38.0
	Canada [29]	River Desert, Quebec	1995	30-64	131	Algonquins	FBG OGT T	Laboratory	≥140mg/dl ≥200mg/dl	16.3 (7.9 – 24.7)	16.3 (9.0– 23.6)	
	Canada [29]	Lac Simon, Quebec	1995	30-64	168	Algonquins	FBG OGT T	Laboratory	≥140mg/dl ≥200mg/dl	23.9 (12.9– 34.9)	48.6 (38.4 – 58.8)	
	United States[24]	Multiple	1993-95	45-74	3,638	Akimel O’odham, Pee-Posh, Tohono O’odham, Ak-Chin Community, Apache, Ft. Sill Apache, Caddo,	OGT T	Laboratory	≥200mg/dl/	48.2	61.3	

						Comanche, Delaware, Kiowa, Wichita, Oglala Sioux, Cheyenne River Sioux, Spirit Lake Sioux						
	Canada [30]	Sandy Lake, Ontario	1993-95	1 0 +	728	Ojibwa-Cree	FBG OGT T	Laborat ory	≥140mg /dl ≥200mg /dl	28.0 ‡	24.2‡	26.1‡ ¹
	USA [31]	Arizona	1995	2 0 - 7 4	900	Pima, Maricopa, Papago	FBG OGT T ⁸	Laborat ory	≥140mg /dl ≥200mg /dl	65 (60. 3- 69.1)	72 (69.3- 75.3)	70 (67.2- 72.2)
	USA [31]	Delaware	1995	2 0 - 7 4	400	Apache, Caddo, Comanche	FBG OGT T ⁸	Laborat ory	≥140mg /dl ≥200mg /dl	38 (33. 9- 41.8)	42 (38.6- 45.4)	40 (37.7- 42.8)
	USA [31]	N & S Dakota	1995	2 0 - 7 4	200	Ogala, Sioux, Cheyenne, River Sioux, Devils Lake Sioux	FBG OGT T ⁸	Laborat ory	≥140mg /dl ≥200mg /dl	33 (29. 0- 36.8)	46 (42.1- 49.1)	40 (37.5- 42.8)
	Mexico [32,33]	Maycoba, Sonora	1995	2 0 +	226	Pima	FBG OGT T	Laborat ory	≥126 mg/dl ≥200 mg/dl	5.6	8.5	7.1
	Mexico [34,35]	Durango	1996 **	30- 64	193	Tepehuanos, Huicholes, Mexicaneros	FBG OGT T	Glucom eter	≥140 mg/dl ≥200 mg/dl	0.0	0.0	0.0
	Mexico [36]	Community	1996 - 1997	15- 77	91	Otomías	FBG	Laborat ory	≥126 mg/dl	-	-	4.4 (0.1- 8.7)

¹ Described as age-standardized

	Colombia [37]	Rural	1996*	18+	147	Arhuaco, Arzario, Kogui, Wayuu	OGT T	Glucometer	>10 mmol/l	0.0	0.0	0.0
	Bolivia [38]	Urban El Alto	1998	25+	776	Aymara	OGT T	Glucometer	≥200 mg/dl	5.3 (2.2 - 8.3)	4.3 (2.7- 6.7)	4.8 (3.4- 6.6)
	Bolivia [38]	Urban Cochabamba	1998	25+	266	Quechua	OGT T	Glucometer	≥200 mg/dl	7.9 (4.2 - 14.3)	8.9 (5.2- 14.8)	8.4 (5.6- 12.4)
	Chile [39]	Rural Community	1998	20+	319	Mapuche	OGT T	Laboratory	≥200 mg/dl	3.2 (0.7 - 9.0)	4.5 (2.2- 8.1)	4.1 (2.2- 6.9)
	Chile [40]	Rural Community	1998	20+	196	Aymara	OGT T	Laboratory	≥200 mg/dl	1.3 (0.0 -7.0)	1.7 (0.2- 6.0)	1.5 (0.3- 4.5)
	Paraguay [41]	Community , Chaco	1998	18-70	225	Ayoreos	FBG or OGT T	Laboratory	≥126 mg/dl ≥200 mg/dl	0.0	0.0	0.0
	Guatemala [42]	Rural, Urban Sololá	1998	30+	400	Quiche, Cakchiquel, Zutuhil	OGT T	Laboratory	≥200 mg/dl	-	-	6.8
	Brazil [43]	Parque Indígena do Xingu (Mato Grosso)	1999	20+	86	Suyá	FBG	Glucometer	≥126 mg/dl	0.0	0.0	0.0
	Mexico [44]	Community , Merida	2000	18-81	263	Maya	FBG	Laboratory	≥126 mg/dl	-	-	10.6
	Brazil [45]	Pará	2000	20+	122	Parkateje	FBG or OGT T	Glucometer	≥126 mg/dl ≥200 mg/dl	-	-	1.1
	Mexico [46]	National	2000	20+	3,645	Multiple indigenous groups	FBG A1c	Laboratory	≥126 mg/dl or 6.5%			4.1 (3.1, 5.2)

