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TYPE 5 DIABETES IN LATIN AMERICA: AN INVISIBLE PHENOTYPE AT THE INTERSECTION OF CHILDHOOD UNDERNUTRITION, FOOD INSECURITY, AND DIAGNOSTIC ERROR

DIABETES TIPO 5 NA AMÉRICA LATINA: UM FENÓTIPO INVISÍVEL NA INTERSEÇÃO ENTRE DESNUTRIÇÃO INFANTIL, INSEGURANÇA ALIMENTAR E ERRO DIAGNÓSTICO

DIABETES TIPO 5 EN AMÉRICA LATINA: UN FENOTIPO INVISIBLE EN LA INTERSECCIÓN DE LA DESNUTRICIÓN INFANTIL, LA INSEGURIDAD ALIMENTARIA Y EL ERROR DIAGNÓSTICO

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ABSTRACT

Type 5 diabetes is the name proposed in 2025 for a form of diabetes that affects lean young individuals with a history of undernutrition, previously described as malnutrition-related diabetes mellitus and removed from the World Health Organization classification in 1999. Its defining feature is a marked deficiency in insulin secretion with preserved insulin sensitivity, in the absence of islet autoimmunity and of the tendency to ketoacidosis typical of type 1 diabetes. In Latin America, the coexistence of persistent food insecurity, a legacy of childhood stunting, and a rapid nutrition transition creates conditions in which this phenotype may occur, although it remains practically absent from regional epidemiological records and clinical protocols. In the absence of specific criteria, affected individuals tend to be labeled as having type 1 or type 2 diabetes, which may lead to inappropriate treatment, hypoglycemia, and loss of the opportunity for nutritional intervention. This review aimed to analyze type 5 diabetes as an invisible phenotype in Latin America, considering its biological bases, the regional determinants related to childhood undernutrition and food insecurity, and the consequences of diagnostic error. This is a narrative literature review, guided by a structured question based

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on the PICo strategy and directed at studies on the classification, pathophysiology, and social determinants of diabetes associated with undernutrition. The evidence shows that early undernutrition reduces beta-cell function, that stunted children from Brazilian urban slums already present lower insulin production, and that self-reported childhood hunger is associated with a higher likelihood of diabetes in older Brazilian adults. Clamp studies in individuals with low body mass index and diabetes describe a metabolic profile distinct from type 1 and type 2 diabetes, although the samples are small and not representative of Latin American populations. The recognition of the entity still faces conceptual criticism, related to the use of low body mass index as a marker of undernutrition and to the limited mechanistic evidence. It is concluded that type 5 diabetes should be incorporated into the diagnostic reasoning of Latin American health services, with the systematic recording of nutritional history, regional studies of characterization, and policies that articulate food security and diabetes care.

Keywords: Diabetes Mellitus. Malnutrition. Food Insecurity. Growth Disorders. Diagnostic Errors. Latin America.

RESUMO

Diabetes tipo 5 é a denominação proposta em 2025 para uma forma de diabetes que acomete indivíduos jovens e magros com histórico de desnutrição — condição anteriormente descrita como "diabetes mellitus relacionado à desnutrição", a qual foi removida da classificação da Organização Mundial da Saúde em 1999. Sua característica definidora é uma deficiência acentuada na secreção de insulina, com sensibilidade à insulina preservada, na ausência de autoimunidade contra as ilhotas pancreáticas e sem a tendência à cetoacidose típica do diabetes tipo 1. Na América Latina, a coexistência de insegurança alimentar persistente, o legado do déficit de crescimento na infância e uma rápida transição nutricional criam condições para o surgimento desse fenótipo; contudo, ele permanece praticamente ausente dos registros epidemiológicos e dos protocolos clínicos regionais. Na falta de critérios específicos, os indivíduos afetados acabam sendo classificados como portadores de diabetes tipo 1 ou tipo 2, o que pode resultar em tratamento inadequado, episódios de hipoglicemia e na perda de oportunidades para intervenções nutricionais. Esta revisão teve como objetivo analisar o diabetes tipo 5 como um fenótipo "invisível" na América Latina, considerando suas bases biológicas, os determinantes regionais associados à desnutrição infantil e à insegurança alimentar, bem como as consequências de um diagnóstico incorreto. Trata-se de uma revisão narrativa da literatura, estruturada a partir de uma pergunta norteadora baseada na estratégia PICo e voltada para estudos sobre a classificação, a fisiopatologia e os determinantes sociais do diabetes associado à desnutrição. As evidências indicam que a desnutrição precoce reduz a função das células beta; que crianças com déficit de crescimento, oriundas de áreas urbanas vulneráveis no Brasil, já apresentam uma menor produção de insulina; e que o relato de fome durante a infância está associado a uma maior probabilidade de diabetes em adultos brasileiros mais velhos. Estudos utilizando a técnica de *clamp* em indivíduos com baixo índice de massa corporal (IMC) e diabetes revelam um perfil metabólico distinto daquele observado no diabetes tipo 1 ou tipo 2 — embora as amostras sejam pequenas e não representativas das populações latino-americanas. O reconhecimento dessa entidade ainda enfrenta críticas conceituais, relacionadas tanto ao uso do baixo IMC como marcador de desnutrição quanto