	Canada [47,48]	Sandy Bay Ojibway First Nation, Manitoba	2002 - 2003	18+	482	Ojibway	FBG	Laborat ory	≥126 mg/dl	27.0 (21. 2– 32.7)	31.0 (25.2 – 36.7)	29.0 (25.0 – 33.1)
	Brazil [49]	Upper Xingu	2002 - 2003	20+	251	Kalapalo, Kuikuro, Matipu, Nahukwá	FBG	Laborat ory	≥126 mg/dl	0.0	0.0	0.0
	Brazil [50]	Community , Espírito Santo	2003 - 2004	25- 64	620	Guarani, Tupinikin	FBG	Laborat ory	≥126 mg/dl	2.4	2.7	-
	Chile [51]	Santiago & Arica	2004 **	18+	160	Aymara	OGT T	Laborat ory	≥200 mg/dl	2.4 (0.1 - 12.6)	8.5 (4.1- 15.0)	
	Chile [51]	Santiago & Arica	2004 **	18+	147	Mapuche	OGT T	Laborat ory	≥200 mg/dl	14.3 (5.4 - 28.5)	5.7 (201- 12.0)	
	Canada [52]	Mistissini, Quebec	2005	18+	172	Cree	FBG	Laborat ory	≥126 mg/dl			20.0
	Belice [53]	National	2003 - 2006	20+	1,1 92	Indigenous/ Mestizo ¥	FBG or OGT T	Laborat ory	≥126 mg/dl ≥200 mg/dl	8.6 (6.0 – 12.1)	13.6 (11.1 – 16.4)	11.0 (9.0– 13.5)
	Guate mala [53]	Urban, Guatemala City	2003 - 2006	20+	1,3 95	Indigenous/ Mestizo ¥	FBG or OGT T	Laborat ory	≥126 mg/dl ≥200 mg/dl	7.8 (5.1 – 11.8)	6.8 (4.8– 9.4)	7.3 (5.4– 9.7)
	Hondu ras [53]	Urban, Tegucigalpa	2003 - 2006	20+	1,5 92	Indigenous/ Mestizo ¥	FBG or OGT T	Laborat ory	≥126 mg/dl ≥200 mg/dl	5.0 (2.7 – 9.1)	5.3 (3.8– 7.2)	5.1 (3.2– 8.0)
	Nicarag ua [53]	Urban, Managua	2003 - 2006	20+	1,5 30	Indigenous/ Mestizo ¥	FBG or OGT T	Laborat ory	≥126 mg/dl ≥200 mg/dl	9.5 (7.2 – –	10.8 (8.1– 14.2)	10.2 (8.2– 12.6)

										12.5)		
	Mexico [46]	National	2006	20+	513	Multiple indigenous groups	FBG A1c	Laborat ory	≥126 mg/dl or 6.5%			9.4 (6.8, 12.9)
	Mexico [54]	Community , Sonora	2006 -	20- 65	120	Yaquis	FBG OGT T	Laborat ory	≥126 mg/dl ≥200 mg/dl	20.5	17.6	18.3
	Mexico [54]	Community , Sonora	2006 - 2007	20- 65	158	Tepehuanos	FBG OGT T	Laborat ory	≥126 mg/dl ≥200 mg/dl	-	-	0.8
	Brazil [55,56]	Community , Jaguapiru, Mato Grosso do Sul	2007 - 2008	18- 69	606	Guarani, Kaiowa, Terena	FBG OGT T ¹	Glucom eter	≥126 mg/dl ≥200 mg/dl	1.5	6.8	4.5
	Mexico [57]	Community , Oaxaca	2010 *	35+	394	Zapotec	FBG OGT T	Not mention ed	≥126 mg/dl ≥200 mg/dl	6.2	13.3	8.7
	Mexico [57]	Community , Oaxaca	2010 *	35+	730	Mixe	FBG OGT T	Not mention ed	≥126 mg/dl ≥200 mg/dl	5.7	7.1	6.9
	Colomb ia [58]	Communiti es, Caldas	2010	20- 69	151	Embera- Chamí	FBG	Laborat ory	≥126 mg/dl			7.9
	Mexico [32,33]	Maycoba, Sonora	2010	20+	359	Pima	FBG OGT T	Laborat ory	≥126 mg/dl ≥200 mg/dl	6.0	11.8	9.0
	Brazil [59]	Xingu Indigenous Park	2010 - 2011	20+	181	Khisêdjê	OGT T	Laborat ory	≥200 mg/dl	2.0	6.8	3.8
	Chile [60]	Rural	2011	15+	264	Pehuenche	2 FBG Or Casu al ²	Laborat ory	≥126 mg/dl ≥200 mg/dl	-	-	0.8