à escassez de evidências sobre os mecanismos subjacentes. Conclui-se que o diabetes tipo 5 deveria ser incorporado ao raciocínio diagnóstico nos serviços de saúde da América Latina, por meio do registro sistemático do histórico nutricional, da realização de estudos regionais de caracterização e da implementação de políticas que articulem a segurança alimentar ao cuidado em diabetes.

Palavras-chave: Diabetes Mellitus. Desnutrição. Insegurança Alimentar. Distúrbios do Crescimento. Erros de Diagnóstico. América Latina.

RESUMEN

La diabetes tipo 5 es la denominación propuesta en 2025 para una forma de diabetes que afecta a personas jóvenes y delgadas con antecedentes de desnutrición —descrita anteriormente como «diabetes mellitus relacionada con la desnutrición» y eliminada de la clasificación de la Organización Mundial de la Salud en 1999—. Su característica definitoria es una deficiencia marcada en la secreción de insulina con una sensibilidad a la insulina preservada, en ausencia de autoinmunidad contra los islotes pancreáticos y sin la tendencia a la cetoacidosis típica de la diabetes tipo 1. En América Latina, la coexistencia de inseguridad alimentaria persistente, el legado del retraso en el crecimiento infantil y una rápida transición nutricional crea condiciones propicias para la aparición de este fenotipo; sin embargo, este sigue estando prácticamente ausente de los registros epidemiológicos y los protocolos clínicos de la región. Ante la falta de criterios específicos, los individuos afectados suelen ser clasificados erróneamente con diabetes tipo 1 o tipo 2, lo que puede derivar en tratamientos inadecuados, episodios de hipoglucemia y la pérdida de oportunidades para realizar intervenciones nutricionales. Esta revisión tuvo como objetivo analizar la diabetes tipo 5 como un fenotipo «invisible» en América Latina, considerando sus bases biológicas, los determinantes regionales vinculados a la desnutrición infantil y la inseguridad alimentaria, así como las consecuencias de un diagnóstico erróneo. Se trata de una revisión narrativa de la literatura, estructurada a partir de una pregunta formulada mediante la estrategia PICo y centrada en estudios sobre la clasificación, la fisiopatología y los determinantes sociales de la diabetes asociada a la desnutrición. La evidencia indica que la desnutrición temprana reduce la función de las células beta; por ejemplo, se ha observado que niños con retraso en el crecimiento en zonas urbanas marginadas de Brasil presentan una menor producción de insulina, y que haber experimentado hambre durante la infancia se asocia con una mayor probabilidad de desarrollar diabetes en la edad adulta en Brasil. Los estudios mediante la técnica de «clamp» (pinzamiento metabólico) en personas con diabetes y un índice de masa corporal bajo revelan un perfil metabólico distinto al de la diabetes tipo 1 o tipo 2, aunque las muestras son pequeñas y no representativas de las poblaciones latinoamericanas. El reconocimiento de esta entidad aún enfrenta críticas conceptuales, relacionadas tanto con el uso del índice de masa corporal bajo como marcador de desnutrición, como con la limitada evidencia sobre sus mecanismos subyacentes. Se concluye que la diabetes tipo 5 debería incorporarse al razonamiento diagnóstico en los servicios de salud de América Latina, mediante el registro sistemático de los antecedentes nutricionales, la realización de estudios regionales de caracterización y el desarrollo de políticas que vinculen la seguridad alimentaria con la atención a la diabetes.

Palabras clave: Diabetes Mellitus. Desnutrición. Inseguridad Alimentaria. Trastornos del Crecimiento. Errores Diagnósticos. América Latina.

1 INTRODUCTION

Diabetes mellitus is conventionally classified into type 1 diabetes, type 2 diabetes, gestational diabetes, and specific types related to other causes. This classification, consolidated at the end of the twentieth century, was built mainly on populations from high-income countries, in which diabetes is strongly associated with obesity, insulin resistance, or autoimmunity. For decades, however, clinicians working in tropical and low-income regions have described young, thin patients with insulin-requiring diabetes who did not fit either of these categories, a group in which a history of undernutrition was frequent (WADIVKAR *et al*., 2025a).

This form of diabetes was recognized by the World Health Organization in 1985 as malnutrition-related diabetes mellitus. Shortly afterwards, the category was questioned because of the lack of consistent diagnostic criteria and of evidence that undernutrition alone could cause diabetes, and it was removed from the classification proposed in 1998 and adopted in 1999. Only fibrocalculous pancreatopathy was kept, as a disease of the exocrine pancreas (ALBERTI; ZIMMET, 1998). From then on, lean individuals with diabetes and a history of undernutrition no longer had their own place in the classification and began to be distributed between the existing categories.

The topic regained attention with physiological studies showing that individuals with diabetes and low body mass index present a metabolic profile distinct from that of type 1 and type 2 diabetes, characterized by a pronounced deficiency in insulin secretion without significant insulin resistance (LONTCHI-YIMAGOU *et al*., 2022). In January 2025, an international meeting held in Vellore, India, proposed the name type 5 diabetes for this condition, a designation adopted by the International Diabetes Federation in April of the same year, followed by the publication of an international consensus statement (WADIVKAR *et al*., 2025a). The proposal, however, has not been received without criticism, particularly regarding the diagnostic criteria and the strength of the available evidence (MITHAL; JOSHI; MISRA, 2025).

Latin America occupies a particular position in this debate. The region combines persistent food insecurity, a legacy of childhood stunting in poorer groups, and a rapid increase in overweight, obesity, and type 2 diabetes, a situation described as the double burden of malnutrition (GRAJEDA *et al*., 2019; POPKIN; CORVALAN; GRUMMER-

STRAWN, 2020). In this scenario, the clinical and epidemiological attention given to diabetes is directed almost exclusively to excess weight, while the possible metabolic consequences of hunger remain little discussed (SILVA; MARCHIONI, 2025). As a result, lean young people with diabetes and a history of deprivation may be classified as having type 1 diabetes because of their age and thinness, or as having type 2 diabetes because they do not have ketoacidosis, without their nutritional history being considered.

Diagnostic error constitutes another fundamental aspect. Classifying a patient incorrectly is not a merely nominal problem, since it guides the therapeutic choice, the insulin dose, the nutritional approach, and the expectations about prognosis. In addition, an entity that is not named in classification systems is not counted, and what is not counted does not enter health planning. Given this scenario, this review aims to analyze type 5 diabetes as an invisible phenotype in Latin America, considering its biological bases, the regional determinants related to childhood undernutrition and food insecurity, and the consequences of diagnostic error for clinical care and public health.

2 METHODOLOGY

This is a narrative literature review, developed with the purpose of gathering and critically discussing knowledge on type 5 diabetes, previously called malnutrition-related diabetes mellitus, and its relevance for Latin America. The guiding question was structured according to the PICo strategy, considering as P (Population) children, adolescents, and young adults with a history of undernutrition, stunting, or exposure to food insecurity; as I (Interest) diabetes associated with undernutrition, including its pathophysiological mechanisms, clinical characteristics, and diagnostic classification; and as Co (Context) Latin American health systems, primary care, and the double burden of malnutrition. Based on these components, the following question was established: what is known about the biological bases of diabetes associated with undernutrition, the regional determinants that favor its occurrence in Latin America, and the consequences of its absence from diagnostic classifications?