	Panam a [61]	Provinces of Panama & Colon	2011	18+	203	Native American ¥	FBG A1C	Laborat ory	≥ 126 mg/dl 6.5%			5.4 (3.2– 7.6)
	Mexico [62]	Urban/rural , Chiapas	2010 - 2012	20+	880	Indigenous ¥	FBG OGT T	Laborat ory	≥126 mg/dl ≥200 mg/dl	3.5 (1.6 – 5.5)	5.8 (3.8– 7.8)	4.7 (3.3– 6.1)
	Canada [47,63]	Sandy Bay Ojibway First Nation, Manitoba	2011 - 2012	18+	596	Ojibway	FBG	Laborat ory	≥126 mg/dl	24.8 (20. 0– 29.6)	27.1 (21.9 – 32.3)	25.9 (22.4 %– 29.4)
	Mexico [46]	National	2012	20+	1,1 22	Multiple indigenous groups	FBG A1c	Laborat ory	≥126 mg/dl or 6.5%			12.7 (9.8, 16.3
	Guate mala [64]	Community , Atitlán	2012 - 2013	20- 65	308	Tzu’tujil, Kaqchikel, mestizo	FBG	Glucom eter	≥126 mg/dl	3.0 (1.1 - 4.8)	1.3 (0.0- 3.2)	4.6 (1.6, 7.7)
	Surina m [65]	National	2013	15- 65	279	Amerindian ¥	FBG	Laborat ory	≥126 mg/dl	15.8	8.7	
	Mexico [66]	Community Baja California	2013 - 2014	18+	275	Indigenous/m estizo ¥	A1c	Micro mehod	≥6.5%	18.6	22.9	21.8
	Brazil [67]	Community , Mato Grosso	2010 - 2012	20+	948	Xavante	OGT T	Glucom eter	≥200 mg/dl	18.4 (14. 9– 22.2)	40.6 (36.2 – 45.1)	28.8 (25.3 – 31.1)
	Argenti na [68]	Communiti es, Chaco	2014	18+	156	Wichi	CBG T	Glucom eter	≥200 mg/dl	1.7	0.0	0.6
	Guate mala [69]	Community , Atitlán	2015	18+	394	Tzu’tujil, Kaqchikel	A1c	Glucom eter	≥6.5%	12.2 (6.3 - 8.1)	14.6 (10.3- 18.8)	13.8 (10.4- 17.2)
	Colomb ia [70]	Cristiania (Jardín) Antioquia	2015 *	14+	145	Embera- Chamí	FBG	Not mention ed	≥126 mg/dl	0.0	0.9	0.7
	Brazil [71]	Communiti es	2018	18+	459	Munduruku	FBG	Glucom eter	≥126 mg/dl			12.2

	Brazil [72]	Community , Amazonia	2018 *	18+	455	Mura	FBG	Glucom eter	≥126 mg/dl			3.0 1.8- 5.1
	Mexico [46]	National	2018	20+	1,1 77	Multiple indigenous groups	FBG A1c ⁴	Laborat ory	≥126 mg/dl or 6.5%			18.7 15.0, 23.2)
	Guate mala [73]	Rural	2018 - 2019	18+	640	Maya	A1c	Micro method	≥6.5%	12.2 (7.4 - 16.9)	12.9 (9.4 - 16.4)	12.2 (7.4- 16.9)
	Panam a [74]	Community	2019 *	18+	211	Kuna Indians	A1c	Micro method	≥6.5%	14.0	12.9	13.0
	Brazil [75]	Community , Pará	2019 *	18+	363	Xikrin (Mebengôkre)	FBG	Laborat ory	≥126 mg/dl	4.4	4.9	3.8
	Ecuado r [76]	Municipalit y	2022	18+	111	Chachi	FBG OGT T ³	Laborat ory	≥126 mg/dl or ≥200 mg/dl			0.9