The bibliographic search was conducted in the PubMed/MEDLINE, Scopus, Web of Science, LILACS, and SciELO databases, the last two included to increase the coverage of Latin American production. Controlled descriptors and free terms related to diabetes,

undernutrition, and food insecurity were used. Combinations of terms such as type 5 diabetes, malnutrition-related diabetes mellitus, lean diabetes, low body mass index diabetes, undernutrition, stunting, childhood hunger, food insecurity, double burden of malnutrition, insulin secretion, diabetes classification, misclassification, and Latin America were considered, combined using the Boolean operators AND and OR and adapted to the indexing characteristics of each database.

The period from 2016 to 2026 was adopted as the main timeframe, seeking to encompass the recent physiological studies on diabetes in individuals with low body mass index, the regional reports on food security and nutrition, and the international consensus that proposed the name type 5 diabetes. Studies prior to this period were used punctually when they presented relevance for understanding the development of the field, as with the World Health Organization report that removed malnutrition-related diabetes from the classification (ALBERTI; ZIMMET, 1998), the thrifty phenotype hypothesis (HALES; BARKER, 2001), and a Brazilian study on insulin production in stunted children (MARTINS; SAWAYA, 2006). Studies published in Portuguese, English, or Spanish were considered, with attention to evidence related to pathophysiology, classification, epidemiology, social determinants, and implications for care.

Consensus statements, physiological studies, population-based studies, modeling studies, reviews, and reports from international agencies pertinent to understanding the relationship between undernutrition, food insecurity, and diabetes were included. Duplicates, editorials without original analysis, and publications without sufficient information for the proposed analysis were excluded, as were studies exclusively focused on disease-related malnutrition in patients with established diabetes when they did not present a relevant relationship with undernutrition as a cause of the disease. Reports from the Food and Agriculture Organization of the United Nations and partner agencies were used to contextualize the regional situation of food insecurity and the double burden of malnutrition in Latin America and the Caribbean.

3 RESULTS

The available evidence indicates that diabetes associated with undernutrition has been described for about seven decades, mainly in South Asia, sub-Saharan Africa, and the

Caribbean, and that its removal from the classification in 1999 did not result from proof that the entity did not exist, but from disagreement about its criteria and etiology (ALBERTI; ZIMMET, 1998; WADIVKAR *et al*., 2025a). The 2025 international consensus brought together these observations and characterized type 5 diabetes as a form of diabetes that usually affects lean young individuals with a history of undernutrition beginning in fetal life or childhood, marked by a deficiency in insulin secretion with preserved hepatic and peripheral insulin sensitivity, and without islet autoantibodies or a tendency to ketoacidosis (WADIVKAR *et al*., 2025a).

The most detailed physiological description of this phenotype comes from a study conducted in India with individuals who had diabetes and a body mass index below 19 kg/m2, in whom other known forms of diabetes were excluded by immunological and genetic analysis. Compared with demographically matched groups with type 1 diabetes, type 2 diabetes, and without diabetes, these individuals showed a lower total insulin secretory response than lean controls and individuals with type 2 diabetes. In hyperinsulinemic clamps, glucose uptake was higher than in type 2 diabetes (10.1 versus 4.2 mg/kg/min) and endogenous glucose production was lower, in addition to less visceral fat and hepatic lipid content (LONTCHI-YIMAGOU *et al*., 2022). These findings support the interpretation of a predominantly secretory defect, distinct from the insulin resistance that characterizes type 2 diabetes and from the autoimmune destruction of type 1 diabetes.

The biological plausibility of the association is reinforced by the developmental origins of health and disease. According to the thrifty phenotype hypothesis, poor nutrition in fetal and early postnatal life leads to adaptive changes, including reduced growth of beta-cell mass, which favor survival under scarcity but increase the risk of diabetes later in life (HALES; BARKER, 2001). Recent reviews add that undernutrition later in childhood, in adolescence, or even in adulthood may also compromise pancreatic function, and that individuals with diabetes and undernutrition frequently differ from the typical profile of type 2 diabetes (WADIVKAR *et al*., 2025b).

Latin American data, although not designed to investigate type 5 diabetes, point in the same direction. In children living in slums in São Paulo, Brazil, those with stunting presented lower fasting insulin, lower beta-cell function estimated by HOMA-B, and higher insulin sensitivity than non-stunted children from the same environment, while fasting glucose was

similar between the groups (MARTINS; SAWAYA, 2006). In older adults, the analysis of 9,412 participants of the Brazilian Longitudinal Study of Aging showed that 24.7% of individuals aged 50 years or older reported having experienced hunger in childhood, and that this experience was associated with about 20% higher odds of diabetes (adjusted odds ratio 1.20; 95% confidence interval 1.02 to 1.41), even after adjustment for sociodemographic and health factors (FÉLIX-BELTRÁN; SEIXAS, 2021).

The regional context helps to explain why this phenotype may be relevant in Latin America. In 2023, the prevalence of undernourishment in Latin America and the Caribbean was 6.2%, corresponding to 41 million people, and moderate or severe food insecurity affected 28.2% of the population, or 186.7 million people. At the same time, overweight reached 8.6% of children under five years of age and obesity reached 29.9% of adults (FAO *et al*., 2024). Hunger, food insecurity, stunting, anemia, overweight, and noncommunicable diseases coexist in the same communities, households, and even in the same individuals over the life course (GRAJEDA *et al*., 2019). In Brazil, the post-pandemic period was marked by more than 33 million people facing hunger, in a country that also ranks among those with the largest number of adults with diabetes in the world (SILVA; MARCHIONI, 2025).

The double burden of malnutrition adds another layer of complexity. The capacity-load model proposes that early undernutrition reduces metabolic capacity, including the functional reserve of beta cells, while later exposure to energy-dense diets and weight gain increases metabolic load, so that the combination of low capacity and high load favors diabetes (WELLS *et al*., 2020). In Latin America, the nutrition transition, with growing consumption of ultra-processed foods, means that many individuals exposed to hunger in childhood reach adulthood in an obesogenic environment (POPKIN; CORVALAN; GRUMMER-STRAWN, 2020). As a consequence, the phenotype observed in adulthood may not be the classic one of extreme thinness, which makes it even harder to recognize.

Diagnostic error appears as a consequence of this invisibility. Because type 5 diabetes usually affects lean young people who require treatment, it is frequently confused with type 1 diabetes, especially in populations with high food insecurity (SILVA; MARCHIONI, 2025). Misclassification is not exclusive to this entity. A global modeling study estimated that about 35,000 people died in 2021 within 12 months of the onset of type 1 diabetes without having been diagnosed, and that there were 3.7 million missing prevalent cases attributable to

premature mortality, with the greatest losses in low- and middle-income settings (GREGORY *et al*., 2022). These data show how weaknesses in diagnostic capacity translate into invisibility in epidemiological statistics.

The recognition of type 5 diabetes, however, is not consensual. Critics argue that a low body mass index is an unreliable marker of undernutrition in constitutionally lean populations, that the mechanistic evidence comes from small samples composed only of men and without follow-up, that the proposal of a type 5 is inconsistent when types 3 and 4 are not formally recognized, and that undernutrition may often be a consequence rather than a cause of diabetes (MITHAL; JOSHI; MISRA, 2025). These objections do not deny the existence of lean individuals with diabetes and a history of deprivation, but they highlight the need for clear criteria and more robust studies.

The relationship between undernutrition and diabetes in Latin America can therefore be understood as a continuum that begins with fetal and childhood deprivation, is expressed as reduced insulin secretory capacity, and may be modulated by later food insecurity or by the nutrition transition. This sequence identifies early childhood, adolescence, and the first contact of young adults with diabetes in health services as the most favorable moments for prevention and correct classification.