(*) Publication year (**) Truncated rates calculated from original data. FBG (Fasting Blood Glucose); OGTT (Oral Glucose Tolerance Test); CBGT (Casual Blood Glucose Test); A1c (Hemoglobin A1c) (1) (FBG ≥126 mg/dl in two occasions, OGTT if FBG ≥100 mg/dl & <126 mg/dl (nonstandard); (2) Two FBG ≥126 mg/dl, or one FBG ≥200 mg/dl (nonstandard); (3) FBG ≥144 mg/dl , OGTT if FBG < 144 mg/dl ; (4) FBG ≥126 mg/dL or A1c ≥6.5%; ¥ Referred as indigenous/mestizo or Native Americans. (8) FBG ≥140 mg/dl or OGTT≥200; (10) OGTT if FBG≥ 115 mg/dl or CBG ≥140 mg/dl and two FBG ≥126 mg/dl. (11) OGTT with 100 gms of glucose.

Only one study was conducted between 1975 and 1979. The highest number of studies were carried out between 1990–1999 and 2001–2010 (n=23 each). Only one study was published after 2020.

Indigenous Groups

Across all studies, 111 Indigenous groups were represented (Supplementary Table S1). Nine studies classified participants under broader labels such as Indigenous, mestizo, or Amerindian (including those from Belize, Ecuador, Guatemala, Honduras, Mexico, Nicaragua, and Panama). The Pima Indians were most frequently represented, included in six studies (three in the United States and three in Mexico).

Blood Processing Method and Diagnostic Test

Most studies (47/64; 73%) used venous blood samples analyzed in laboratory settings, while 16 studies (24%) relied on capillary finger-prick methods; two studies did not report the blood processing method. Fasting blood glucose (FBG) was the most common diagnostic test (n=50; 75%), followed by oral glucose tolerance testing (OGTT) (n=41; 61%). Glycated hemoglobin (HbA1c) was used in 9 studies (13%). Nearly half of the studies (n=29; 43%) used both FBG and OGTT in combination (Supplementary Table S2).

Prevalence of Diabetes

The Overall mean prevalence of diabetes among Indigenous and mestizo populations in the Americas was 12% (14% among men and 17% among women). The highest reported prevalence—70%—occurred in 1995 among Native American groups in Arizona (Pima, Maricopa, and Tohono O’odham), with sex-specific estimates of 65% in men and 72% in women. Other high-burden areas included Indigenous groups in Delaware (Apache, Caddo, Comanche) and the Dakotas (Oglala Sioux, Cheyenne River Sioux, and Devils Lake Sioux), where prevalence reached 40% in 1995. In the same year, Delisle et al. reported a prevalence of diabetes of 23.9% in men and 48.6% in women among First Nations groups in Quebec, Canada. In contrast, five studies—conducted in Brazil, Chile, Colombia, Mexico, and Paraguay—reported zero diabetes cases, four of which were conducted between 1990 and 1999 and one in 2011.

Marked geographic disparities were observed. Indigenous populations in the United States and Canada exhibited high mean prevalence estimates (32% and 25%, respectively), while studies in Belize (11%), Nicaragua (10%), Mexico (9%), and Panama (9%) suggested intermediate levels. In South America, prevalence was generally lower, ranging from 0.6% in Argentina to 8% in Brazil. Across the region, mean prevalence was highest in North America (17%), followed by Central America (9%) and South America (5%). A notable exception in South America was observed among the Xavante in Brazil, who exhibited a prevalence of 29% in 2014 (18% in men; 41% in women).

Obesity and Diabetes Clustering

Forty-eight studies (71%) reported mean BMI or the prevalence of obesity ($BMI \geq 30 \text{ Kg/m}^2$). The prevalence of Diabetes increased in parallel with higher mean BMI or greater proportion of obesity. One exception was a study in Chile [40], which reported low diabetes prevalence despite a mean BMI $> 25 \text{ kg/m}^2$ (Supplementary Tables S3–S5). Clusters of elevated diabetes were consistently found in groups with high prevalence of obesity (Supplementary Table S6).