In an integrated manner, the literature allows the findings to be organized into dimensions related to the type of study, the population assessed, the domain investigated, the main results, and their implications for clinical practice and public health. The systematization of these characteristics makes it possible to compare evidence from different regions and designs, distinguish physiological data from population associations, and separate the arguments in favor of recognizing the entity from the criticisms that remain, in addition to identifying the main gaps related to Latin American data, aspects that are presented in an organized manner in the summary table.

Table 1

Synthesis of the main evidence on type 5 diabetes, childhood undernutrition, and food insecurity in Latin America

REFERENCE	STUDY TYPE / POPULATION	OUTCOME DOMAIN	MAIN FINDINGS	CLINICAL IMPLICATIONS
Alberti and Zimmet (1998)	Provisional report of a WHO consultation	Diabetes classification	Proposed the etiological classification of diabetes and removed malnutrition-related diabetes mellitus as a category, keeping only fibrocalculous pancreatopathy as a disease of the exocrine pancreas.	Explains the historical origin of the invisibility of the entity and why lean patients came to be distributed between type 1 and type 2 diabetes.
Martins and Sawaya (2006)	Cross-sectional study with 61 children living in slums in São Paulo, Brazil (21 stunted)	Insulin secretion and sensitivity in childhood	Stunted children had lower fasting insulin and lower HOMA-B, with higher insulin sensitivity than non-stunted children, while fasting glucose was similar.	Indicates that the secretory defect may already be present in Latin American children exposed to chronic undernutrition, before the onset of diabetes.
Grajeda *et al*. (2019)	Regional overview of the double burden of malnutrition in Latin America and the Caribbean	Nutritional epidemiology and public policy	Described the coexistence of stunting, anemia, overweight, obesity, and noncommunicable diseases in the same communities and households, with examples of regional policy responses.	Supports the view that undernutrition and excess weight should be addressed together in diabetes prevention in the region.
Wells *et al*. (2020)	Narrative review on the double burden of malnutrition	Etiological pathways	Proposed that early undernutrition reduces metabolic capacity and that later weight gain increases metabolic load, combining to raise the risk of cardiometabolic disease.	Helps to explain why individuals exposed to hunger in childhood may develop diabetes in adulthood even without extreme thinness.
Félix-Beltrán and Seixas (2021)	Population-based study (ELSI-Brazil) with 9,412 adults aged 50 years or older	Childhood hunger and chronic disease	24.7% reported childhood hunger, and this experience was associated with higher odds of diabetes (adjusted odds ratio 1.20; 95% CI 1.02 to 1.41) and osteoporosis.	Supports including the history of childhood hunger in the clinical assessment of adults with diabetes in Brazil.
Gregory *et al*. (2022)	Global modeling study of type 1 diabetes	Undiagnosed cases and premature mortality	Estimated about 35,000 deaths in 2021 within 12 months of onset without diagnosis and 3.7 million missing prevalent cases,	Shows how limited diagnostic capacity results in invisibility in statistics, a mechanism that also applies to

REFERENCE	STUDY TYPE / POPULATION	OUTCOME DOMAIN	MAIN FINDINGS	CLINICAL IMPLICATIONS
			with major losses in low- and middle-income settings.	atypical forms of diabetes.
Lontchi-Yimagou *et al*. (2022)	Physiological study with hyperinsulinemic clamps in Indian individuals with diabetes and BMI below 19 kg/m2, compared with type 1, type 2, and controls	Pathophysiology	Lower insulin secretory response than lean controls and type 2 diabetes, higher glucose uptake and lower endogenous glucose production than type 2 diabetes, and less visceral and hepatic fat.	Supports the existence of a predominantly secretory phenotype, which should not be treated as insulin-resistant type 2 diabetes.
FAO *et al*. (2024)	Regional report of United Nations agencies	Food security and nutrition in Latin America and the Caribbean	In 2023, undernourishment affected 6.2% of the population (41 million) and moderate or severe food insecurity affected 28.2% (186.7 million), with childhood overweight of 8.6% and adult obesity of 29.9%.	Confirms that exposure to hunger remains frequent in the region and coexists with excess weight, which favors atypical presentations.
Wadivkar *et al*. (2025a)	International consensus statement	Definition and classification of type 5 diabetes	Described the entity in lean young individuals with a history of undernutrition, with deficient insulin secretion, preserved insulin sensitivity, no autoantibodies, and no ketoacidosis, and supported the name type 5 diabetes.	Provides a reference framework for recognizing the condition and calls for research in low- and middle-income countries.
Wadivkar *et al*. (2025b)	Review of pathophysiology	Mechanisms of undernutrition-associated diabetes	Indicated that undernutrition in early life, and possibly in later periods, may compromise pancreatic function and produce a profile different from that of type 2 diabetes.	Reinforces the need to investigate nutritional history throughout the life course, not only in fetal life.
Mithal, Joshi and Misra (2025)	Critical review	Validity of the type 5 category	Questioned low BMI as a marker of undernutrition, the limited mechanistic evidence based on small male-only samples, and the direction of causality between undernutrition and diabetes.	Recommends caution and clear diagnostic criteria before the category is widely adopted in clinical practice.
Silva and Marchioni (2025)	Perspective article on Brazil	Food insecurity and public health	Highlighted the risk of confusing malnutrition-related diabetes with type 1	Offers practical indicators for primary care and links diabetes

REFERENCE	STUDY TYPE / POPULATION	OUTCOME DOMAIN	MAIN FINDINGS	CLINICAL IMPLICATIONS
			diabetes and proposed tracking low birth weight, childhood hunger, short stature, and food insecurity screening in primary care.	care to food security policies in Brazil.

Source: Prepared by the authors based on the studies included in this narrative review (2026).
Note: BMI, body mass index; CI, confidence interval; ELSI-Brazil, Brazilian Longitudinal Study of Aging; FAO, Food and Agriculture Organization of the United Nations; HOMA-B, homeostasis model assessment of beta-cell function; WHO, World Health Organization.

4 DISCUSSION

The recognition of type 5 diabetes establishes an interface between nutrition, social determinants of health, and endocrinology that deserves specific attention in Latin America. Although the international consensus offers a reference framework, the available physiological evidence comes mainly from South Asia and Africa, and there are no studies characterizing this phenotype in Latin American populations (LONTCHI-YIMAGOU *et al*., 2022; WADIVKAR *et al*., 2025a). The absence of regional data should not be interpreted as absence of the disease, but as a consequence of the fact that the entity has not been sought.

The pathophysiological interpretation particularly exemplifies this complexity. Brazilian findings in stunted children show reduced beta-cell function before any diagnosis of diabetes, which is compatible with the secretory defect described in adults with type 5 diabetes (MARTINS; SAWAYA, 2006). On the other hand, the same children presented greater insulin sensitivity, a condition that may change with later weight gain. In the Latin American context, therefore, the expected phenotype may be mixed, with low secretory reserve combined with variable degrees of insulin resistance acquired during the nutrition transition (WELLS *et al*., 2020). This possibility makes the strict use of thinness as a criterion insufficient to identify all affected individuals.

A particularly relevant clinical aspect is that the nutritional history is rarely recorded in the care of people with diabetes. Questions about low birth weight, hunger in childhood, growth delay, and current food insecurity are not part of the routine of most services, although they are simple and inexpensive to obtain (SILVA; MARCHIONI, 2025). The association between childhood hunger and diabetes observed in Brazilian older adults suggests that this information has clinical meaning even decades after exposure (FÉLIX-BELTRÁN; SEIXAS,

2021). Including these questions in the clinical history would make it possible to identify candidates for more careful classification.

The consequences of diagnostic error require careful interpretation. A lean young patient without ketoacidosis who is classified as having type 1 diabetes may receive intensive insulin regimens in doses higher than necessary, with a greater risk of hypoglycemia, especially when food intake is irregular because of food insecurity. Conversely, the same patient classified as having type 2 diabetes may receive insulin-sensitizing drugs and dietary guidance aimed at weight loss, which are inadequate for a predominantly secretory defect and for a person who may need nutritional recovery (WADIVKAR *et al*., 2025a). In both situations, the nutritional dimension of the problem is ignored.