Sampling methods

Random or cluster sampling was used in 45 studies (62%), while 20 studies (27%) relied on volunteer or invitation-based recruitment. Across the Americas, random/cluster sampling yielded lower diabetes prevalence estimates (combined: 10% among participants of both genders) compared with volunteer-based sampling (combined: 14%). In the United States, the difference was especially pronounced: both gender prevalence of DM of 24% (random/cluster) vs. 55% (volunteers).

Volunteer-based sampling (Supplementary table S7) was most common in Mexico (23%; $n=5$), followed by Chile and the United States (18%; $n=4$ each), Brazil and Canada (14%; $n=3$ each), and Colombia (5%; $n=1$). Nineteen out of 20 studies (95%) reported response rates. The overall mean response rate was 62% (Supplementary Table S7). Two studies from Brazil—conducted among the Parkatejé and Suyá Indigenous groups—reported the highest response rates at 90%. In contrast, three studies—two from Canada (both involving Ojibway communities) and one from Colombia (Arahuaco)—reported response rates below 50%.

Discussion

This review provides a comprehensive synthesis of 50 years of research conducted between 1975 and 2025 across 16 countries in the Americas. Our findings reveal marked heterogeneity across countries, Indigenous groups, and time periods, underscoring the limitations of treating Indigenous populations as a single epidemiological category. This heterogeneity reflects the combined influence of genetic susceptibility, environmental and socioeconomic contexts, and historical trajectories, as well as differences in diagnostic approaches and sampling methodologies. Accordingly, these findings align with emerging personalized medicine and precision public health frameworks, as well as with international consensus recommendations from the American Diabetes Association (ADA) and the European Association for the Study of Diabetes (EASD)[77, 78], which emphasize diabetes strategies tailored to distinct population contexts rather than one-size-fits-all models [77-80].

Given the wide variation in diabetes frequency across Indigenous groups, along with differences in diagnostic and sampling techniques and the influence of both genetic and modifiable factors that cannot be fully controlled, it is difficult to draw firm conclusions about the true magnitude of variation in diabetes prevalence. Nevertheless, the heterogeneity observed in this review has important implications for personalized medicine and precision public health. The wide variation in diabetes prevalence across Indigenous groups highlights the need for standardized methodologies to measure disease frequency, while simultaneously underscoring the importance of tailored approaches to diabetes prevention and management that take into account environmental, nutritional, and social determinants of health.

By around 1975, the initial year covered by this review, the Indigenous population of the Americas had begun to recover from the severe demographic decline experienced during colonization. Although no hemisphere-wide census existed at that time, regional estimates indicate the presence of tens of millions of Indigenous people across North, Central, and South America, with the largest concentrations in Mexico, Central America, the Andean region, and parts of North America[81-83]. By contrast, by 2024–2025, the end of the review period, the Indigenous population is more robust and better documented, with over 58 million Indigenous people in Latin America[81-83], 574 federally recognized tribes in the United States[84], and more than 70 First Nations and other native peoples in Canada[85]. In total, this amounts to more than 800 Indigenous peoples in Latin America alone and over 1,000 distinct Indigenous groups across the hemisphere when North American nations and uncontacted Amazonian peoples are included[81, 82, 84, 85].

A major challenge encountered in this review stems from the substantial variability across studies in age distributions, methodological approaches, and the diagnostic cut-off points used to define diabetes. Although this methodological heterogeneity reflects an inherent historical characteristic of the published literature—spanning several decades during which diagnostic tests, classification criteria, and sampling methodologies evolved—it nonetheless limits comparability and may affect the accuracy of prevalence estimates. Despite these constraints, the application of rigorous inclusion criteria and systematic analyses provides the best attainable approximation of the prevalence of diabetes among Indigenous populations of the America, and provides insight into how shifting clinical paradigms influence disease classification within diverse populations.

Pioneering earlier studies conducted by Stein [86], Bennett [87], Henry [88] and Forman [89] in the United States, in the 1960s had previously reported unusually high prevalence of diabetes ranging from 29% to 43%, among the Cherokee, Pima, Cocopah, and Seneca ethnic groups, respectively.

For years, researchers speculated whether indigenous communities south of the U.S. border would follow the same pattern observed among the Pima Indians. This curiosity fueled many subsequent studies. However, in contrast to the strikingly high prevalence of diabetes reported in the North American[29, 31, 47, 66, 90] studies, our review suggests a lower diabetes risk among indigenous populations in Latin America, with the notable exception of a study in Brazil, where the Xavante community of Mato Grosso exhibited a prevalence of 28.8%[67].