The criticism of the new category constitutes a point of legitimate uncertainty. The use of low body mass index as a marker of undernutrition, the small size of the physiological studies, and the possibility that undernutrition is a consequence of uncontrolled diabetes are relevant objections (MITHAL; JOSHI; MISRA, 2025). In addition, the decline in extreme undernutrition in several countries may suggest a lower current importance of the entity. However, in Latin America, food insecurity has not disappeared and has even increased in specific periods, such as the years following the COVID-19 pandemic, which keeps the problem current for generations exposed to hunger in childhood (FAO *et al*., 2024; SILVA; MARCHIONI, 2025).

Primary care represents, in this scenario, an opportunity to maximize benefits and reduce invisibility. It is at this level that families in food insecurity are monitored, that child growth is followed, and that most cases of diabetes in young adults are first identified. The use of simple indicators, such as birth weight, adult height, reported childhood hunger, and screening instruments for household food insecurity, may help to identify individuals at risk (SILVA; MARCHIONI, 2025). However, this approach depends on access to C-peptide measurement and autoantibody testing, which are not universally available in the public health systems of the region.

It is also important to differentiate the phenotypes grouped under lean diabetes. Lean young individuals with diabetes may have type 1 diabetes with slow progression, monogenic diabetes, fibrocalculous pancreatopathy, secondary forms, or type 5 diabetes, and each of these conditions has distinct therapeutic implications (ALBERTI; ZIMMET, 1998; WADIVKAR

et al., 2025b). The fragility of diagnostic capacity in low- and middle-income settings, which already results in undiagnosed deaths from type 1 diabetes, indicates that the problem is not limited to a single category, but reflects broader limitations of access to diagnosis (GREGORY *et al*., 2022).

Future development of this field should include studies capable of characterizing type 5 diabetes in Latin America. Cohorts of young adults with recent diabetes, with systematic recording of nutritional history, measurement of C-peptide, investigation of autoantibodies and, when possible, genetic tests, could estimate the proportion of cases compatible with the phenotype. The region also has birth cohorts and longitudinal studies that collected data on early growth and nutrition, which could be used to assess the relationship between childhood undernutrition and later beta-cell function. Studies with women and with mixed phenotypes are particularly necessary, given the limitations of the existing samples (MITHAL; JOSHI; MISRA, 2025).

In this context, the care of lean young people with diabetes and a history of deprivation requires an integrated approach. Recording of nutritional history, careful classification with the support of laboratory tests, individualized insulin therapy, nutritional recovery, and articulation with income transfer and food security programs constitute complementary components of care. The growing recognition of this entity makes it necessary for type 5 diabetes to be included in the diagnostic reasoning and in the epidemiological surveillance of Latin American countries, particularly in the groups in which hunger in childhood was a common experience.

5 FINAL CONSIDERATIONS

Type 5 diabetes is no longer understood only as a historical curiosity of tropical medicine, but as a form of diabetes that reveals the long-term metabolic consequences of hunger. Its defining features, especially the deficiency in insulin secretion without significant insulin resistance or autoimmunity, help to explain why affected individuals do not fit the conventional categories. However, the available evidence does not y*et al*low the size of the problem in Latin America to be estimated, since the entity has not been studied in the populations of the region.

The coexistence of food insecurity, a legacy of childhood stunting, and a rapid nutrition transition reinforces the importance of recording nutritional history and using it in the classification of diabetes. Because the phenotype in Latin America may be attenuated or mixed by later weight gain, the diagnosis cannot depend only on thinness, and simple indicators of early deprivation may help to identify the individuals who require further investigation.

In the field of public health, the limited availability of regional studies justifies caution in interpreting the magnitude of type 5 diabetes, but it does not justify its invisibility. The expansion of characterization studies and the use of existing cohorts may progressively clarify the contribution of undernutrition to diabetes in the region, but, in the current scenario, diabetes care must integrate clinical classification and food security. This approach makes it possible to reduce diagnostic error, avoid inappropriate treatment, and recognize hunger as a determinant of metabolic disease throughout the life course.

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