The extreme prevalence rates observed among the Pima Indians are believed to stem from a combination of genetic predisposition and environmental factors, particularly nutrition and body mass index (BMI)[9]. While this review did not assess diabetes-related risk factors, it is well documented that, despite high obesity rates, the prevalence of diabetes remains relatively low among the Aymara tribes in Chile[91].

Comparability between studies and among native population groups is limited by the diversity of sampling techniques and diagnostic testing methods. Many studies were conducted among volunteers or respondents to open invitations, which may introduce selection bias compared with more statistically rigorous approaches such as random or cluster sampling. Because this type of bias is difficult to control, comparability across studies represents a major limitation of this review. For example, the highest prevalence of diabetes ever reported among Indigenous groups—and possibly among all populations in the Americas—was documented by Lee et al.[31] among the Pima,

Maricopa, and Papago Indians of Arizona in 1995, where participants were all volunteers drawn from an official list of eligible individuals.

The greatest strength of this review is its revival of a subject that has faded from academic focus over time. By including papers from monographs and gray literature, we were able to compile the most comprehensive picture of diabetes risk among the indigenous populations of the Americas. However, this study has several unavoidable limitations, primarily the lack of rigorous detailed analysis on contributing factors such as BMI, socioeconomic conditions, cultural dietary patterns, income levels, and other modifiable risk factors. Investigating these determinants is beyond the scope of this review and should be a focus for future research. Furthermore, we did not perform a meta-analysis or calculate pooled effect sizes because the included studies exhibited substantial heterogeneity in study populations, diagnostic tests, and time periods. Instead, we adopted a descriptive approach, presenting prevalence estimates stratified by ethnic group, country, sex, diagnostic test, and diagnostic criteria. This method provides a transparent view of the variability in the prevalence of diabetes across the Americas and aligns with established recommendations for scoping reviews and prevalence studies characterized by methodological diversity. A formal meta-analysis could be considered in a subsequent stage.

As noted previously, despite the profound risks faced by Indigenous peoples of the Americas following European colonization, subsequent population growth, cultural revitalization movements, and increasing legal recognition have contributed to a demographic and cultural resurgence not witnessed since before colonial contact [81, 82]. However, despite this growth, research interest in the epidemiology of diabetes among Indigenous populations has declined markedly in recent years, perhaps reflecting a contraction of funding following the golden era of North American studies in the 1970s, 1980s, and 1990s.

Conclusion

The prevalence of diabetes among Indigenous populations in the Americas is highly heterogeneous, with considerably higher rates reported in North America compared with Central and South America. Although genetic predisposition may play an important role, environmental and lifestyle factors likely contribute substantially to these differences. The decline in published studies in recent years suggests a reduction in research focus on this topic. Further investigation into modifiable risk factors—such as diet, physical activity, and socioeconomic conditions—is essential to better understand the epidemiology of diabetes, clarify how these determinants interact, and support the development of targeted interventions to reduce risk and address health disparities among Indigenous populations across the region.

Overall, the observed heterogeneity in diabetes prevalence across Indigenous populations emphasizes the importance the use of standardized methodologies to accurately measure disease prevalence, which are essential for informing personalized care and precision public health approaches to prevention, tailored to the specific environmental and sociocultural contexts of distinct Indigenous groups. These findings align with emerging approaches to personalized diabetes care and precision public health strategies.

Supplementary Materials: The following supporting information can be downloaded at: <https://www.mdpi.com/article/doi/s1>, Table S1: Diagnosis test used for the studies of diabetes in indigenous population of the Americas by country; Table S2: Ethnic groups represented in studies of diabetes among indigenous in the Americas by country; Table S3: Body Mass Index and the prevalence of diabetes among indigenous populations of the Americas among males; Table S4: Body Mass Index and the prevalence of diabetes among indigenous populations of the Americas among females; Table S5: Body Mass Index and the prevalence of diabetes among indigenous populations of the Americas among males and females; Table S6: Obesity (%) and the prevalence of diabetes (%) by study and gender in indigenous populations of the Americas; Table S7: Response rate (%) to open invitations by studies of diabetes in indigenous populations in the Americas.

Funding: This research received no external funding.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: The original contributions presented in this study are included in the article and supplementary material. Further inquiries can be directed to the corresponding author.

Conflicts of Interest: The authors declare no conflict of interest.

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